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Least Bell's Vireos and Southwestern Willow Flycatchers at the San Luis Rey Flood Risk Management Project Area in San Diego County, California: Breeding Activities and Habitat Use

2008 Annual Report

Prepared for:

RECON Environmental, Inc.

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

Least Bell's Vireos and Southwestern Willow Flycatchers at the San Luis Rey Flood Risk Management Project Area in San Diego County, California: Breeding Activities and Habitat Use

By Kimberly Ferree and Barbara E. Kus

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EXECUTIVE SUMMARY

Surveys for the endangered least Bell's vireo (*Vireo bellii pusillus*) were conducted at the San Luis Rey Flood Control Project Area (Project Area) in the city of Oceanside, San Diego County, California, between 1 April and 15 July 2008. Three protocol surveys were conducted during the breeding season and supplemented by weekly territory monitoring visits. A total of 130 least Bell's vireo territorial males were identified; 117 were confirmed as paired, four were confirmed as single males, and nine were not confirmed as paired. Six transient vireos were detected during surveys.

The least Bell's vireo population at the San Luis Rey Flood Risk Management Project Area increased by 20% (22 territories) from 2007, to achieve the highest number of territories ever detected at this site. We evaluated the impact of ongoing channel vegetation clearing and giant reed (*Arundo donax*) eradication that has occurred in the river channel since 2005 on the Project Area vireo population by comparing vireos in the river channel (Channel), where vegetation treatment has occurred, with sites outside of the river channel (Untreated), where vegetation treatment has not occurred. While the total number of territories in 2008 at Untreated sites outside of the river channel rebounded to the same number as in 2006, the number of territories in the Channel, increased by 11 territories since 2006. Therefore, despite major habitat changes between 2005 and 2008 within the Channel, vegetation removal did not appear to have a negative impact on the abundance of vireos in 2008.

The majority of vireo territories (64%) occurred in habitat characterized as willow riparian. Sixteen percent of birds occupied habitat co-dominated by willows (*Salix* spp.) and cottonwoods (*Populus fremontii*), and 20% of territories were found in riparian scrub, dominated by mule fat (*Baccharis salicifolia*) and/or sandbar willow (*S. exigua*). Most vireo territories (61%) were established in habitat where 50 to 95% of the vegetation cover was native species, 38% of the territories were in habitat vegetated almost entirely (>95%) by native species, and one territory was placed in habitat where 5 to 50% of the vegetation cover was native. The most common exotic species within territories was *A. donax* followed by black mustard (*Brassica nigra*), poison hemlock (*Conium maculatum*) and tamarisk (*Tamarix ramosissima*).

Nesting activity was monitored in 102 territories. Pair success was slightly higher for Treated pairs; 93% (62/67) of Treated pairs versus 83% (24/29) of Untreated pairs were successful in fledging young from at least one nest. Nest success (number of nests fledging at least one young/total number of nests found) of pairs breeding in the Channel was statistically higher than that of pairs breeding in the Untreated sites (64%; 87/136 versus 50%; 30/60). Successful and failed nests within Treated and Untreated sites did not differ statistically in average nest height, height of the host plant, or the distance the nest was placed from the edge of the host plant. Ninety percent of nests were placed in arroyo willow (*S. lasiolepis*), mule fat and sandbar willow. Predation was believed to be the primary source of nest failure.

A total of 462 least Bell's vireos were banded during the 2008 season. These included 55

adult vireos and three hatch-year vireos that were target netted and banded with a unique color combination, 385 hatch-year birds banded as nestlings, seven second-year vireos that were banded as nestlings in 2006, ten first-year birds that were banded as nestlings in 2007, one vireo that was banded as a nestling at Pilgrim Creek in 2003 and one vireo that was banded as a nestling at the Santa Margarita River in 2005. Adult survivorship was high; of 58 uniquely color banded adult vireos present during the 2008 breeding season, 78% (45/58) returned to the San Luis Rey Flood Risk Management Project Area in 2008. Territory site fidelity was strong among the banded vireos; 77% (33/43) of adults returned to breed in the same territory as the previous year. First-year survivorship was 6% (14/236).

We conducted three protocol surveys for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) in the Project Area between 15 May and 12 July 2008. We detected four willow flycatcher transients of unknown sub-species in the river channel and one outside of the river channel. There were no breeding pairs of southwestern willow flycatchers detected in 2008. A female that was originally banded in 2005 as an adult and was observed breeding in the same territory from 2005-2007 was detected on Camp Pendleton in 2008.

A total of 46 vegetation transects (528 points) were sampled at the San Luis Rey Flood Risk Management Project Area in 2008. Seventy-two percent (378/528) of points were located in the Channel site while the remaining 28% (150/526) were located at the Upper Pond and Whelan Mitigation mitigation sites. One hundred and nine of the 528 points, all within the Channel site, were located in areas cleared in 2005 and 2006 of vegetation (66%, 72 points), *A. donax* (19%, 21 points) or both (15%, 16 points). Points in cleared areas made up 29% (109/378) of the points in the Channel and 21% (109/528) of all points sampled in these sites.

We did not detect large changes in vegetation structure or composition from 2007 to 2008. Total foliage cover increased at the treated Channel points in middle and upper canopy vegetation and at all heights at Upper Pond. Differences in overall vegetation cover were attributed to an increase in herbaceous, shrub, and tree cover at Upper Pond and tree cover at the treated points in the Channel indicating that rainfall was a key factor explaining the observed increase in foliage cover.

Sixty nests and 60 random plots (480 sampling points in total) were sampled following the 2008 breeding season. As in 2007, habitat use by vireos was non-random, particularly with regard to nest site selection. In the Channel, nest placement by vireos was largely random, foliage cover between nests and random plots did not differ except at 1-2 m. However, territory placement within the Channel was non-random, with vireos selecting sites with greater foliage cover between 2-4 m than that generally available. In the Untreated sites, where canopy cover was lower than in the Channel, vireos were more selective in both placement of nests and territories.

INTRODUCTION

Least Bell's Vireo

The least Bell's vireo (*Vireo bellii pusillus*) 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 (Franzreb 1989, U.S. Fish and Wildlife Service 1998, RHJV 2004). Additional factors contributing to the vireo's decline have been the expansion in range of the brown-headed cowbird (*Molothrus ater*), a brood parasite, to include the Pacific coast (U.S. Fish and Wildlife Service 1986; Franzreb 1989; Brown 1993; Kus 1998, 1999), and the introduction of invasive exotic plant species such as giant reed (*Arundo donax*) into riparian systems. By 1986 the vireo population in California numbered just 300 territorial males (U.S. Fish and Wildlife Service 1986).

In response to the dramatic reduction in numbers of least Bell's vireos 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 (Kus 1999, Kus and Whitfield 2005). As of 2006 the statewide vireo population was estimated to be approximately 2,500 territories (U.S. Geological Survey, unpublished data) of which approximately 10% occur along the San Luis Rey River between Interstate 15 and Interstate 5.

Male least Bell's vireos typically arrive on breeding grounds in southern California in mid-March. Male vireos are vocally conspicuous, and sing their diagnostic primary song throughout the breeding season from exposed perches. Females arrive approximately 1-2 weeks after males and are more secretive but are often seen early in the season traveling through habitat with the male. The female, with the male's help, builds an open cup nest in dense vegetation approximately 1 m above the ground. Clutch size for least Bell's vireos averages 3-4 eggs. Typically, the female and male incubate the eggs for 14 days and young fledge from the nest at 11-12 days of age. It is not unusual for vireos to re-nest after a failed attempt provided ample time remains within the breeding season. Nesting lasts from early April through July but adults and juvenile birds remain on the breeding grounds into late September/early October before migrating to their wintering grounds in southern Baja California, Mexico.

Southwestern Willow Flycatcher

The southwestern willow flycatcher (*Empidonax traillii extimus*) 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 and Utah, and western Texas (Hubbard 1987, Unitt 1987). Restricted to riparian habitat for breeding, 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 1933; Grinnell

and Miller 1944; Remson 1978; Garrett and Dunn 1981; Unitt 1984, 1987; Gaines 1988; Schlorff 1990; Whitfield and Sogge 1999, Kus and Whitfield 2005). By 1993, the species was believed to number approximately 70 pairs in California (U.S. Fish and Wildlife Service 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 with the least Bell's vireo. However, unlike the vireo which has increased six-fold since the mid-1980's in response to management efforts, willow flycatcher numbers have remained 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 (Rourke *et al.* 2008). Outside of these sites, southwestern willow flycatchers occur as small, isolated populations of one to half a dozen pairs (Kus *et al.* 2003).

Male southwestern willow flycatchers typically arrive in southern California at the end of April while females arrive approximately one week later. Males sing repeatedly from exposed perches while on the breeding grounds. Once the pair bond is established, the female builds an open-cup nest usually placed in a branch fork of a willow or plant with a similar branching structure approximately 1-3 meters above the ground. The typical clutch of 3-4 eggs is laid in May-June. Females incubate for approximately 12 days and nestlings fledge within 12-15 days in early July. Adults usually depart from their breeding territory in mid-August/early September to their wintering grounds in central Mexico and northern South America.

San Luis Rey Flood Risk Management Area

The San Luis Rey Flood Risk Management Area encompasses approximately 576 acres (233 ha) of the lower San Luis Rey River in northwestern San Diego County, California (Figure 1). Authorized in 1970 and constructed during the late 1980's and early 1990's, the flood control Project Area includes single- and double-levee reaches and six out-of-channel detention ponds, five of which also serve as mitigation sites for impacts to biological resources within the channel. Operation and maintenance of the flood control project includes periodic vegetation clearing, exotic plant removal, and sediment removal to ensure that sufficient conveyance capacity is maintained (U.S. Fish and Wildlife Service 2006).

Riparian vegetation communities in the Project Area included willow (*Salix* spp.) dominated riparian, mixed mule fat (*Baccharis salicifolia*) and sandbar willow (*S. exigua*) riparian scrub, freshwater marsh, and areas dominated by non-native giant reed (*Arundo donax*). Dominant plants included arroyo willow (*S. lasiolepis)*, black willow (*S. gooddingii*), cottonwood (*Populus fremontii*), sandbar willow, mule fat, and *A. donax*. Adjacent habitat and land use types included coastal sage scrub, nonnative grassland, and urban housing and commercial developments. Human-induced disturbances such as homeless camps, recreation, illegal dumping, and invasive exotic plants were pervasive throughout the Project Area.

Prior to the 2006 least Bell's vireo breeding season, the U.S. Army Corps of Engineers (Corps) began two project activities: (1) *A. donax* eradication and (2) channel vegetation clearing. In December of 2005, they used a masticator to mulch large stands of *A. donax* which was then left on site. For those areas that were difficult to reach with the masticator they used an excavator with a mowing attachment. In March 2006, the Corps cleared and mulched an approximately 30–m swath of vegetation in the flood channel between Benet Road and College Boulevard [7.5 km (4.6 miles)], overlapping when possible with the *A. donax* eradication areas. Both activities resulted in a loss of approximately 15-20% of the riparian vegetation in the river channel. Beginning in 2008, the main channel will be cleared annually while the adjacent vegetation will be mowed on a rotational basis approximately every five years.

In February and March of 2008, the Corps continued vegetation removal activities in the river channel west from Benet Road approximately 3.5 km (2.2 miles). Eradication of *A. donax* was conducted before vegetation was cleared. A small section east of Benet Road was also cleared of vegetation. Extensive vegetation removal was conducted throughout the remainder of the Project Area (i.e. Benet Road to College Boulevard) in September and October following the 2008 breeding season, thereby completing the first phase of the rotational mowing scheme that will be maintained in the future. The effects of these activities will be evaluated in future years.

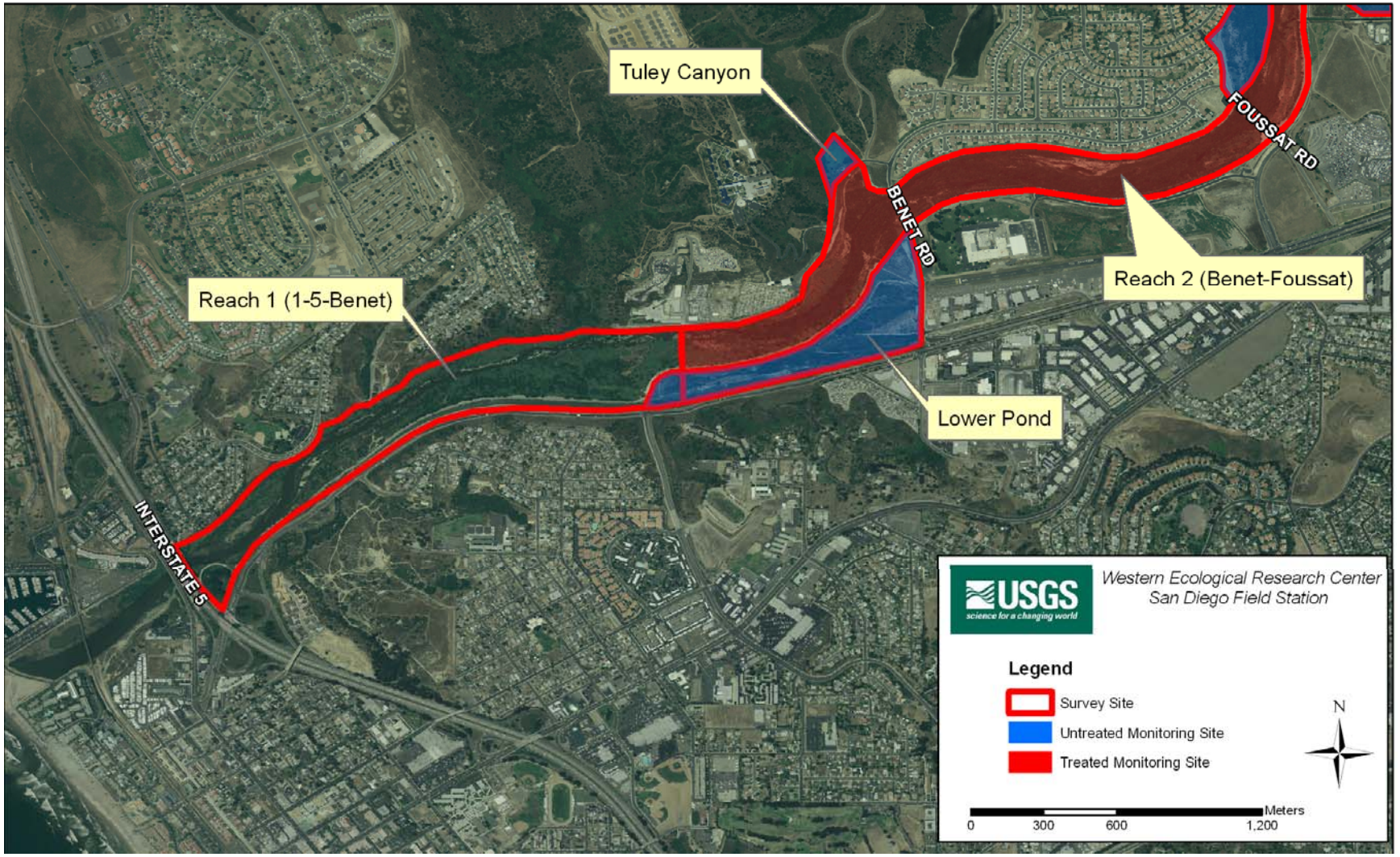

Figure 1. (a) Least Bell's vireo and southwestern willow flycatcher survey and monitoring sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

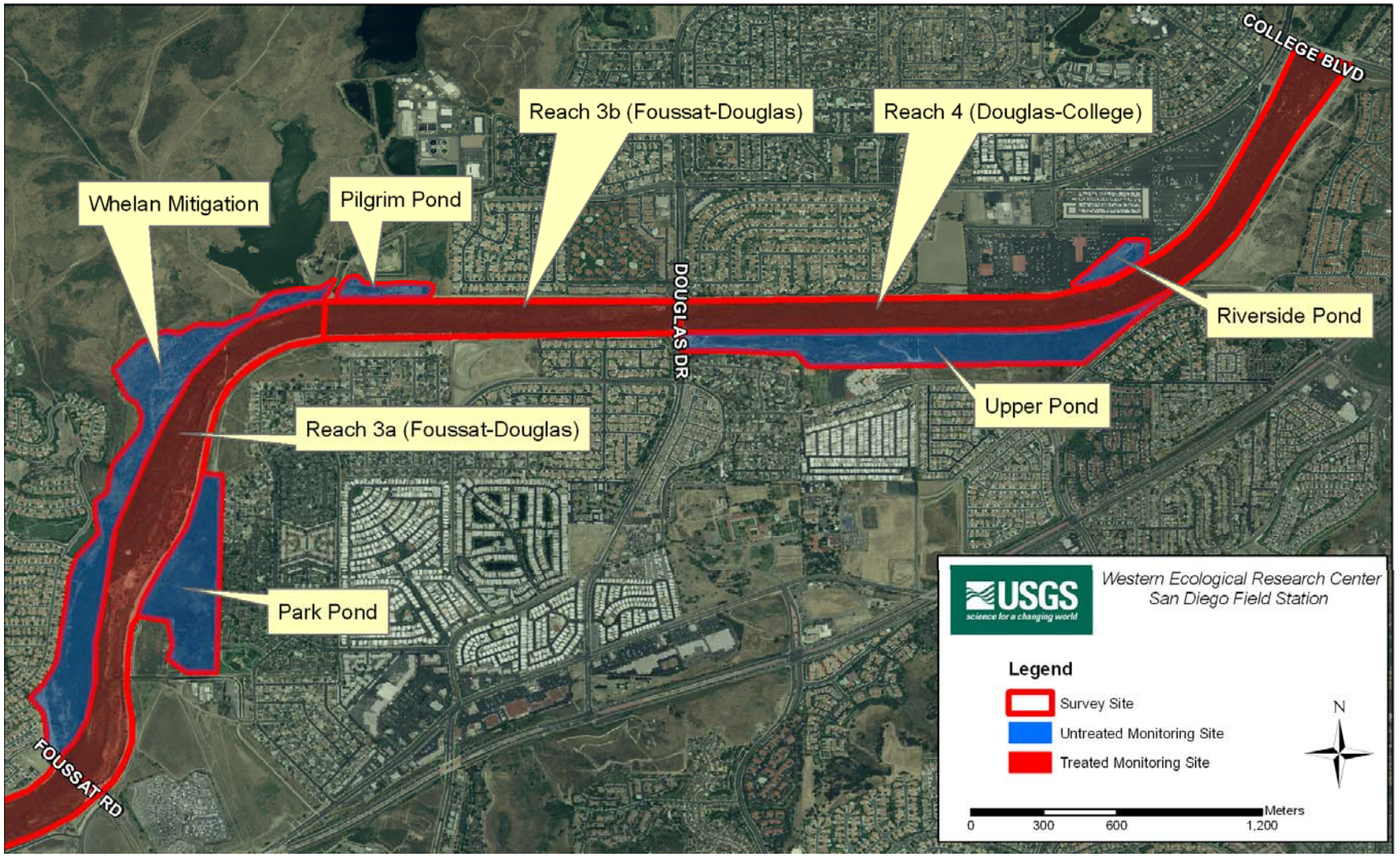

Figure 1. (b) Least Bell's vireo and southwestern willow flycatcher survey and monitoring sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

The purpose of this study was to document the status of least Bell's vireos and southwestern willow flycatchers at the San Luis Rey Flood Risk Management Project Area (Project Area) and characterize habitat structure and composition within the Project Area (Figure 1). Specifically, our goals for least Bell's vireos were to (1) determine the size and composition of the vireo population, (2) characterize habitat used by vireos, (3) band vireos and resight banded vireos to estimate vireo survivorship and movement, and (4) assess the short-term effects of vegetation removal on vireo reproductive success and productivity by monitoring established nest monitoring plots in treated and untreated sites. Our goals for southwestern willow flycatchers were to (1) determine the size and composition of the willow flycatcher population in the Project Area, (2) document and monitor nesting activities of resident flycatchers, and (3) band and resight all flycatchers to facilitate the estimation of flycatcher turnover and movement. The purpose of the habitat component of the study was (1) to provide post-treatment data on the habitat composition and structure of the study area including areas that underwent vegetation removal in 2005-2006 and (2) characterize habitat use by least Bell's vireos at the Project Area. These data, when combined with data from other years, will inform natural resource managers about the status of these endangered species in the Project Area, and guide modification of land use and management practices as appropriate to ensure the species' continued existence.

This work was funded by the U.S. Army Corps of Engineers and RECON Environmental, Inc.

STUDY AREA AND METHODS

Vireo and Flycatcher Surveys

The Project Area included a channelized 10.7-km section of the lower San Luis Rey River from College Boulevard to Interstate 5 and six detention ponds outside of the channel in Oceanside, California (Figure 1). The Project Area was divided into 12 survey sites, five of which were located primarily within the flood control channel and seven that were located outside of the flood control channel. The seven sites outside of the flood control channel included one restored site north of the levee and west of Whelan Lake and six in the detention ponds (Figure 1, Table 1).

Vireo surveys were conducted at the Project Area between 1 April and 15 July 2008. Three protocol surveys (U.S. Fish and Wildlife Service 2001) were conducted during the breeding season and followed standard survey techniques described in the California Least Bell's Vireo Working Group and USFWS least Bell's vireo survey guidelines (U.S. Fish and Wildlife Service 2001). We supplemented these protocol surveys with weekly territory monitoring visits; therefore most survey sites were visited >10 times throughout the breeding season resulting in complete coverage of the study area. Vireo field work was conducted by Lisa Allen, Melissa Blundell, Kevin Clark, Cynthia Jones Daverin, Kimberly Ferree, and Barbara Kus.

We conducted three willow flycatcher surveys of the Project Area, completing one survey during each of three protocol survey periods (Sogge *et al*. 1997, U.S. Fish and Wildlife Service 2000). The first period extended from 15 May through 31 May, the second period from

Table 1. Least Bell's vireo and southwestern willow flycatcher survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Survey Site	Description
Channel Sites	
Reach 1	From Benet Road to the Pacific Ocean
Reach 2	From Foussat Road to Benet Road
Reach 3a	From Whelan canal to Foussat Road
Reach 3b	From Douglas Drive to Whelan canal
Reach 4	From College Boulevard to Douglas Drive
Non-channel Sites	
Lower Pond	Detention pond with restored habitat, west of Benet Road and south of the levee
Park Pond	Detention ponds with restored habitat, located south of the levee, between Douglas Drive and Foussat Road
Pilgrim Pond	Detention pond with restored habitat, north of Reach 4.
Riverside Pond	Detention pond with restored habitat, north of Reach 3b.
Tuley Canyon	Detention pond with restored habitat, west of Benet Road and north of the levee
Upper Pond	Detention pond with restored habitat located south of levee between College Boulevard and Douglas Drive
Whelan Mitigation	Restored habitat north of levee, between Whelan canal and Foussat Road

1 June through 21 June, and the third from 22 June through 12 July. Flycatcher field work was conducted by Lisa Allen, Ursula Carliss, Kimberly Ferree, Scarlett Howell, Eric Nolte, and Michael Wellik.

For both species, observers moved slowly (1-2 km per hour) through the riparian habitat while searching and listening for vireos or flycatchers. Observers walked along the north and south levees to survey the flood control channel. In wider stands, observers traversed the habitat to detect all birds throughout its extent. Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions. For each bird encountered, investigators recorded age (adult or juvenile), sex, breeding status (paired, single, undetermined, or transient), and whether the bird was banded. Birds were considered transients if they were not detected on two or more consecutive surveys after an initial detection. 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 (WGS84). Distance to the nearest surface water was recorded for each flycatcher location. Dominant native and exotic plants were recorded within each vireo and flycatcher territory, and percent cover of exotic vegetation estimated using cover categories of <5%, 5-50%, 51-95%, and >95%. Overall habitat type was specified according to the following categories:

Mixed willow riparian: Habitat dominated by one or more willow species including black willow, arroyo willow, and red willow *(S. laevigata),* with mule fat as a frequent co-dominant.

Willow-cottonwood: Willow riparian habitat in which cottonwood is a co-dominant.

Willow-sycamore: Willow riparian habitat in which California sycamore *(Platanus racemosa)* is a co-dominant.

Sycamore-oak: Woodlands in which California sycamore and coastal live oak (*Quercus agrifolia)* occur as co-dominants.

Riparian scrub: Dry and/or sandy habitat dominated by sandbar willow or mule fat, with few other woody species.

Upland scrub: Coastal sage scrub adjacent to riparian habitat.

Non-native: Areas vegetated exclusively with non-native species such as *A. donax* and tamarisk.

Vireo Nest Monitoring

We monitored least Bell's vireo nests to evaluate the effects of native and exotic vegetation removal on nest success and productivity. Work was conducted within four established monitoring sites; two sites in the river channel where both exotic and native vegetation removal has occurred and two sites adjacent to the flood channel where vegetation removal will not occur (Table 2). In 2005-2006, 7.5 km (4.6 miles) of the river channel between Benet Road and College Boulevard, representing approximately 75% of the total Project Area, was treated. This Treated monitoring area is referred to hereafter as the "Channel", to be distinguished from "river channel", which is used generically to refer to the low-flow channel throughout the Project Area. A second section of the river channel extending west of Benet Road to Interstate 5 was treated in 2008. The monitoring site Benet West, which was previously designated as an Untreated site in 2006 and 2007, was treated in February and March of 2008 and henceforth will function as a second Treated site. The Untreated sites included several detention ponds and restored habitat located outside of the channel. Upper Pond consisted of a detention pond located east of Douglas Drive. Whelan Mitigation encompassed the area beginning at the Whelan Lake Bird Sanctuary and extending west to Foussat Road (Figure 1). Additionally, several pairs were monitored in the smaller detention ponds including Lower Pond, Park Pond, Pilgrim Pond, and Tuley Canyon (Figure 1). All of these Untreated sites were riparian restoration sites established by the Corps in the early 1990's.

72 pairs in the Treated sites and 30 pairs in the Untreated sites were monitored during the breeding 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 three to four visits per nest. The first visit was timed to determine the number of eggs laid, the next visits to determine hatching and age of young, and the last to band nestlings (see below). Cowbird eggs were removed from nests by monitors according to when they were found. In nests with fewer than three vireo eggs, cowbird eggs were removed no sooner than the seventh day of incubation to minimize the possibility of nest abandonment in response to the removal. Cowbird eggs were removed from nests containing three or more vireo eggs as they were found. Cowbird nestlings were removed immediately from nests. Fledging was determined through direct observation of fledglings in the territory or in some rare cases inferred from an accumulation of feather dust and fecal material in the nest indicative of vireo fledging. Characteristics of nests, including height, host species, and host height were recorded following abandonment or fledging of nests.

Table 2. Site attributes of Treated (Channel and Benet West) and Untreated (Upper Pond, and Whelan Mitigation) monitoring sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

	Treated (2005-2006)[a, b]	**Treated (2008)[c]**	**Untreated**	
Attribute	Channel	Benet West	Upper Pond	Whelan Mitigation
Size: acres (ha)	296 (120)	69 (28)	49 (19)	55 (22)
Habitat Type[d]	Mixed Willow	Mixed Willow	Riparian Scrub/Mixed Willow	Mixed Willow/ Riparian Scrub
Dominant Canopy Species[d]	arroyo willow, black willow	black willow, arroyo willow	sandbar willow, mule fat, arroyo willow, black willow	black willow, mule fat, arroyo willow
Dominant Exotic Species[d]	*A. donax*	*A. donax*	*A. donax,* tamarisk, pampas grass	poison hemlock, black mustard, *A. donax*
Disturbance[d]	Homeless camps; moderate-heavy human use	Homeless camps, pets; heavy human use	Homeless camps, pets, recreation; heavy human use	Some human use
Restoration	<25 acres (10 ha)	no	yes	yes

[a] *A. donax* eradication occurred in December 2005 and vegetation clearing occurred in March 2006.
[b] Channel = Reach 2, Reach 3a, Reach 3b, and Reach 4 survey sites.
[c] Both *A. donax* eradication and vegetation clearing occurred in February and March of 2008. Formally used as an Untreated monitoring site.
[d] Listed in order of dominance.

Data Analysis

We conducted statistical tests to determine whether there were differences in nest success, productivity, or vegetation characteristics between pairs nesting at Treated and Untreated sites. Chi-square analysis was used to test for differences in nest success between sites. Depending on the dispersion of the data, either equal or unequal variance two-sample t-tests were used to test for differences in average clutch size, average brood size, and the number of young fledged per pair. Two-sample t-tests were also used to test for differences in vegetation characteristics between successful and unsuccessful nests within and between Treated and Untreated sites. Analysis of Variance (ANOVA) was used to test for differences in: 1) reproductive success of vireos by year (2006-2008) and treatment (with vegetation removal, without vegetation removal) and 2) foliage cover at each site by height class and year. We considered $P \leq 0.10$ to be significant for all statistical tests. Analyses were conducted using Systat 11.0 (Systat 2004).

Flycatcher Nest Monitoring

We monitored southwestern willow flycatchers in the vicinity of Whelan Lake as part of an ongoing demographic study initiated in 2000 (Kus unpubl. data). Procedures followed Rourke *et al*. 1999 and were similar to those described in the previous section for least Bell's vireo.

Vireo and Flycatcher Banding

The primary goals of banding least Bell's vireos were: 1) to better understand adult vireo site fidelity, 2) to investigate natal dispersal, and 3) to understand how vegetation removal and alteration affects vireo productivity, site fidelity, and survivorship. Nestlings from monitored nests were banded at 6-7 days of age with a single blue anodized numbered federal band on the right leg. Adult male vireos were targeted for banding at three of the monitoring sites (Channel, Whelan Mitigation, and Upper Pond). We banded all adults with a unique combination of colored plastic and anodized metal bands. Adults previously banded with a single numbered federal band were target netted to determine their identity, and their original band was supplemented with other bands to generate a unique color combination. These data will supplement banding data currently being gathered by USGS and other investigators on nearby vireo populations on the upper San Luis Rey River, Santa Margarita River on Camp Pendleton, San Diego River, and Sweetwater River.

The primary goals of banding southwestern willow flycatchers were: 1) to better understand adult flycatcher site fidelity and population turnover and 2) to investigate natal dispersal. Unbanded flycatcher adults were captured in mist nets within their territories, and were banded with a unique combination of a silver numbered federal band on one leg and a bi-colored metal band on the other. Nestlings were banded at 7-9 days of age with a silver numbered federal band on the left leg. These data will supplement banding data currently being gathered by USGS on Camp Pendleton and upstream on the San Luis Rey River.

Baseline Vegetation Study Design

Vegetation was sampled along permanent linear transects within two of the least Bell's vireo monitoring sites (Channel and Upper Pond). Transects were originally established in 2006 using a systematic sampling design. Transects located in the flood control channel contained points with vegetation treatment (i.e., removal) (hereafter "treated points") and without vegetation treatment (hereafter "untreated points"), while transects located outside of the channel did not contain vegetation treatment and thus had no treated points. To provide uniform coverage, transects were placed at fixed distances from each other; distances varied with the size of the site. In the Channel, transects were placed at 200- or 400-m intervals depending on the width of the river. In the Upper Pond, transects were placed every 100 m. To capture the range of variability of riparian vegetation structure and composition, we positioned transects perpendicular to the river channel. In addition, we re-sampled two 350-m transects at Whelan Mitigation that were surveyed from 1991-1993 to monitor riparian restoration by the Corps (Kus 1998). The Whelan Mitigation transects were located 75 m apart and oriented approximately parallel (320 degrees) to the flood control channel. Sampling points consisted of 2- by 2-m quadrats located at 10-m intervals along each transect; the number of points sampled varied with the length of each transect (Figure 2).

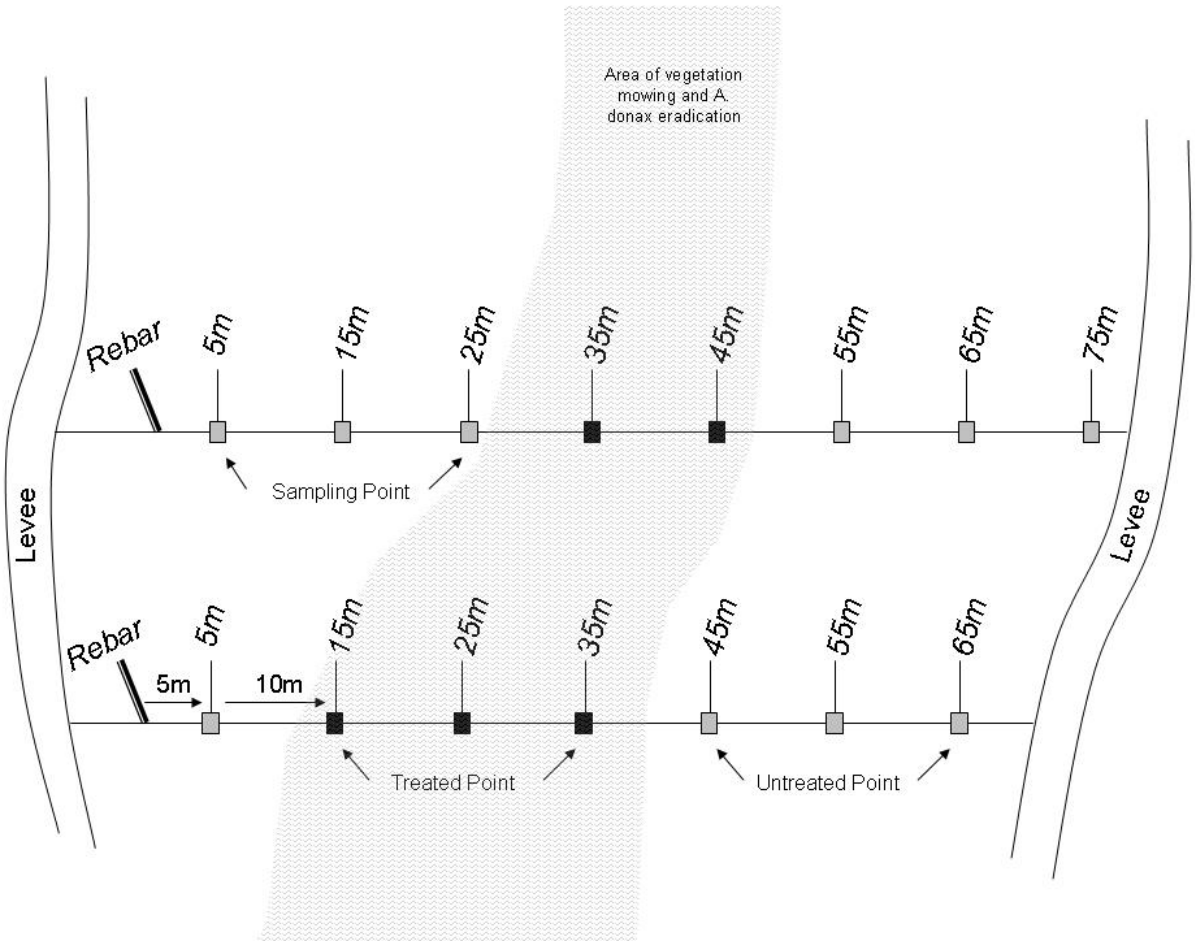

Figure 2. Schematic of vegetation transects in the Channel site at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

We used a number of permanent and semi-permanent methods to ensure that transects could be re-sampled in future years. First, a metal 1.5-m rebar was driven into the ground, leaving 75 cm above ground to mark the start of each transect. We spray-painted the rebar pink or orange and placed them at the intersection of the south levee and the river bed. From the rebar, using a compass and tape measure, two field personnel measured the distances between sampling points. A numbered, wooden stake, spray painted pink or orange, was placed in the ground and colored plastic flagging was tied nearby to aid in locating the points. Finally, we obtained geographic coordinates for each rebar and point using a GPS unit.

Vireo Habitat Use Study Design

We collected vegetation data at the nest and a paired random location (hereafter "nest plot" and "random plot") within the territory for a subset of monitored vireos. Prior to data collection, vireo nests were chosen randomly, and only one nest per pair was sampled. Nest and random plots consisted of four 2-x 2-m quadrats; one quadrat centered on the nest (or center for random plots) with the remaining three quadrats located 10 m from the nest/center and oriented at 0, 120, and 240 degrees from it (Figure 3). Random plot locations were selected using a

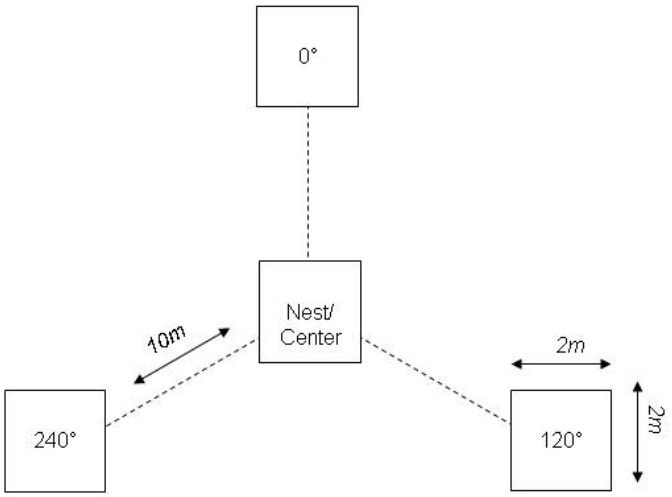

Figure 3. Schematic of nest-centered and random vegetation plots sampled at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

random compass bearing and distance from a nest. Distances generated were ≥20 m to avoid overlap in plots and ≤50 m to ensure that random plots remained within the territory of the corresponding pair.

Vegetation Sampling and Analysis

Foliage cover at 1-m height intervals was estimated using the "stacked cube" method, developed specifically to characterize canopy architecture in structurally diverse riparian habitat (Kus 1998). At each point along a vegetation transect or nest/random plot we recorded canopy height and percent cover of vegetation, by species, at 1-m height intervals, using a modified Daubenmire (1959) scale with cover classes <1, 1-10, 11-25, 26-50, 51-75, 76-90, and >90 percent. The sampling units were 2- by 2- by 1-m high "cubes," which were "stacked" vertically between the ground and the top of the canopy. Four 2-m length PVC pipes were placed on the ground to define quadrat boundaries, and a 7.5 m tall fiberglass telescoping pole, demarcated in 1-m intervals, was used to determine height class and canopy height. Vegetation data were collected by USGS and RECON field personnel.

For analysis, cover codes were converted to class midpoints, which were then used to quantify vegetation structure at each sampling point. We calculated means for each transect for nine height classes: 0-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, and >8 m, then averaged these means across transects for each site. For the Channel, we analyzed treated and untreated points separately. We examined percent cover for species that occurred at >5% of the sampling points (>25 points). Species that were less common (<5%) were grouped together by plant life form. These groups included: tree, shrub, herbaceous, dead woody species, and fresh-water marsh. We considered $P \leq 0.10$ to be significant for all statistical tests. Analyses were conducted using Systat 11.0 (Systat 2004).

RESULTS

Least Bell's Vireos

Population Size and Distribution

Least Bell's vireo territory numbers increased from 108 territories in 2007 to 130 territories in 2008, a 20% increase; the highest number of vireos ever detected at the Project Area since surveys began in 1984 (Table 3; Figure 4). A total of 130 least Bell's vireo territories were identified during surveys and weekly territory monitoring (Table 4; Appendix 1, Figures 16-19). Of the 130 territorial males, 117 (90%) were confirmed as paired, four (3%) were confirmed as single males. Nine (7%) territorial males, all present throughout the season, were not confirmed as paired. We detected six transient vireos during surveys.

Sixty-eight percent of the territories (88/130) were located within the flood control channel. The remaining 32% of the territories (42/130) were located outside of the channel. Vireo density was highest in the Upper Pond site where 21 pairs were detected (1 pair/0.9ha [1 pair/2.3 acre]). Four territories were detected in detention ponds south of the levee (Park Pond) and one territory was detected north of the levee and east of the Whelan canal (Pilgrim Pond). (Appendix 1, Figure 18b). Three territories were located in Lower Pond and one territory was located in Tuley Canyon (Appendix 1, Figure 16b).

Table 3. Number and distribution of least Bell's vireo territories at the San Luis Rey Flood Risk Management Project Area, California, in 2006-2008. .

Survey Site	2006	2007	2008
Channel Sites (Treated)			
Reach 1	13	7	10
Reach 2	15	14	16
Reach 3a	14	19	23
Reach 3b	13[a]	14[a]	13
Reach 4	21[b]	21[b]	25
Total	**76**	**75**	**87**
Non-channel Sites (Untreated)			
Lower Pond	3	2	3
Tuley Canyon	1	1	1
Whelan Mitigation	14	9	12
Park Pond	3	2	4
Pilgrim Pond[a]	1	1	1
Upper Pond	20	17	21
Riverside Pond[b]	1	1	1
Total	**43**	**33**	**43**
Grand Total	**119**	**108**	**130**

[a] One territory located in Pilgrim Pond was classified in Reach 3b in 2006 and 2007; this territory was switched to Pilgrim Pond in 2008. Numbers were adjusted for 2006 and 2007 to reflect this change.

[b] One territory located in Riverside Pond was classified in Reach 4 in 2006 and 2007; this territory was switched to Riverside Pond in 2008. Numbers were adjusted for 2006 and 2007 to reflect this change.

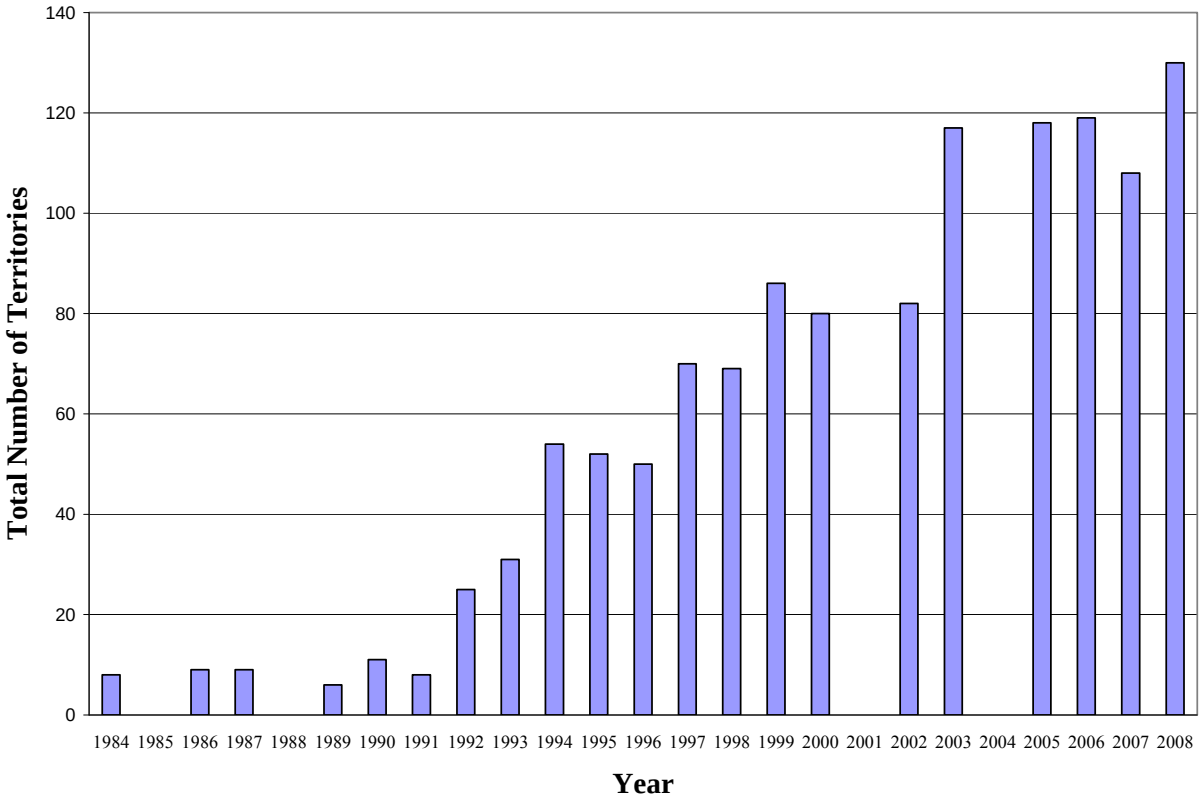

Figure 4. Number of least Bell's vireo territories from 1984-2008 at the San Luis Rey Flood Risk Management Project Area, California. Surveys were not conducted during 1985, 1988, 2001, or 2004.

From 2007 to 2008, within Treated sites, the number of territories increased by 16% (12/75) compared to 30% (10/33) within Untreated sites. In general, territory numbers increased across the Project Area with the exception of the three smallest sites (Tuley Canyon, Pilgrim Creek, and Riverside Pond) which remained the same and Reach 3b, which lost one territory. Territory increases varied between 1-4, with the largest gains occurring in the channel survey sites, Reach 4 and Reach 3a, and outside of the channel at Upper Pond, each of which gained four territories.

We observed some shifts in territory distribution, especially in the high density sites, as well as the addition of 22 new territories in areas that were not previously occupied in either 2006 or 2007. While the establishment of new territories was generally evenly distributed throughout the survey sites, there were two areas in the channel, located east and west of Foussat Road, where new territories were clustered. At the Reach 2 survey site, three territories were clumped at the west end and at Reach 3a, in a predominantly treated part of the channel, three new territories were added in the west section. At Reach 4, Reach 2 and Upper Pond, several territories shifted to accommodate new territories. For example, at Reach 4, a new pair moved in between two adjacent territories, causing the original pairs to readjust their territory boundaries;

therefore the new territory occurred in an area that was previously occupied. The distribution of territories at Reach 3b remained the same, except for one territory that shifted from the channel to more upland habitat, outside of the channel. At the remaining survey sites, all additional territories were in new locations.

Table 4. Number and distribution of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Survey Site	Known Pairs	Single Males	Status Undetermined[a]	Transient[b]	Total Territories
Channel Sites (Treated)					
Reach 1[c]	9	0	1	1	10
Reach 2	15	0	1	0	16
Reach 3a	22	0	1	1	23
Reach 3b	11	0	2	1	13
Reach 4	23	2	0	1	25
Non-channel Sites (Untreated)					
Lower Pond	3	0	0	0	3
Park Pond	3	0	1	0	4
Pilgrim Pond	1	0	0	0	1
Riverside Pond	0	1	0	0	1
Tuley Canyon	1	0	0	0	1
Upper Pond	20	1	0	0	21
Whelan Mitigation	9	0	3	2	12
Total	117	4	9	6	130

[a] Territorial male observed, female not confirmed.
[b] Transient birds were detected only once during the breeding season.
[c] 3.5 km (2.2 miles) of Reach 1 beginning at Benet Road and heading west has been treated.

Habitat Characteristics

Vireos used three different habitat types at the Project Area (Table 5). The majority of vireo territories occurred in habitat characterized as mixed willow riparian, with 64% of the males in the study area found in this habitat. An additional 16% of birds occupied willow-cottonwood. The second most commonly used habitat type, occupied by 20% of the population, was riparian scrub.

The majority of vireo territories (61%) were placed in habitat where 50 to 95% of the vegetation cover was native species, while 38% of the territories were placed in habitat where >95% of the vegetation was native species, and one territory was placed in habitat where 5 to 50% of the vegetation cover was native. *A. donax* was the most commonly identified exotic species within territories followed by black mustard (*Brassica nigra*), poison hemlock (*Conium maculatum*), and tamarisk.

Table 5. Habitat types used by least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

	Number of Territories				
Habitat Type	**>95% Native**	**50-95% Native**	**5-50% Native**	**Total**	**Percent of Total**
Mixed Willow	36	51	0	87	64%
Riparian Scrub	12	14	1	27	20%
Willow/Cottonwood	4	18	0	22	16%
Total	52	83	1	136	100%

Nest Monitoring

Nesting activity was monitored in 102 territories within the San Luis Rey River Flood Control Project monitoring sites (Table 6; Appendix 1, Figures 16-19; Appendix 3). Of these, 97 territories were "fully" monitored, meaning that all nests within the territory were found and monitored during the breeding season. Pairs within the remaining five territories were documented as nesting; however, only a subset of nests by a pair was found and monitored ("partially monitored" territories). A total of 205 nests were monitored during the breeding season, 200 (98%) of which came from fully monitored territories. Nine nests were not completed and subsequently excluded from calculations of nest success and productivity.

Table 6. Number of least Bell's vireo territories and nests monitored at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

	Site Type		
	Treated[a]	**Untreated[b]**	**Total**
Fully monitored:			
Territories	67	30	97
Nests	136	64	200
Incomplete nests[c]	2	4	6
False nests[d]	0	1	1
Total number of completed nests	134	59	193
Completed nests/pair (std)	2.0 ± 0.7	2.0 ± 0.8	2.0 ± 0.7
Partially monitored:			
Territories	4	1	5
Nests	4	1	5
Incomplete nests[c]	1	0	1
False nests[d]	1	0	1
Total number of completed nests	2	1	3
Total # of nests monitored	140	65	205

[a] Numbers were combined for Treated sites: Benet West and Channel.
[b] Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation. In addition, one pair each from: Lower Pond (two nests), Park Pond (one nest), Pilgrim Pond (one nest), and Tuley Canyon (one nest), outside of the monitoring sites, were included in these calculations.
[c] Incomplete nests were partially built, but not completed.
[d] False nests were partially built by a single male, but not completed.

Nest Success

Overall, 60% (117/196) of completed nests were successful at the monitoring sites (Table 7). Sixty-four percent (87/136) of nests in the Treated sites (Channel and Benet West) fledged young, compared with 50% (30/60) of nests in the Untreated sites (Upper Pond and Whelan Mitigation; Table 7). Since sample sizes were low we combined the numbers for the Untreated sites. We also combined the Treated sites, Benet West and the Channel, into one sample.

Causes of nest failure were similar between Treated and Untreated sites. Predation was believed to be the primary source of nest failure for all sites, although only two predation events were witnessed (Table 7). Predation accounted for 90% (44/49) and 100% (30/30) of nest failures at Treated and Untreated sites, respectively. While most predators were believed to be bird, mammal, or snake, predation by Argentine ants (*Linepithema humile)* was observed for two nests during the nestling stage. Overall, 32% (44/136) of Treated nests and 50% (30/60) of Untreated nests were lost to predation.

Nests failed for reasons that were known and unknown in this study. Infertility was the likely cause of failure for one nest that was abandoned with two eggs after it had been incubated

for more than two weeks. The cause of failure of four nests was unknown. One nest was found with three dead 6-day-old nestlings; there was no sign of injury to the nestlings or disturbance to

Table 7. Fate of least Bell's vireo nests in fully and partially monitored territories at the San Luis Rey Flood Risk Management Project Area, California, in 2008. Proportion of total nests shown in parentheses.

	Number of Nests		
Nest Fate	**Treated[a]**	**Untreated[b]**	**Total**
Successful	87	30	117 (60%)
Failed			
Predation	44	30	74 (37%)
Other/Unknown	5	0	5 (3%)
Total Completed Nests	136	60	196 (100%)

[a] Numbers were combined for Treated sites: Benet West and Channel.
[b] Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation. In addition, one pair each from: Lower Pond (two nests), Park Pond (one nest), Pilgrim Pond (one nest), and Tuley Canyon (one nest), outside of the monitoring sites, were included in these calculations.

the nest. Two nests were abandoned prior to or during egg laying; because we did not observe eggs in these nests, they could have been either abandoned before egg laying or depredated in the egg stage. One nest was abandoned during egg laying.

We tested whether vegetation treatment or monitoring site had an effect on nest fate (successful versus failed). First, we tested whether treatment had an effect on nest fate (Treated versus Untreated nests). Nest fate was not independent of treatment ($\chi^2_{0.05,1} = 2.86$, P = 0.09). Nests located in the Treated sites were more likely to be successful than those in Untreated sites . Next, we compared nest success across the four monitoring sites (Channel, Benet West, Upper Pond, and Whelan Mitigation). Nest success was significantly higher at both the Treated sites, and lower at Upper Pond ($\chi^2_{0.05,3} = 9.01$, P = 0.03) (Table 8). Finally, we removed Upper Pond from the analysis, and compared nest fate between Treated and Untreated sites. Nest fate was independent of treatment ($\chi^2_{0.05,2} = 1.01$, P = 0.58); therefore nest fate was not significantly different between the Channel, Benet West, and Whelan Mitigation sites.

Table 8. Fate of least Bell's vireo nests in fully and partially monitored territories at the San Luis Rey Flood Risk Management Project Area, by monitoring site, in 2008. Proportion of total nests shown in parentheses.

	Treated				Untreated			
	Channel		Benet West		Upper Pond		Whelan Mitigation	
Nest Fate	Nests	Terr.[a]	Nests	Terr.	Nests	Terr.	Nests	Terr.
Successful	79 (62%)	58	8 (80%)	5	17 (40%)	15	9 (69%)	6
Failed	47 (38%)	5	2 (20%)	1	25 (60%)	5	4 (31%)	0
Total	126 (100%)	63	10 (100%)	6	42 (100%)	20	13 (100%)	6

[a] Territories indicated as successful had pairs that fledged at least one young and may also have had failed nest attempts

Parasitism

Brown-headed cowbirds parasitized three nests (2%; 3/195), all of which failed for reasons other than parasitism (Table 9). Two nests were depredated by the second visit after a cowbird egg had been removed; because the nest was active for one visit after the egg removal, the cause of failure was predation and not parasitism. The third nest was abandoned after it had been incubated for longer than two weeks. One vireo egg fragment and one cowbird egg fragment were found beneath the nest after it had been abandoned. Since only two vireo eggs were observed during all of the visits while the nest was active, the cowbird egg must have been dropped/ejected during egg laying; consequently the cause of failure for this nest was likely infertility rather than parasitism. Parasitism occurred only in the river channel, and was concentrated in the Reach 2 survey site, east of Foussat Road.

Table 9. Fate of parasitized least Bell's vireo nests in fully and partially monitored territories at the San Luis Rey Flood Risk Management Project Area, California, in 2008. One brown-headed cowbird egg was removed from each nest.

	Number of Nests		
Nest Fate	Treated[a]	Untreated[b]	Total
Parasitized	0	0	0
Parasitized and depredated	2	0	2
Parasitized and abandoned	1	0	1
Total	3	0	3

[a] Numbers were combined for Treated sites: Benet West and Channel.
[b] Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation. One pair from Park Pond was also included in these calculations.

Nesting Attempts

The average number of nesting attempts within fully monitored territories did not differ significantly between Treated (2.0 ± 0.7 nests/pair) and Untreated (2.0 ± 0.8 nests/pair) pairs ($t_{0.05, 94}$ = -0.04, P = 0.74) over the course of the 2008 breeding season. However, Treated pairs were more likely to re-nest after their first nest attempt; 70% versus 43% of pairs attempted a

second nest in the Treated and Untreated sites respectively ($\chi^2_{0.05,2}$ = 6.10, P = 0.05). Conversely, Treated pairs were less likely to re-nest a third time compared to Untreated pairs (14% versus 29%). Nest fate influenced the likelihood that pairs would re-nest. Pairs whose nests failed during their first nest attempt were more likely to re-nest than were pairs that were successful. Ninety-seven percent of Treated pairs and 100% of Untreated pairs re-nested after their initial nest attempt failed. However, more Treated pairs re-nested following a successful first nest attempt; 77% of Treated pairs compared to 43% of Untreated pairs. Ten pairs from the Treated site and nine pairs from the Untreated sites initiated three nesting attempts; of these, 14 pairs successfully fledged young (eight Treated pairs and six Untreated pairs). We observed two pairs that built five nests during the breeding season; one pair successfully fledged young from the fifth nest while the other pair, although it had one nest that reached the nestling stage, was not able to successfully fledge young. In addition, we documented 25 Treated pairs and 7 Untreated pairs that successfully raised and fledged two broods.

Reproductive Success and Productivity

Reproductive success of least Bell's vireos nesting at Treated and Untreated sites was slightly higher for Treated pairs, although the number of young fledged per pair was not significantly different (Table 10). Likewise, measures of productivity did not differ at the egg or nestling stage as average clutch size and average brood size were not statistically different between Treated and Untreated sites. However, pairs at Treated sites exhibited a higher hatching rate of eggs (77% versus 70%) and a higher proportion of nests in which at least one egg hatched (82% versus 73%) than did pairs in Untreated sites. Fledging success parameters were slightly higher for Treated pairs than Untreated pairs. Treated pairs had a slightly higher percentage of nestlings that fledged (81% versus 70%) as well as a higher percentage of nests that fledged at least one young (79% versus 68%).

Overall, fledging success was high in 2008; 76% of nests with nestlings produced at least one young while 77% of hatchlings survived to the fledgling stage. Pair success was also high; 90% (86/96) of pairs in fully monitored territories were successful and produced at least one vireo fledgling by the end of the season.

Table 10. Reproductive success and productivity of nesting least Bell's vireos at Treated and Untreated sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008. Numbers given for all pairs, both fully and partially monitored, unless otherwise noted. Standard deviations presented with means.

	Number		
Parameter	**Treated[a]**	**Untreated[b]**	**Overall**
Nests with eggs	131	59	190
Eggs laid	455	210	665
Average clutch size[c]	3.6 ± 0.6	3.7 ± 0.5	3.6 ± 0.5
Nests with hatchlings	108	43	151
Hatchlings	351	146	497
Average brood size[d]	3.4 ± 0.7	3.5 ± 0.7	3.5 ± 0.7
Hatching success:			
Eggs[e]	77%	70%	75%
Nests[f]	82%	73%	79%
Nests with fledglings	87	30	117
Fledglings	278	99	377
Fledging success:			
Hatchlings[g]	81%	70%	77%
Nests[h]	79%	68%	76%
Fledglings per nest	2.1	1.7	2.0
Average number of young fledged per pair[i]	4.1 ± 2.0	3.4 ± 2.2	3.9 ± 2.1
Pairs fledging ≥ one young[j]	62 (93%)	24 (83%)[k]	86 (90%)
Pairs fledging two broods	25 (37%)	7 (24%)[k]	32 (33%)

[a] Numbers were combined for Treated sites: Benet West and Channel.

[b] Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation. In addition, one pair each from: Lower Pond (two nests), Park Pond (one nest), Pilgrim Pond (one nest), and Tuley Canyon (one nest), outside of the monitoring sites, were included in these calculations.

[c] Based on 110 Treated and 50 Untreated non-parasitized nests with a full clutch (Two-sample *t*-test: $t_{0.05,\ 158} = -0.91$, $P = 0.36$).

[d] Based on 89 Treated and 35 Untreated non-parasitized nests known to have a full brood (Two-sample *t*-test: $t_{0.05,122} = -0.73$, $P = 0.47$).

[e] Percent of all eggs that hatched.

[f] Percent of all nests with eggs in which at least one egg hatched.

[g] Percent of all nestlings that fledged.

[h] Percent of all nests with nestlings in which at least one young fledged.

[i] Based on 67 Treated and 29 Untreated pairs who were fully monitored (Two-sample *t*-test: $t_{0.05,\ 94} = 1.46$, $P = 0.15$).

[j] Based on pairs whose territories were fully monitored.

[k] One pair was included in which the second successful nest was not found, but fledglings were detected.

We tested for differences in year and treatment for average clutch size per pair, average brood size per pair, and total number of fledglings per pair. Average clutch size and average brood size were significantly higher in 2006 and 2008 than in 2007, while average number of fledglings per pair was significantly higher in 2008 than in both previous years (Table 11, Figure 5). Treatment was a significant factor in explaining differences in total number of fledglings per pair, but not average clutch size or brood size per pair. From 2006-2008, on average, pairs in Treated sites had significantly more fledglings per pair than pairs in Untreated sites (3.2 ± 1.9 versus 2.7 ± 1.9).

Table 11. Results of two-way ANOVA comparing average clutch size per pair, average brood size per pair, and total number of fledglings per pair for Least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, from 2006-2008. Standard error presented in parentheses.

Productivity	**2006**	**N[a]**	**2007**	**N**	**2008**	**N**	**Variable[b]**	**F-ratio**	***P*[c]**
Average Clutch Size Per Pair	3.6 (0.06)	76	3.2 (0.06)	86	3.7 (0.06)	92[d]	Year	20.64	**0.00**
							Treatment	0.56	0.46
							Year x Treatment	0.18	0.84
Average Brood Size Per Pair	3.5 (0.10)	46	3.0 (0.08)	83	3.5 (0.08)	87	Year	15.32	**0.00**
							Treatment	0.33	0.56
							Year x Treatment	0.57	0.95
Total Number of Fledglings per Pair	2.4 (0.18)	83	2.7 (0.18)	92	3.9 (2.1)	96	Year	13.05	**0.00**
							Treatment	2.67	**0.10**
							Year x Treatment	1.32	0.27

[a] Sample size = pair.

[b] Model - Response variables: Average Clutch Size Per Pair, Average Brood Size Per Pair, or Total Number of Fledglings per Pair = Year (2006, 2007, 2008) + Treatment (Treated, Untreated) + Year x Treatment.

[c] *P* = P-value

[d] Four territories analyzed in Table 10 were excluded because they had a nest that was not seen with eggs.

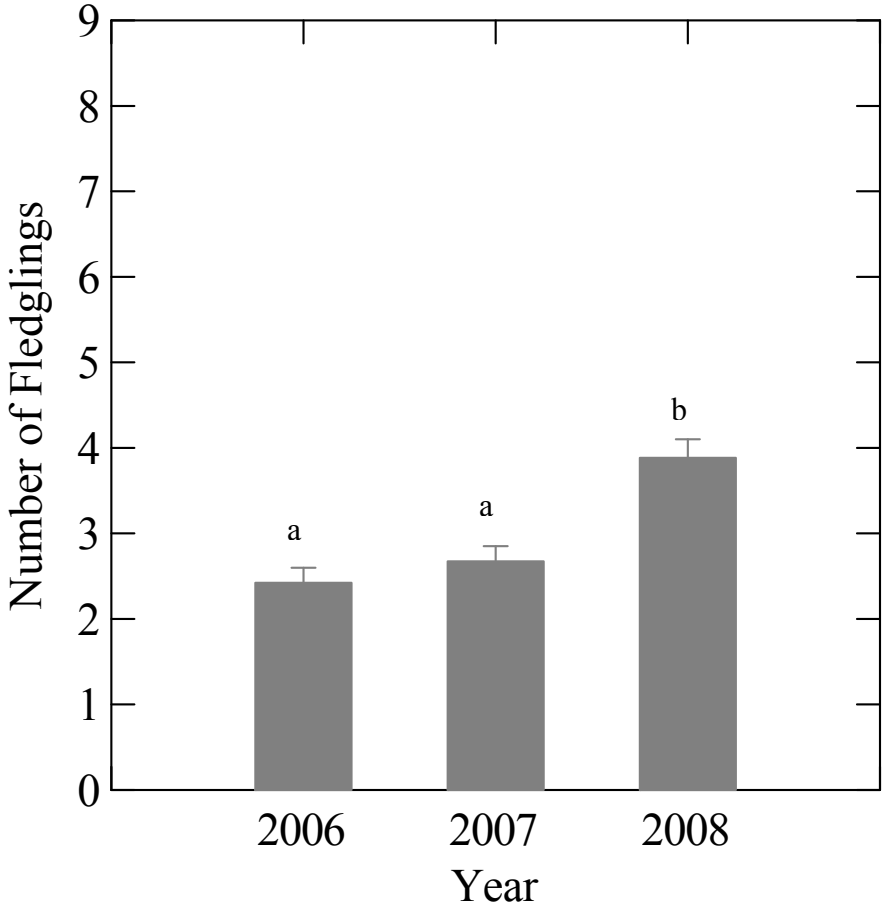

Figure 5. Total number of fledglings per pair by Year at the San Luis Rey Flood Risk Management Project Area, California, in 2006-2008. Bars with different letters differed significantly from one another ($P \leq 0.10$). Standard error bars are shown.

Nest Characteristics

Successful and failed nests within Treated and Untreated sites did not differ statistically in height of the nest, height of the host plant, distance the nest was placed from the edge of the host, or distance of nest to the edge of riparian vegetation (Table 12). However, successful nests were placed significantly further from the edge of the clump than failed nests in the Untreated sites, but not the Treated sites (Table 12).

Table 12. Least Bell's vireo nest characteristics and results of two-sample t-tests comparing successful and failed nests at the San Luis Rey Flood Risk Management Project Area, California, in 2008. Standard deviation presented in parentheses.

Nest Characteristic	**Successful**	**N[a]**	**Unsuccessful**	**N**	**df[b]**	***t*[c]**	***P*[d]**
Treated Sites[e]							
Average nest height (m)	1.1 (0.4)	100	1.1 (0.5)	35	49	-0.20	0.85
Average host height (m)	4.1 (2.5)	101	4.1 (2.4)	34	58	-0.01	0.99
Average distance to edge of host (m)	1.0 (1.0)	102	1.0 (0.8)	34	68	0.33	0.74
Average distance to edge of clump (m)[f]	4.3 (3.3)	102	3.4 (2.6)	34	70	-1.67	**0.10**
Average distance to edge of riparian (m)	34.3 (31.4)	102	32.0 (36.4)	34	50	-0.34	0.73
Untreated Sites[g]							
Average nest height (m)	1.2 (0.4)	39	1.1 (0.6)	23	37	-0.60	0.55
Average host height (m)	3.7 (2.1)	38	4.2 (2.4)	24	44	0.93	0.36
Average distance to edge of host (m)	1.0 (1.0)	39	0.9 (0.1)	22	50	-0.36	0.72
Average distance to edge of clump (m)	3.4 (4.1)	39	3.5 (2.2)	24	60	0.06	0.95
Average distance to edge of riparian (m)	28.3 (25.5)	39	40.1 (40.1)	24	35	1.29	0.20
Overall	**Treated**	**N**	**Untreated**	**N**	**df**	***t***	***P***
Average nest height (m)	1.1 (0.5)	135	1.1 (0.5)	62	114	-0.52	0.61
Average host height (m)	4.1 (2.5)	135	3.9 (2.2)	62	131	0.52	0.60
Average distance to edge of host (m)	1.0 (0.9)	136	1.0 (0.9)	61	119	0.45	0.66
Average distance to edge of clump (m)	4.1 (3.2)	136	3.5 (3.5)	63	112	1.19	0.24
Average distance to edge of riparian (m)	33.8 (32.6)	136	32.8 (32.1)	63	123	0.20	0.84

[a] Sample size

[b] df = degrees of freedom

[c] *t* = two-sample unequal variance t-test test statistic

[d] *P* = P-value

[e] Numbers were combined for Treated sites: Benet West and Channel.

[f] Clump boundaries were defined where leaves and/or branches of neighboring plants no longer overlapped.

[g] Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation. One pair each from Lower Pond, Pilgrim Pond, Park Pond, and Tuley Canyon were also included in these calculations.

Vireos at Treated and Untreated sites were comparable in their selection of host species, with >90 % of nests placed in arroyo willow, mule fat, sandbar willow, and black willow (Table 13). Whereas vireos in both treatments selected mule fat in similar proportions, birds at Treated sites placed proportionately fewer nests in sandbar willow and proportionately more nests in arroyo willow and black willow than did birds at Untreated sites. Differences in host species were likely a reflection of the relative availability of those species at each site. An additional seven plant species were used as nest support by vireos. Vireos used two non-native plants as host species at the Treated sites; two nests were placed in *A. donax*, one of which was successful, and two nests were placed in tamarisk, both of which failed.

Table 13. Host plant species used by least Bell's vireos at Treated and Untreated sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

	Treated[a]			Untreated[b]		
Host Species	**Successful**	**Unsuccessful**	**Total[b]**	**Successful**	**Unsuccessful**	**Total[c]**
Salix lasiolepis	37	25	62 (0.46)	8	2	10 (0.17)
Baccharis salicifolia	24	12	36 (0.26)	8	11	19 (0.32)
Salix gooddingii	14	4	18 (0.13)	2	1	3 (0.05)
Salix exigua	6	2	8 (0.06)	10	13	23 (0.39)
Toxicodendron diversilobum	4	2	6 (0.04)	0	0	0
Arundo donax	2	0	2 (0.01)	0	0	0
Tamarix ramosissima	0	2	2 (0.01)	0	0	0
Populus fremontii	0	1	1 (0.01)	0	0	0
Rosa californica	0	1	1 (0.01)	0	0	0
Baccharis pilularis	0	0	0	1	2	3 (0.05)
Conium maculatum	0	0	0	0	1	1 (0.02)

[a] Numbers were combined for Treated sites: Benet West and Channel.
[b] Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation. One pair each from Lower Pond, Pilgrim Pond, Park Pond, and Tuley Canyon were also included in these calculations.
[c] Numbers in parentheses are proportions of total nests.

Banded Birds

We were able to observe 85% (209) of least Bell's vireos (121 males, 93% of all males, and 88 females, 75% of all females) at the Project Area well enough to determine banding status in 2008. A total of 57 least Bell's vireos banded prior to the 2008 breeding season and identifiable by a unique color band combination returned to the San Luis Rey Flood Risk Management Project Area to establish territories in 2008 (Appendix 4, Table 14). Of these, 40 were returning adult vireos that were banded with full combinations prior to 2008: 30 were banded in 2006 and 10 were banded in 2007. The remaining 17 birds were recaptured and given supplemental bands in 2008: 10 were returning first-year vireos that were banded as nestlings in 2007, five were returning second-year vireos that were banded as nestlings in 2006, one vireo was banded as a nestling at Pilgrim Creek in 2003, and one bird was banded as a nestling at the Santa Margarita River in 2005. With the exception of the aforementioned birds banded at Pilgrim Creek and the Santa Margarita River, all birds were originally banded at the San Luis Rey Flood Risk Management Project Area. Adult birds of known age ranged from one to nine

years old. The nine-year-old male is the oldest long-lived least Bell's vireo on record.

Table 14. Number of least Bell's vireos individually identified by bands at San Luis Rey Flood Risk Management Project Area, California, in 2008, by original year color banded, and age.

Year Color Banded	Age in 2008	Number of Vireos		
		Male	Female	Total
2006	9 yrs	1	0	1
	≥ 3 yrs[a]	27	2	29
2007	≥ 2 yrs[a]	5	0	5
	2 yrs	4	1	5
2008	5 yrs	0	1[b]	1
	3 yrs	0	1[c]	1
	2 yrs	3	2	5
	1 yr	9	1	10
Total		49	8	57

[a]Banded as an adult; exact age not known.
[b] Banded as a nestling at Pilgrim Creek in 2003.
[c] Banded as a nestling at Santa Margarita in 2005.

Nine vireos (four males and five females) with a single numbered metal band were resighted in 2008 (Table 15). Eight of these individuals were banded as nestlings on the San Luis Rey River as indicated by a dark blue band, and one vireo was banded as a nestling on Pilgrim Creek as indicated by a black band. Efforts to recapture and identify these vireos were unsuccessful.

Table 15. Banding location and sex of least Bell's vireos with single metal numbered federal bands observed at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Original Banding Location	Number of Vireos		
	Males	Females	Total
San Luis Rey River	3	5	8
Pilgrim Creek	1	0	1
Total	4	5	9

We banded 442 least Bell's vireos during the 2008 season (Table 16). These included 54 adult vireos and three hatch-year vireos that were target netted and banded with a unique color combination, and 385 hatch-year birds that were banded with a single dark blue numbered federal band. All of the adult birds were unbanded prior to their capture.

Table 16. Total number of new least Bell's vireos captured and banded at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Age Banded	Males	Females	Unknown Sex	Total
Adult[a]	51	1	2	54
Juvenile[b]			3	3
Nestling[c]			385	385
Total	51	1	390	442

[a] Adults banded with unique color combinations.
[b] Incidentally captured post-fledging, given unique color band combinations.
[c] Nestlings banded with single anodized federal band.

Survivorship, Fidelity, and Movement

The recapture and resighting of banded birds allowed us to estimate survivorship, or the proportion of individuals known to survive from one year to the next. Adult survivorship was high: of 58 uniquely color banded adult vireos present during the 2007 breeding season, 78% (45/58) returned to the San Luis Rey Flood Risk Management Project Area in 2008 (Appendix 5). Three of seven adult females that were banded in 2007 returned in 2008.

Territory site fidelity was strong among adult vireos that were uniquely banded in 2006 or 2007 and were resighted in 2008; 77% (33/43) of adults (two of which were females) returned to breed in the same territory as the previous year (Appendix 5). Three vireos (one female and two males) returned to areas adjacent to their previous territories (within 500 m). Five vireos (one female and four males) moved between 0.5 and 1.5 km, one male vireo moved 2.2 km and one female moved 4.0 km from their 2007 breeding territories to their 2008 breeding territories. Average distance moved by returning adult vireos was 1.2 ± 1.2 km (std).

Ten of the 236 hatch-year vireos banded in 2007 that survived to fledge were resighted at the San Luis Rey Flood Risk Management Project Area in 2008, yielding an estimated second-year survivorship of 4% (Appendix 5). Inclusion of four males and one female captured outside of the Project Area and confirmed to natal territories within the Project Area (see below; Appendix 6) increased the estimate of annual survivorship to 6% (15/236). We recaptured nine males and one female and banded them with a unique color combination in 2008. Dispersal distance within the Project Area of first-year vireos ranged from 0.2 – 6.0 km and averaged 1.5 ± 1.7 km (std).

Banding allowed us to examine adult and juvenile dispersal within and between Treated and Untreated sites. Ten first-year birds were recaptured and their natal territories identified (Appendix 5). Of these, five were fledged from Treated sites and five from Untreated sites. Although sample sizes were small, no clear pattern of dispersal among the returning birds emerged within or between treatment types. One bird remained within the Treated site, three remained within the Untreated sites, four dispersed from a Treated location to an Untreated site, and three dispersed from an Untreated site to a Treated location (Appendix 5).

Ten adult birds moved to new territories between 2007 and 2008; four stayed within the Treated site, one moved to another territory within Whelan Mitigation, two moved from Reach 4 to Upper Pond and three moved from Untreated sites to the Treated site. By comparing the banding status of adults in 2007 and 2008 territories, we were able to determine that seven of the dispersing adults displaced the 2007 adult from that territory. Three territories occupied by dispersing males in 2008 contained banded adults in 2006 that were not detected during the 2007 breeding season, suggesting that the birds may have died prior to the 2008 breeding season.

Banding and surveying of least Bell's vireos at other study sites allowed us to examine movements between the San Luis Rey Flood Risk Management Project Area and other drainages in San Diego County. Five first-year birds (one female and four males) and two second-year males were recaptured at Camp Pendleton and banded with a unique color combination in 2008 (Appendix 6). Dispersal distances ranged from 4.5 – 12.2 km and averaged 7.8 ± 2.9 km (std). In addition, five males and one female were resighted at Camp Pendleton with a metal dark blue federal band indicating they were originally banded either at the San Luis Rey Flood Risk Management Project Area or at the upper San Luis Rey River study area (Appendix 6). Although the exact natal territory was unknown, we calculated the shortest distance that a vireo could have dispersed from either study site at the San Luis Rey River to their 2008 territory (Appendix 6). In addition, we resighted four vireos with metal dark blue federal bands at other drainages outside of Camp Pendleton: one female at the San Dieguito River, one male at Otay River, one male at Aqua Hedionada Creek, and one male at Calavera Hills along a tributary of Aqua Hedionada Creek. Estimated shortest dispersal distances ranged from 9.6 – 75.0 km.

Southwestern Willow Flycatcher

Population Size and Distribution

A total of five transient willow flycatchers of unknown sub-species were detected within the Project Area in 2008 between 22 May and 5 June. Two transients were observed in the river channel between Foussat Road and Douglas Drive; one between Douglas Drive and College Boulevard, and one between Benet Road and Interstate 5. We detected one transient in Whelan Mitigation, outside of the river channel. No southwestern willow flycatcher pairs were detected within the Project Area in 2008.

Habitat Characteristics

Flycatchers used mixed willow riparian habitat at the Project Area (Table 17). All flycatcher locations were in habitat where <50% of the vegetation cover was native species. Dominant native species included arroyo willow, black willow, sandbar willow, and cottonwood. *A. donax*, poison hemlock and tamarisk (*Tamarix ramosissima*) were the most commonly identified exotic species at flycatcher locations. Flycatchers were detected between 0 and 40 m away from surface water.

Table 17. Habitat characteristics of transient southwestern willow flycatcher at the San Luis Rey Flood Risk Management Project Area, California, in 2008

Bird ID	Date First Detected	% Cover Exotics	Dominant Exotics	Distance to Surface Water (m)
WL2	22 May	<5%	poison hemlock	10
CGF01	3 June	5-50%	*Arundo donax*	10
08WF01	5 June	5-50%	tamarisk	20
08WF02	5 June	5-50%	tamarisk	20
BNF01	5 June	5-50%	*Arundo donax*	40

Nest Monitoring

No southwestern willow flycatcher pairs were detected within the Project Area in 2008. Therefore, no nest monitoring was conducted during the 2008 season.

Banded Birds

We did not detect any banded adult flycatchers during the 2008 season. However, only one transient flycatcher (BNF01) was confirmed unbanded. We were unable to confirm whether the remaining four transient flycatchers were banded.

Baseline Vegetation Study

A total of 46 transects (528 points) were established and sampled at the Project Area in 2006, 2007, and 2008 (Table 18; Appendix 2, Figures 21–23). Seventy-two percent (378/528) of points were located in the Channel site while the remaining 28% (150/528) were located at Upper Pond and Whelan Mitigation. The number of points per transect varied between 4 and 18. GPS coordinates for the start and end point of each transect are provided in Appendix 5.

One hundred and nine of the 528 points, all within the Channel site, were located in areas points) or both (15%, 16 points). Points in treated areas made up 29% (109/378) of the points in the Channel and 21% (109/528) of all points sampled in these sites. All Channel transects spanned treated areas (represented by up to seven points per transect).

Table 18. Number of vegetation transects and points at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Site	Transects	Untreated Points	Treated Points[a]	Total Points
Channel	31	269	109	378
Upper Pond	13	115	0	115
Whelan Mitigation	2	35	0	35
Total	46	419	109	528

[a] Treated points were located in areas with vegetation clearing and/or *A. donax* removal.

Vegetation Structure

Foliage cover below 1 m was greater at the treated Channel points than at the untreated Channel points and the other sites, (Figure 6). Foliage cover was similar for treated and untreated Channel points from 1-3 m. However, at heights above 3 m, vegetation at untreated Channel points was taller and more dense than that at treated points and sites outside of the flood control channel. In general, foliage cover was more similar among treated Channel points, and Upper Pond and Whelan Mitigation because of their lower average canopy height (treated points: 4.4 ± 3.0 m; Upper Pond: 4.8 ± 2.9 m; Whelan Mitigation: 4.2 ± 1.9 m). In contrast, average canopy height at untreated Channel points measured approximately 4 m higher (9.0 ± 3.5). Consequently, 80% of the total cover measured was below 3 m for treated Channel points, and Upper Pond and Whelan Mitigation, whereas 80% of the total cover measured for untreated Channel points was below 6 m (Figure 7).

Vegetation Composition

Cover of tree species was highest at untreated Channel points and lowest at the Upper Pond (Figure 8). Dominant tree species in the Channel included arroyo willow and *Black willow*, with a higher percent cover of arroyo willow at all height classes. Together these species represented 53% and 41% of the total foliage cover over all heights for untreated and treated points, respectively. Cottonwood was also documented in the Channel, although it contributed <3% of the total cover for treated and untreated points. Arroyo willow was the dominant tree species at Upper Pond and Whelan Mitigation, representing 26% and 37% of the total foliage cover. Cottonwood was the second most dominant species at Upper Pond and Whelan Mitigation, contributing 6% and 8% of the total foliage cover.

Cover of shrub species was highest outside of the flood control channel at Upper Pond and Whelan Mitigation (Figure 9). There, shrub cover represented a higher proportion of the total foliage cover than any other plant type; 38% of Upper Pond and 30% of Whelan Mitigation cover was from shrub species. Sandbar willow and mule fat were co-dominants at Upper Pond while mule fat was the dominant shrub species at Whelan Mitigation. In the Channel, shrub cover was dominated by mule fat and comprised 10% and 8% of the total foliage cover of the untreated and treated points, respectively.

Herbaceous cover was highest within the Channel at the treated points and at Upper Pond; 22% of the total foliage cover at each site was classified as herbaceous (Figure 10). Thirteen percent of foliage cover at Whelan Mitigation was herbaceous. Vegetation at the untreated Channel points had the lowest percent herbaceous cover; 9% of the total cover was classified as herbaceous.

Freshwater marsh, which included such species as cattail (*Typha* spp.) and rush (*Juncus* spp.) was recorded only in the Channel and represented 20% of the total foliage cover at untreated and treated points (Figure 10).

Cover of dead woody species was highest in the Channel at the untreated points and at Whelan Mitigation, where 4% of the total foliage cover at each site was comprised of dead woody species (Figure 10). Two percent of the total cover at the treated Channel points was dead cover. Dead woody cover was 1% of the total cover at Upper Pond.

A. donax was the dominant exotic perennial species across sites (Figure 11). *A. donax* was most prevalent at the Channel points, making up approximately 13% and 7% of the total cover of treated and untreated points, respectively. *A. donax* represented 2% of the total cover at Whelan Mitigation and <1% in the Upper Pond. Although tamarisk was detected in 2006 and 2007, we did not record tamarisk on any of our points in 2008.

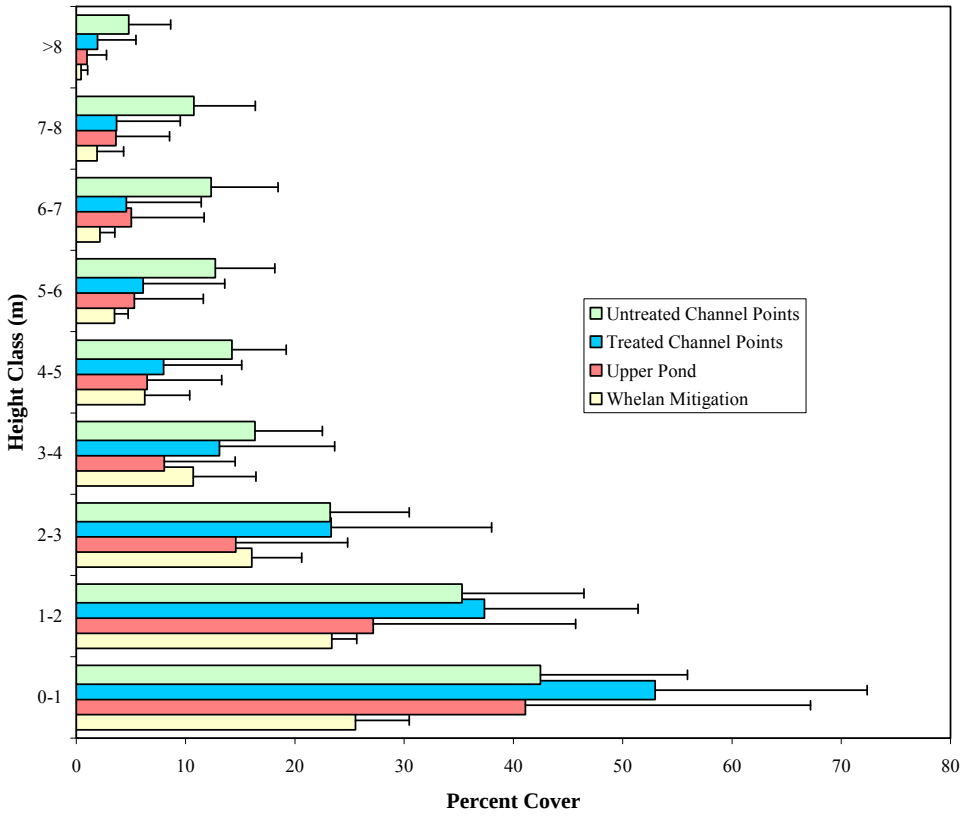

Figure 6. Average percent foliage cover by height class (m) at the San Luis Rey Flood Risk Management Project Area, California, in 2008. Bars are standard deviations.

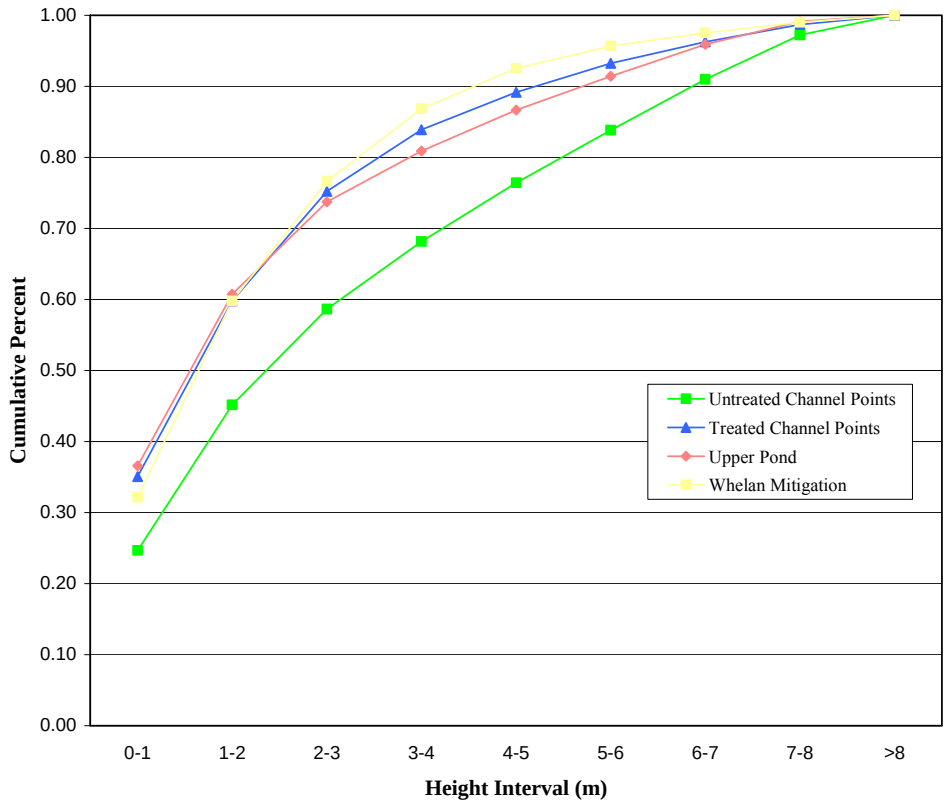

Figure 7. Cumulative percent foliage cover by height interval (m) at the San Luis Rey Flood Risk Management Area, California, in 2008.

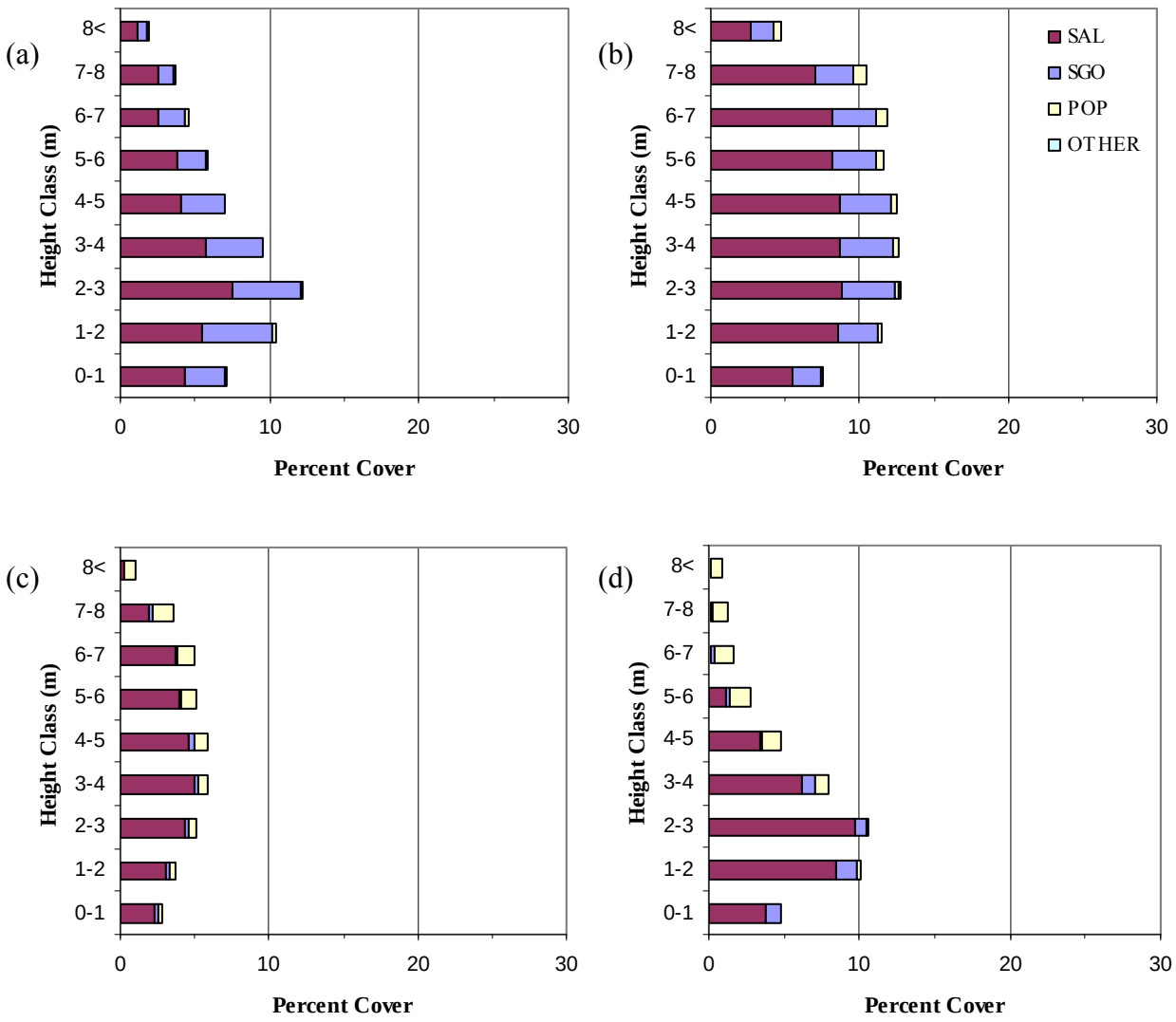

Figure 8. Average percent cover of tree species: *S. lasiolepis* (SAL), *S. gooddingii* (SGO), *P. fremontia* (POP), and the remaining tree species (OTHER) by height class (m) for: (a) Channel treated points (b) Channel untreated points (c) Upper Pond and (d) Whelan Mitigation at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

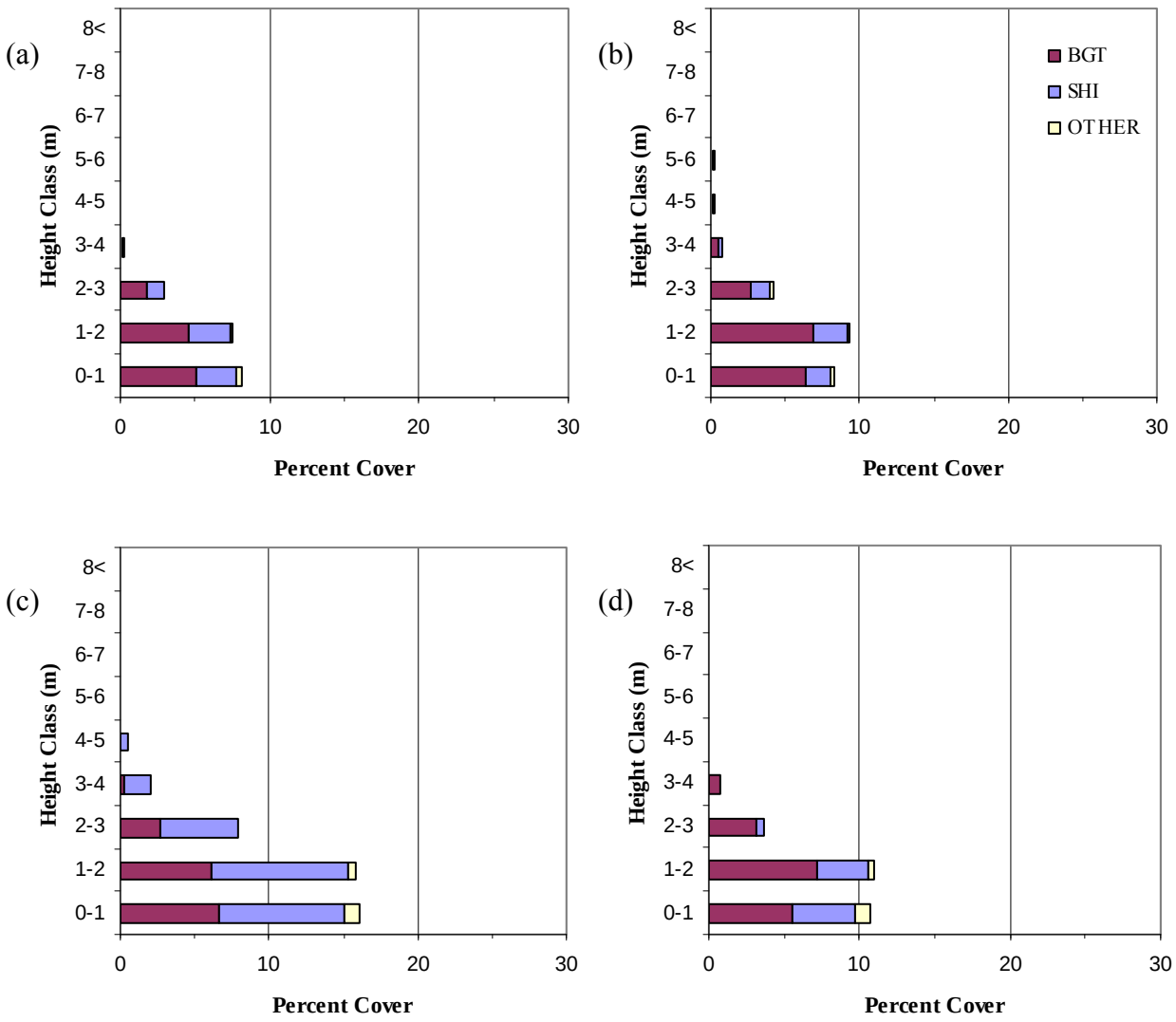

Figure 9. Average percent cover of shrub species: *B. salicifolia* (BGT), *S. exigua* (SHI), and remaining shrub species (OTHER) by height class (m) for (a) Channel treated points (b) Channel untreated points (c) Upper Pond and (d) Whelan Mitigation at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

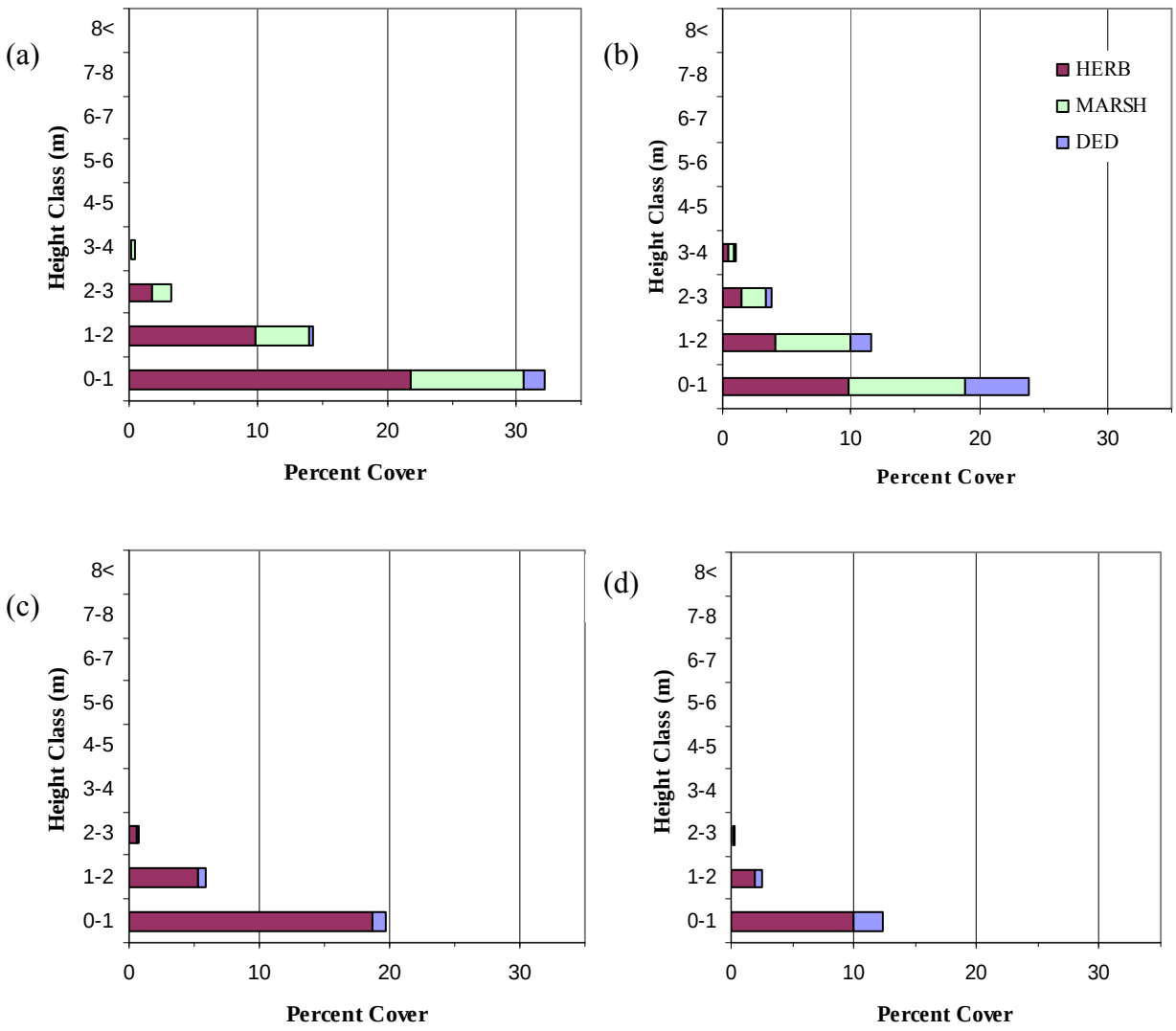

Figure 10. Average percent cover of herbaceous species (HERB), marsh species (MARSH), and dead woody cover (DED) by height class (m) for (a) Channel treated points (b) Channel untreated points (c) Upper Pond and (d) Whelan Mitigation at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

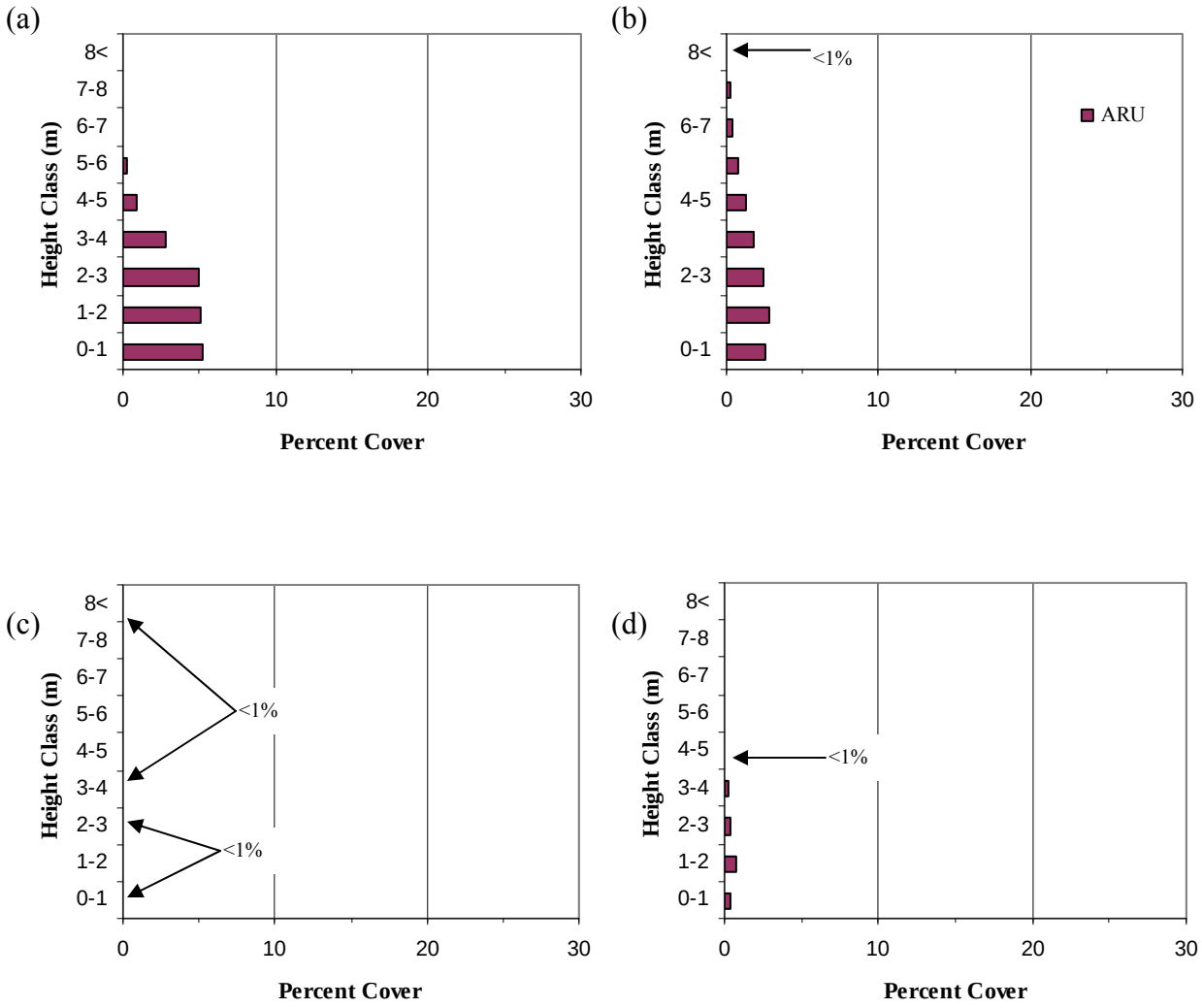

Figure 11. Average percent cover of *A. donax* by height class (m) for (a) Channel treated points (b) Channel untreated points (c) Upper Pond and (d) Whelan Mitigation at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Vegetation Changes from 2007 to 2008

Year-to-year differences in vegetation cover occurred in the Channel and at Upper Pond, but not at Whelan Mitigation (Figures 12-13). The largest vegetation changes occurred at Upper Pond where foliage cover doubled at 0-1 m and increased by greater than 40% at all other heights between 2007 and 2008 . Foliage cover changes occurred in the middle to upper canopy heights in the Channel; foliage cover significantly increased by greater than 30% for treated points at 2-7 m and significantly decreased by 11%-20% for untreated points at 4-7 m.

Differences in overall vegetation cover at Upper Pond from 2007 to 2008 were attributed to an increase in herbaceous and shrub cover at height intervals <4 m and smaller increases in tree cover above 4 m. In the Channel, changes in foliage cover were a result of an increase in tree cover at treated points and a decrease in tree cover at untreated points.

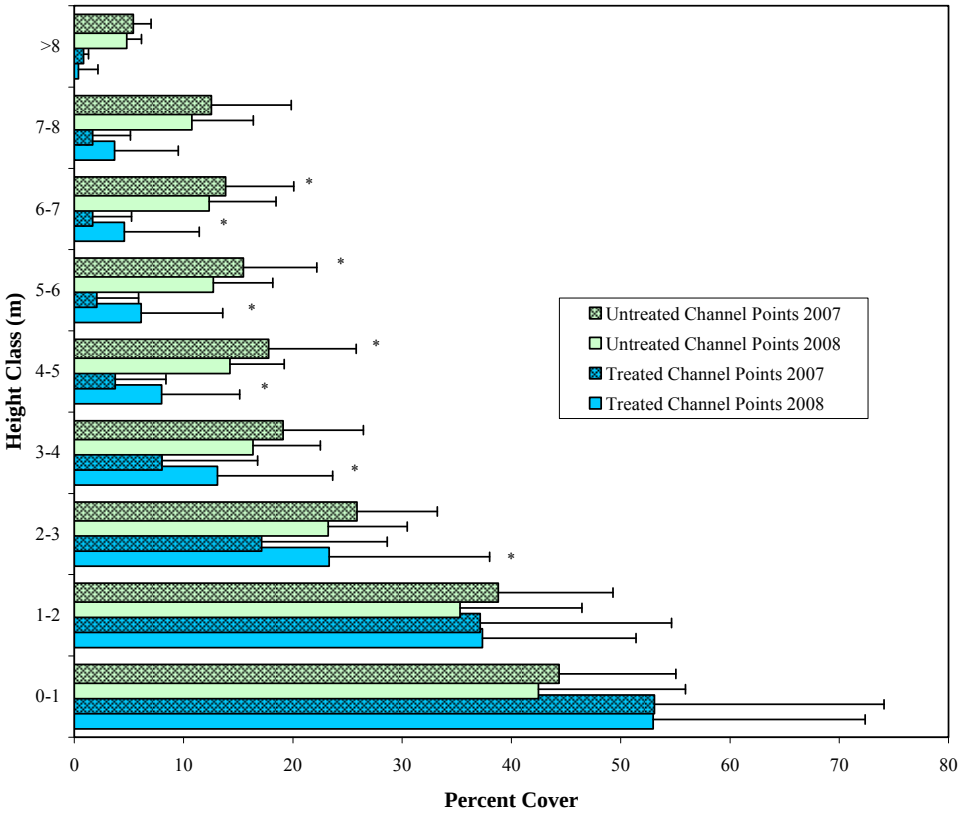

Figure 12. Average percent foliage cover by height class (m) for untreated and treated Channel points at the San Luis Rey Flood Risk Management Area from 2007 to 2008. Bars are standard deviations. Asterisks denote significant differences between years by height class and site ($P \leq 0.10$).

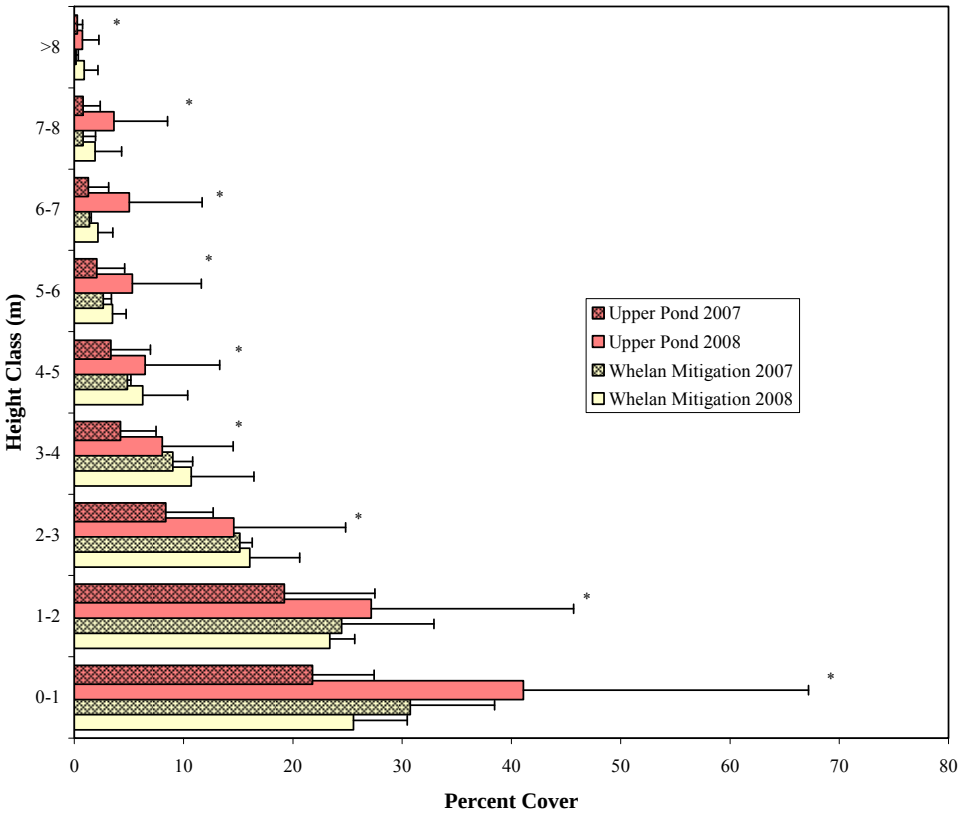

Figure 13. Average percent foliage cover by height class (m) for the Upper Pond and Whelan Mitigation sites at the San Luis Rey Flood Risk Management Area from 2007 to 2008. Bars are standard deviations. Asterisks denote significant differences between years by height class and site ($P \leq 0.10$).

Vireo Habitat Use

Vegetation parameters were measured at 60 vireo nests and 60 random plots (480 sampling points in total) following the 2008 breeding season. We measured 45 paired plots in the Channel, 10 paired plots at Upper Pond, and five paired plots at Whelan Mitigation (Figures 14–15). Comparisons were made between the Treated and combined Untreated sites; therefore nests and random plots in the Channel were separated from those in the Upper Pond and Whelan Mitigation sites. Although most vireo nests in the Channel were located in areas without treatment, some sampling points from nest and random plots fell within the boundaries of vegetation removal areas. In addition, five nests and four random plots fell completely within treated areas of the Channel. Treated points represented 11% (20/180) of the total points for nest plots and 9% (16/180) of the total points for random plots. Small sample sizes prevented us from examining the effects of treatment at the scale of the nest/random plot; thus we pooled treated and untreated points within nest plots and random plots in the Channel.

Least Bell's vireo nest placement within territories was largely independent of vegetation structure in the Channel site, where foliage cover between nest and random plots did not differ except at 1-2 m (Figure 14). However, territory placement within the Channel was non-random,

with vireos selecting sites with greater foliage cover between 2-4 m than that generally available. In contrast, vireos nesting in the Untreated sites, where canopy cover was lower than in the Channel, were selective in both placement of nests within territories, and establishment of territories within the sites. Foliage cover at nests in Untreated sites was greater than that at random points at nearly all heights above 1 m (Figure 15); moreover, cover at random (territory) points was greater than that in the surrounding habitat between 1-4 m. The result of this non-random habitat use, although achieved differently in the Channel and Untreated sites, was that vegetation structure at nest sites was remarkably similar across all pairs.

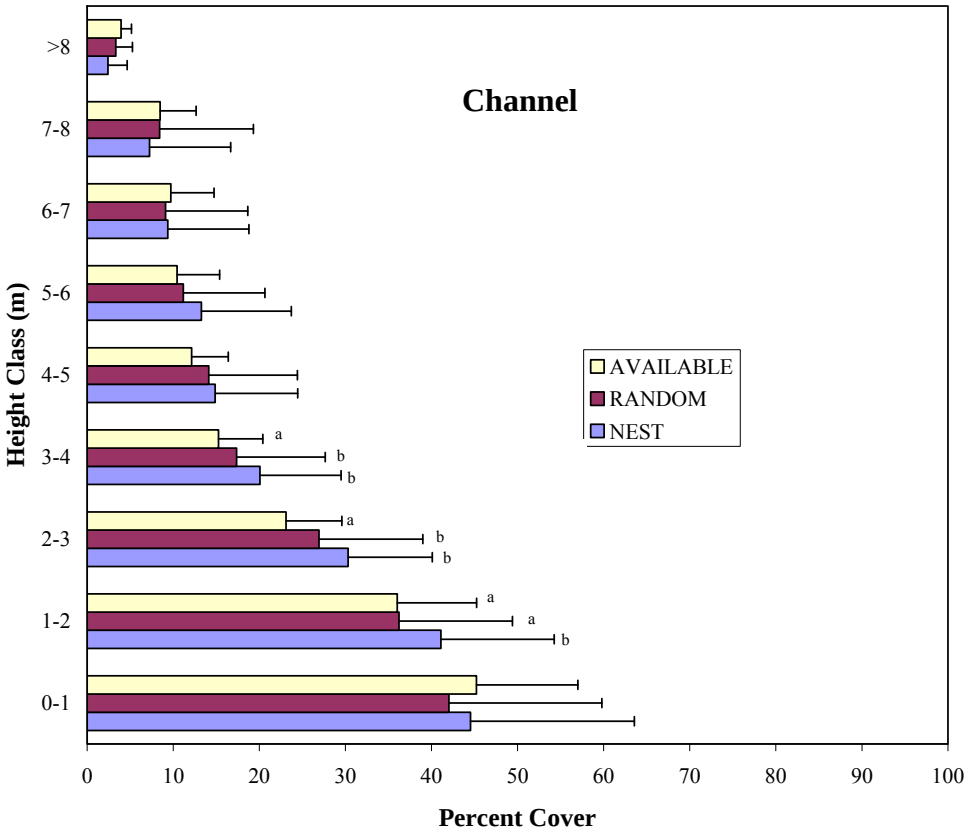

Figure 14. Average percent foliage cover for nest plots (N=45), random plots (N=45), and vegetation transects (N=31) (shown as "available") by height class in the Channel site at the San Luis Rey Flood Risk Management Project Area, California, in 2008. Bars are standard deviations. Bars with different letters differed significantly from one another ($P \leq 0.10$).

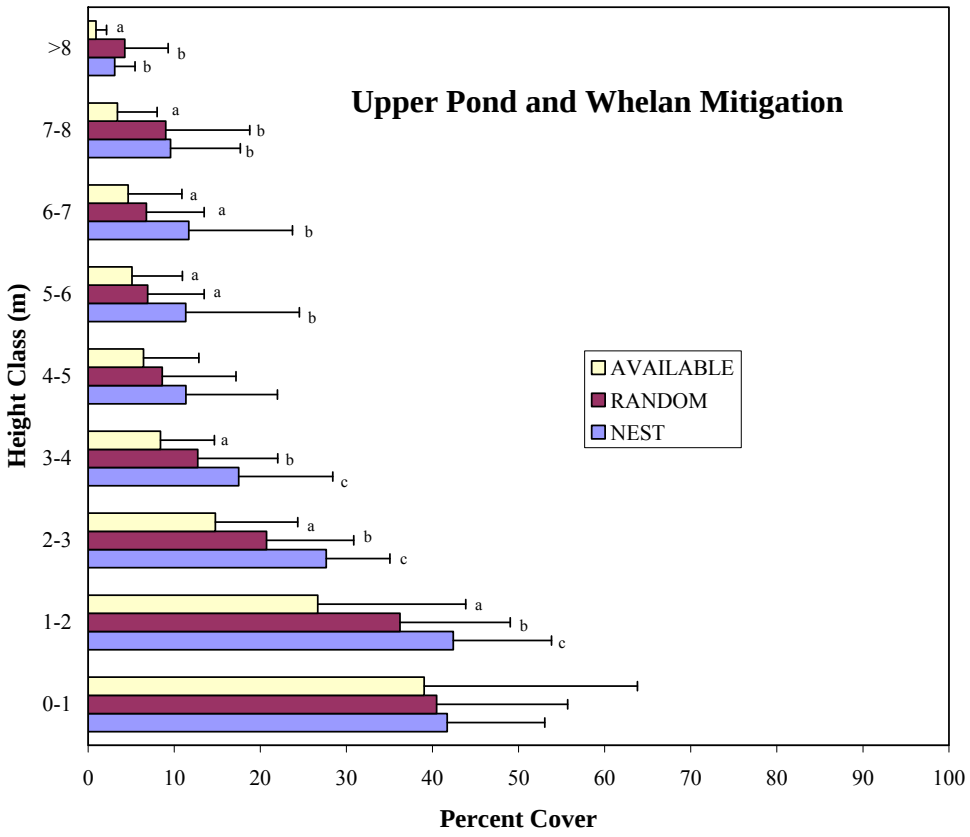

Figure 15. Average percent foliage cover for nest plots (N=15), random plots (N=15), and vegetation transects (N=15) (shown as "available") by height class in the Upper Pond and Whelan Mitigation sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008. Bars are standard deviations. Bars with different letters differed significantly from one another ($P \leq 0.10$).

DISCUSSION

Least Bell's Vireo

The Least Bell's vireo population at the Corps Project Area increased by 20% (22 territories) from 2007 to 2008, to achieve the highest number of territories ever detected at this site. Following the largest annual increase in 2003 (RECON 2006), when a 43% increase in territories was observed (82 to 117 territories), territory numbers appeared to stabilize, increasing by only two territories from 2003 to 2006. Since surveys began in 1984, the least Bell's vireo population at the Project Area has steadily risen from a low of six territories in 1989 (Kus 1989) to the current high of 130 territories, likely a result of an increase in the availability of suitable riparian habitat and high productivity of nesting pairs (Kus and Whitfield 2005). Furthermore, the 2008 population increased by 9% since 2006, which had the second highest number of territories ever recorded at this site, a sizeable gain of 11 territories. Moreover, while the total number of territories in 2008 at Untreated sites outside of the Channel rebounded to the same number as in 2006, the number of territories in the Channel actually *increased* by 11 territories since 2006. Therefore, despite major habitat changes between 2005 and 2008 within the Channel, vegetation removal did not appear to have a negative impact on the abundance of vireos in 2008. Continued surveys are necessary to assess the short- and long-term effects of vegetation removal on this vireo population.

Both the Project Area and Camp Pendleton vireo populations experienced an increase in territory numbers, although the Camp Pendleton population increase was much lower, 5% (increase of 32 territories) from 2007 to 2008 (Lynn and Kus). The vireo population on the upper San Luis Rey River between I-15 and Gird Road also increased by 5% (gain of two territories) (USGS unpublish. data).

The largest changes in vireo abundance between 2007 and 2008 occurred at the Untreated sites; territory numbers in the Untreated sites increased by 30% (10/33), compared to 16% (12/75) for the Treated sites. In general, territory numbers increased across the Project Area with the largest gains occurring at Reach 3a and Reach 4 in the Channel site, and outside of the river channel at Upper Pond, each of which gained four territories. What is most remarkable about the Project Area is the high proportion of occupied to unoccupied habitat. Within the Channel, between College Boulevard and Benet Road (survey sites: Reach 2, Reach 3a, Reach 3b and Reach 4), the addition of the 2008 territories appeared to have pushed these survey sites even closer to their carrying capacities. Least Bell's vireo territories lined both sides of the river channel, leaving little room for additional territories (Appendix 1, Figures 17-19). Even Reach 3b, which lost one territory in 2008, had very little unoccupied habitat. It is unclear how vireos will respond to further population increases; in particular, whether they will adjust territory size to accommodate new pairs in these areas. Thus from College Boulevard to Benet Road, where the majority of vegetation clearing has occurred, future treatment could have an impact on this population. The least populated section of the Channel survey sites, Reach 1, increased from 7 to 10 territories from 2007 to 2008, although it was still down from 13 territories in 2006. However, the increase occurred despite major habitat changes including vegetation clearing and *A. donax* eradication in February and March of 2008. Because the area has been historically dominated by large stands of *A. donax* and pampas grass (*Cortaderia* spp), the habitat in this

section has been of generally lower quality as characterized by the high exotic cover and more open habitat structure, and has supported far fewer vireo territories than in other parts of the river channel. In the long term, vegetation treatment will likely have a positive impact on the vireo population by providing higher quality habitat. This reach could function as a refuge for vireos displaced from the Channel, especially if the population continues to increase and habitat becomes more limited in other parts of the Channel.

The Untreated sites outside of the Channel were also crowded with vireo territories. In particular, Upper Pond, which had the highest density of vireos in the Project Area, supported 21 territories in 2008. Territory numbers also increased in Whelan Mitigation, and although it had more available habitat than Upper Pond, some of this was more characteristic of upland habitat less suitable for vireos. Over time, changes in habitat structure and composition at Whelan Mitigation may result in a decline in vireo abundance. Park Pond gained two territories since 2007 and had the youngest habitat of any of the sites. As habitat at this site matures, it has the potential to become similar to Upper Pond habitat and support a larger vireo population than it currently does. Lower Pond, which gained one territory since 2007, could also support a larger vireo population, although the impact of a large homeless population has degraded some of the understory habitat. Finally, the two smallest sites, Tuley and Pilgrim Pond, which can only support 1-2 territories, did not change from 2007-2008.

While a few new territories were squeezed in between established territories, especially in higher density areas such as Reach 4 and Upper Pond, the majority occurred in areas that were not previously occupied in either 2006 or 2007. Notably, 16% (21/130) of territories were in areas that have been unoccupied since at least 2005; 13 in the Channel and 8 outside of the Channel. Within the Channel, five new territories were added to the Reach 4 survey area, one of which was located between two established territories. In the Reach 3a survey area, east of Foussat Road, four new territories were added in the Channel; all of these birds used large sections of the Treated area. In addition, three new territories were added west of Foussat Road in the Reach 2 survey area. In the Reach 1 survey area, one territory was added. Outside of the Channel, two territories were added to Upper Pond (one took over half of another pair's territory), and four new territories were added in Whelan Mitigation. At Upper Pond, several pairs started using the area to the south, outside of the detention pond berm which is composed of dense, young willow and herbaceous growth, habitat favored by vireos. Although no nesting was documented here, birds were observed foraging in this area. At Whelan Mitigation, birds that had shifted their territories from upland habitat into the Channel in 2007 remained in the Channel in 2008 suggesting that the upland area occupied in 2006 may be lower quality habitat since vireos settled in different areas of the site. One territory each was added to Park Pond and Lower Pond. There are several reasons why vireos might be using new areas. First, birds may be moving from lower quality habitat that has degraded over time to higher quality habitat as it has become available. This has likely happened at Reach 1 where in 2006, four territories were abandoned mid-season and have not been occupied since then. This was also documented at Whelan Mitigation when banded pairs shifted their territories from upland habitat in 2006 to the Channel in 2007 and have remained in the new territories in 2008. Second, high site fidelity combined with a population increase may limit available habitat so that new pairs must use new areas Finally, resources may have been more abundant in 2008 because of the greater precipitation allowing territories to be smaller and therefore more tightly packed or making

otherwise unsuitable habitat suitable.

Hatching rate, fledging rate, and reproductive measures such as average clutch size, average brood size, and average number of young fledged per pair did not differ significantly between Treated and Untreated sites. However, nest success was higher in the Treated sites compared to the Untreated sites. Just as in 2006, this difference was driven primarily by the Upper Pond nests, where nest success was only 40%, although still higher than in 2006 when nest success was 29%. When the Upper Pond site data were removed from the Untreated dataset, nest success increased to 71%, similar to the nest success rate of 72% in the Treated sites. Given the low rate of nest success in the Upper Pond, it is possible that this site could be functioning as a sink in this population. Vireos may be attracted to this site because of factors such as habitat quality, the presence of other vireos, or in response to vegetation alteration in the Channel, but experience reduced nesting success. Further investigation into predation pressures and monitoring is needed to determine whether this is a recurring pattern. Overall, pair success was high; 90% of pairs in fully monitored territories were successful and produced at least one vireo fledgling by the end of the season.

Predation was the primary cause of nest failure in Treated and Untreated sites, accounting for 32-50% percent of all nest losses, respectively. Unlike in 2007, when predation rates were higher in the river channel, predation was highest at Upper Pond in 2008. Both Upper Pond and Whelan Mitigation experienced high predation rates during 2006. Thus, there appears to be a spatial and temporal component to predation in the Project Area, suggesting that potential site-specific differences such as vegetation composition and structure, or predator community and abundance in these areas may contribute to varying predation rates.

By all measures of reproductive performance, 2008 was a banner year for vireos at the San Luis Rey Flood Risk Management Project Area. Average clutch size and average brood size were significantly higher in 2006 and 2008 compared to 2007 (3.6 and 3.7 versus 3.2 eggs per nest; 3.5 and 3.5 versus 3.0 nestlings per nest) (Ferree and Kus 2007, Ferree and Kus 2008). Moreover, the total number of fledglings per pair was significantly higher in 2008 than in previous years (3.9 versus 2.4 and 2.7). Pairs in 2008 had a higher percentage of eggs that hatched and a higher percentage of nestlings that fledged. Treatment was found to influence the total number of fledglings per pair; on average, pairs in Treated sites had a higher number of fledglings than pairs in Untreated sites in all years combined.

The most dramatic difference between 2008 and the previous years was the number of pairs that fledged two broods; 33% (32/96) of pairs successfully raised and fledged two broods in 2008 compared with 5% (4/85) of pairs in 2006 and 12% (11/92) of pairs in 2007. This trend was also observed at Camp Pendleton where 39% (20/51) of pairs double-brooded (Lynn and Kus 2008). The unusually high number of double broods in 2008 may be explained by vireos starting the nesting season earlier in 2008 than in previous years, which extended the breeding season allowing time for multiple successful nesting attempts. The median laydate for first nests at the Project Area in 2008 was 14 April, 15 days earlier than in 2007 (29 April) and 19 days earlier than in 2006 (3 May). A successful nesting cycle takes approximately 30 days and pairs will typically spend another 2-6 weeks attending fledglings. Since successful nesting attempts take longer than failed attempts, in previous years, vireos that had successful early nests may

have been less likely to attempt a second brood because what remained of the breeding season was not sufficient to successfully fledge a second nest. Indeed, pairs in 2006 and 2007 that double-brooded had earlier median laydates than pairs that did not double brood (unpublish. data, USGS).

Reproductive success and productivity were similar for this population and the nearby Camp Pendleton population monitored by USGS in 2008 (Lynn and Kus 2008). At Camp Pendleton, 94% of pairs successfully fledged young compared to 90% of the San Luis Rey project pairs. The mean number of fledglings per nest was 2.1 for Camp Pendleton and 2.0 for San Luis Rey Project Area vireos. The mean number of fledglings per pair was slightly higher at Camp Pendleton (4.4 versus 3.9). Finally, 35% (18/51) of vireo pairs successfully double-brooded at Camp Pendleton compared to 34% of the San Luis Rey project pairs.

Banding of least Bell's vireos with unique color combinations, started in 2006, has allowed us to estimate adult and juvenile return rates as well as to examine adult and juvenile dispersal between Treated and Untreated sites. Adult return rates were high: 78% of adults that were uniquely color banded in 2007 returned to breed in the Project Area. Furthermore, territory fidelity was strong among adult vireos, with 77% of adults returning to breed in the same territory as the previous year. Not unexpectedly, juvenile return rates were significantly lower than adult return rates. Only 6% of hatch-year birds banded in 2007 were detected this year, lower than the 12% return rate observed at Camp Pendleton in 2008 (Lynn and Kus 2008). In 2008, five vireos at the San Luis Rey Flood Risk Management Project Area and four vireos at Camp Pendleton with single blue bands were recaptured and identified as having fledged in 2006. With the addition of the nine birds, juvenile return rates for 2007 should be revised upward to 10% (22/220), still below the rate of 22% calculated for Camp Pendleton juveniles during the same period. Several possibilities might account for low return rates at the San Luis Rey Flood Risk Management Project Area. First, the decline in population that we observed in 2007 for adult vireos may have also been reflected in juvenile survivorship, especially if mortality during migration or on the wintering grounds was higher than in previous years. Alternatively, because the San Luis Rey River vireo population is large and habitat availability is low, first-year birds may have dispersed to other areas. Notably, five of the 10 first-year birds that were banded in 2007 occupied an area that had not been known to be occupied by a vireo pair in the Project Area and three were in territories that were occupied in 2006, but not in 2007, suggesting habitat availability is limited in this population. We recaptured one first-year female and three first-year males that had been banded as nestlings in the Project Area at Camp Pendleton. In addition we resighted six first-year birds (one female, five males) at Camp Pendleton that were banded either at the San Luis Rey Flood Risk Management Project Area or at the upper San Luis Rey study area. Finally, we resighted four male vireos with a single metal dark blue federal band at four other drainages in San Diego County. Thus the San Luis Rey Flood Risk Management Project Area is functioning as a source population for other populations.

Southwestern Willow Flycatcher

There were no breeding pairs of southwestern willow flycatchers detected in 2008. This is the first year that the Project Area has not been occupied by willow flycatchers since it was colonized and monitoring began in 2000 (Kus and Rourke 2005). A female that had bred

previously in the Project Area was detected breeding nearby on Camp Pendleton in 2008 (Kenwood and Kus 2007, Ferree and Kus 2008, Howell and Kus in prep.). The female did not have a successful nest in 2007, but was successful at Camp Pendleton. It is unknown why birds did not return to breed in the study area. The habitat was not as dry as it had been in 2007; herbaceous understory species were 1-2 m taller in 2008 than they had been in 2007. Conditions in the historical flycatcher territories appeared similar to how they had been in 2006 when three pairs occupied the site.

A concomitant decline in southwestern willow flycatchers was observed at Camp Pendleton (Howell and Kus, in prep) and at the South Fork of the Kern River (Mary Whitfield, pers. comm.), indicating there may have been a region-wide decline in flycatcher populations during 2008. At Camp Pendleton, the population declined from 14 females and 12 males in 2007 to 7 females and 5 males in 2008 (Rourke *et. al* 2008, Howell and Kus in prep.). Vegetation clearing in 2008 does not appear to have played a role in the decline of the flycatcher in the San Luis Rey Flood Risk Management Project Area population. More likely explanations include continuing response to the drought in 2007 or other life history factors such as juvenile or adult mortality experienced during migration or on the wintering grounds. More information is warranted for this challenging species.

Baseline Vegetation and Vireo Habitat Use

We did not detect large changes in vegetation structure or composition from 2007 to 2008 largely because vegetation removal did not occur during the previous non-breeding season where the vegetation transects are located. The significant changes that we documented appear to be a result of herbaceous re-growth following higher than average precipitation in Spring 2008. Foliage cover below 1 m was greater at the Treated Channel points than at the Untreated Channel points and the Untreated sites outside of the Channel. Total foliage cover at all height intervals significantly increased by >40% at Upper Pond. In the Channel, foliage cover significantly increased by >30% for Treated points in the middle and upper canopy vegetation whereas foliage cover significantly decreased by 11-20% for Untreated points in the upper canopy vegetation. Differences in overall vegetation cover at Upper Pond and the Treated Channel points from 2007 to 2008 were attributed to an increase in herbaceous, shrub, and tree cover, indicating that rainfall was a key factor explaining the observed increase in foliage cover.

As in 2007, habitat use by vireos was non-random, particularly with regard to nest site selection. In the Channel, nest placement by vireos was largely random, foliage cover between nests and random plots did not differ except at 1-2 m. However, territory placement within the Channel was non-random, with vireos selecting sites with greater foliage cover between 2-4 m than that generally available. In the Untreated sites, where canopy cover was lower than in the Channel, vireos were more selective in both placement of nests and territories. The result of this non-random habitat use, although achieved differently in the Channel and Untreated sites, was that vegetation structure at nest sites was remarkably similar across all pairs.

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APPENDIX 1

LOCATIONS OF LEAST BELL'S VIREO TERRITORIES AND NESTS AND LOCATIONS OF WILLOW FLYCATCHER TRANSIENTS AT THE SAN LUIS REY FLOOD RISK MANAGEMENT PROJECT AREA, CALIFORNIA, 2008

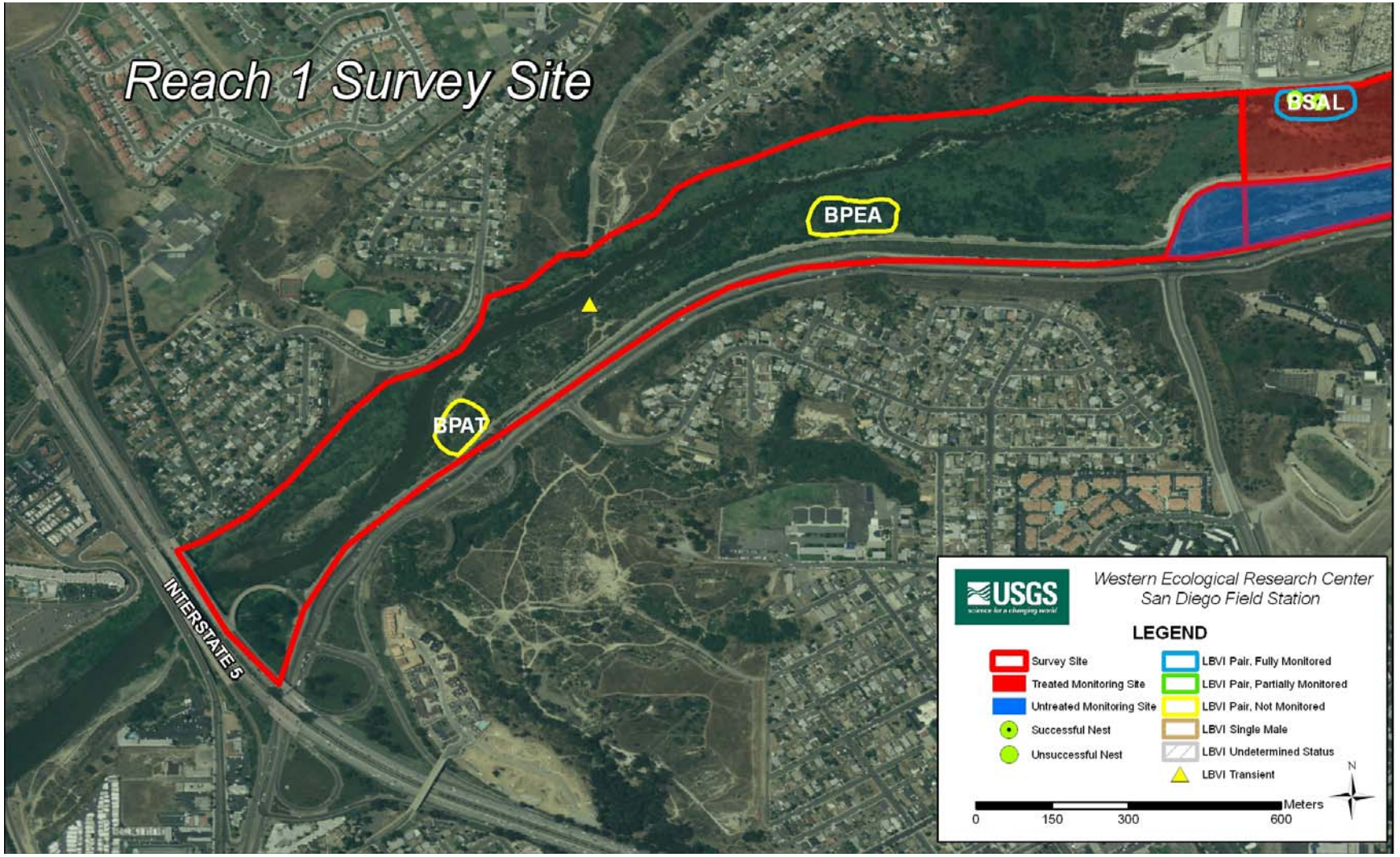

Figure 16. (a) Locations of least Bell's vireo territories (LBVI) and nests in the Reach 1, Lower Pond, and Tuley Canyon survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

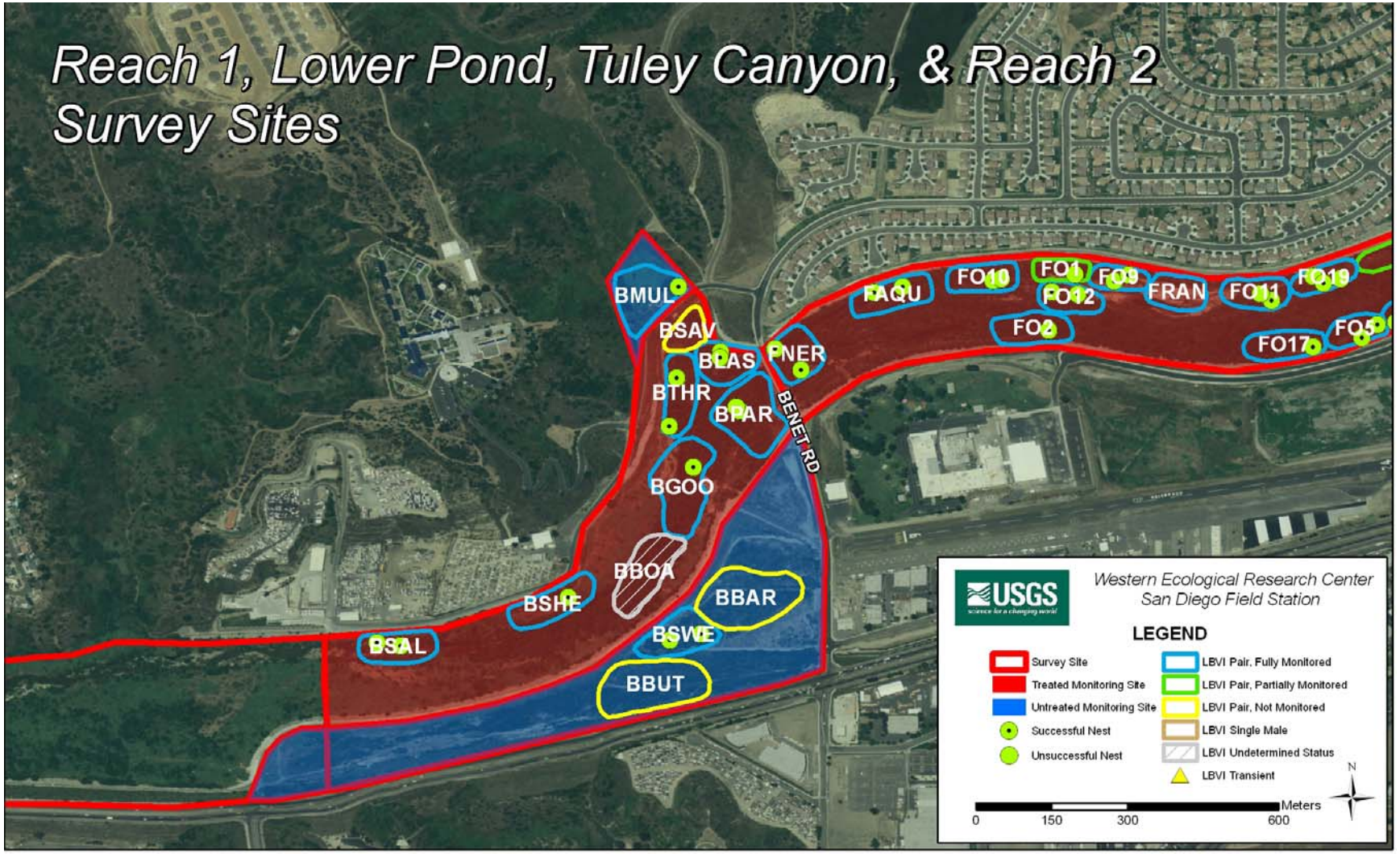

Figure 16. (b) Locations of least Bell's vireo (LBVI) territories and nests in the Reach 1 survey site at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

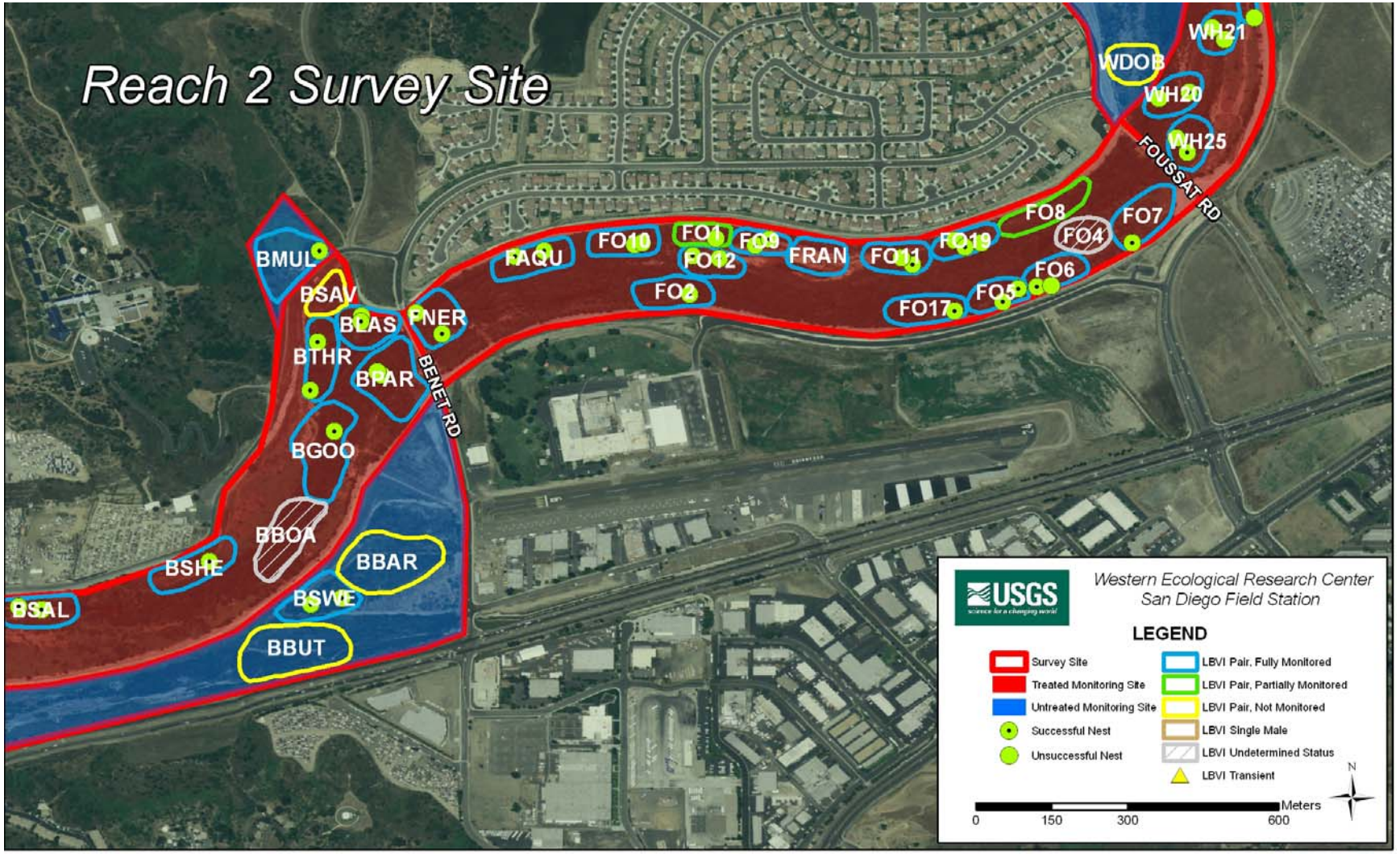

Figure 17. Locations of least Bell's vireo (LBVI) territories and nests in the Reach 2 survey site at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

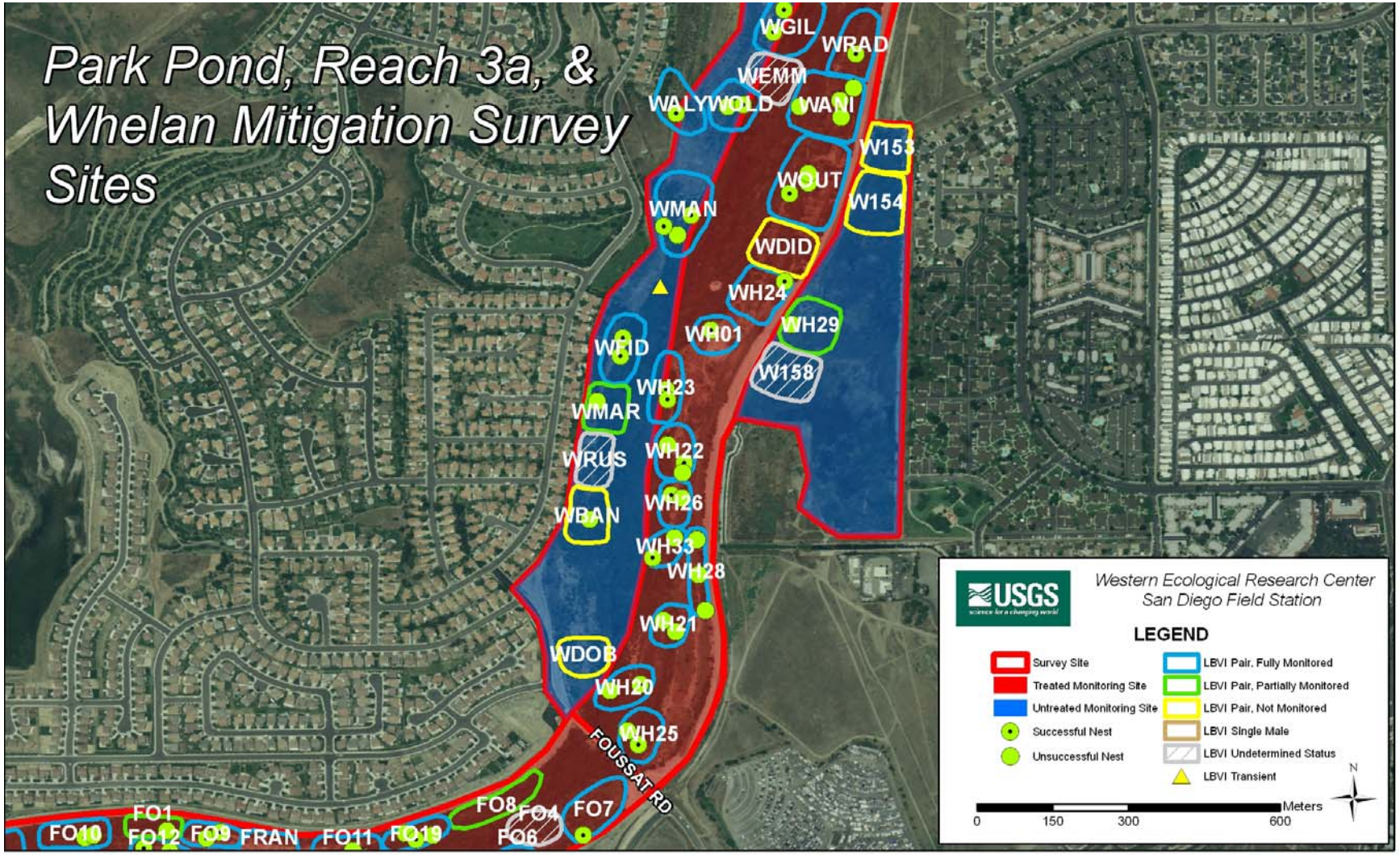

Figure 18. (a) Locations of least Bell's vireo (LBVI) territories and nests in the Reach 3a, Reach 3b, Park Pond, and Whelan Mitigation survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

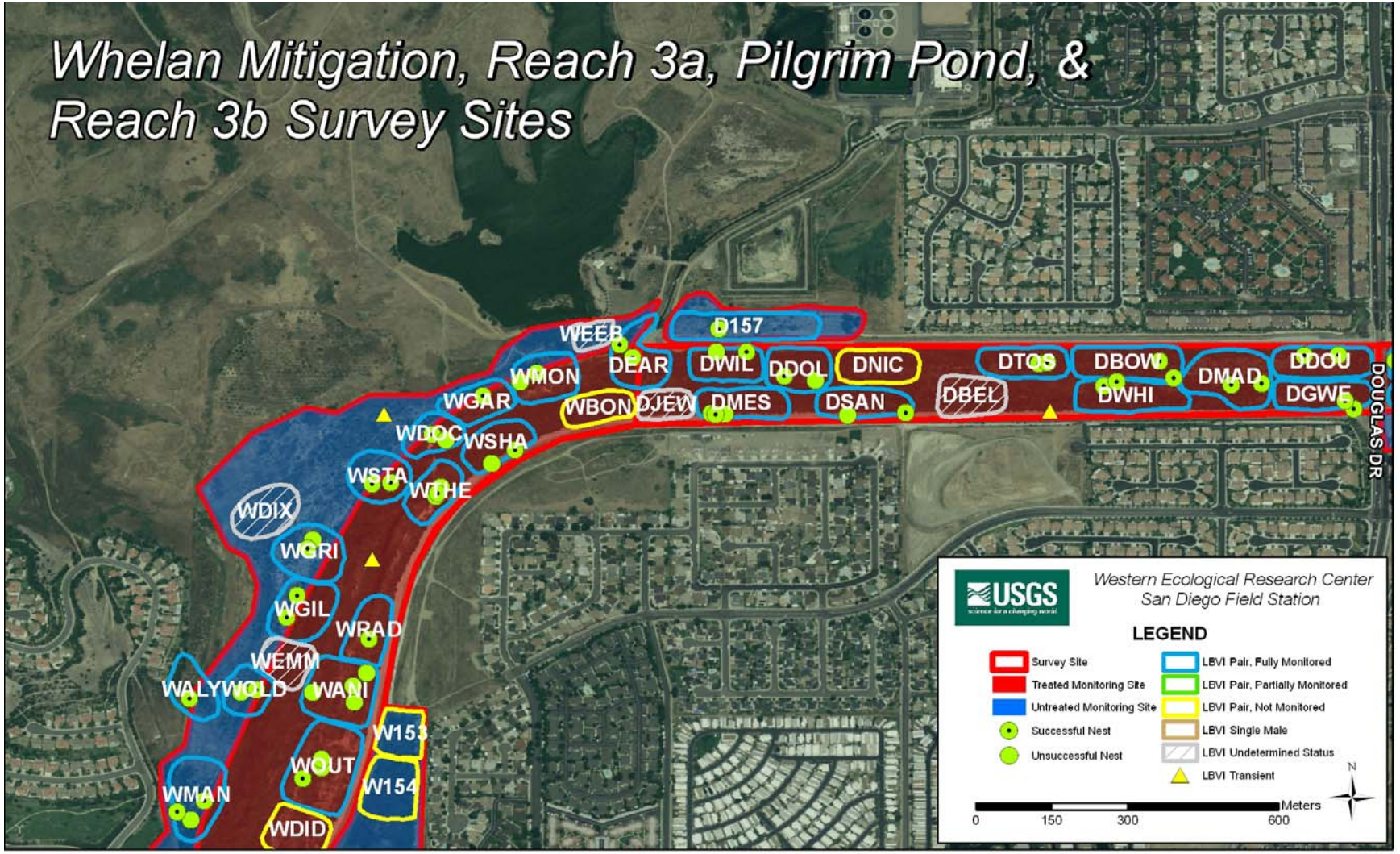

Figure 18. (b) Locations of least Bell's vireo (LBVI) territories and nests in the Reach 3b, Park Pond, Reach 3a and Whelan Mitigation survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

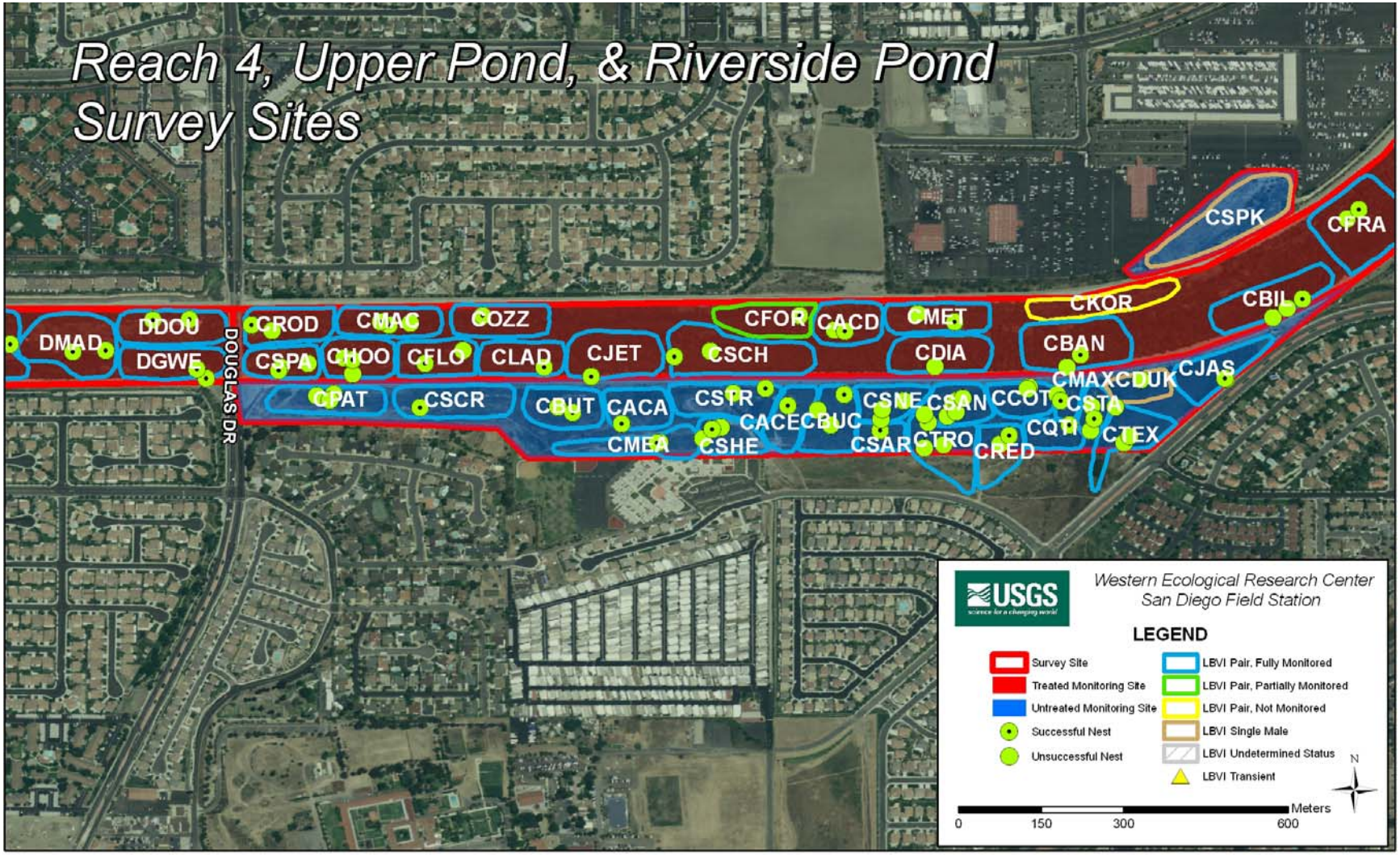

Figure 19. (a) Locations of least Bell's vireo (LBVI) territories and nests in the Reach 4 and Upper Pond survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

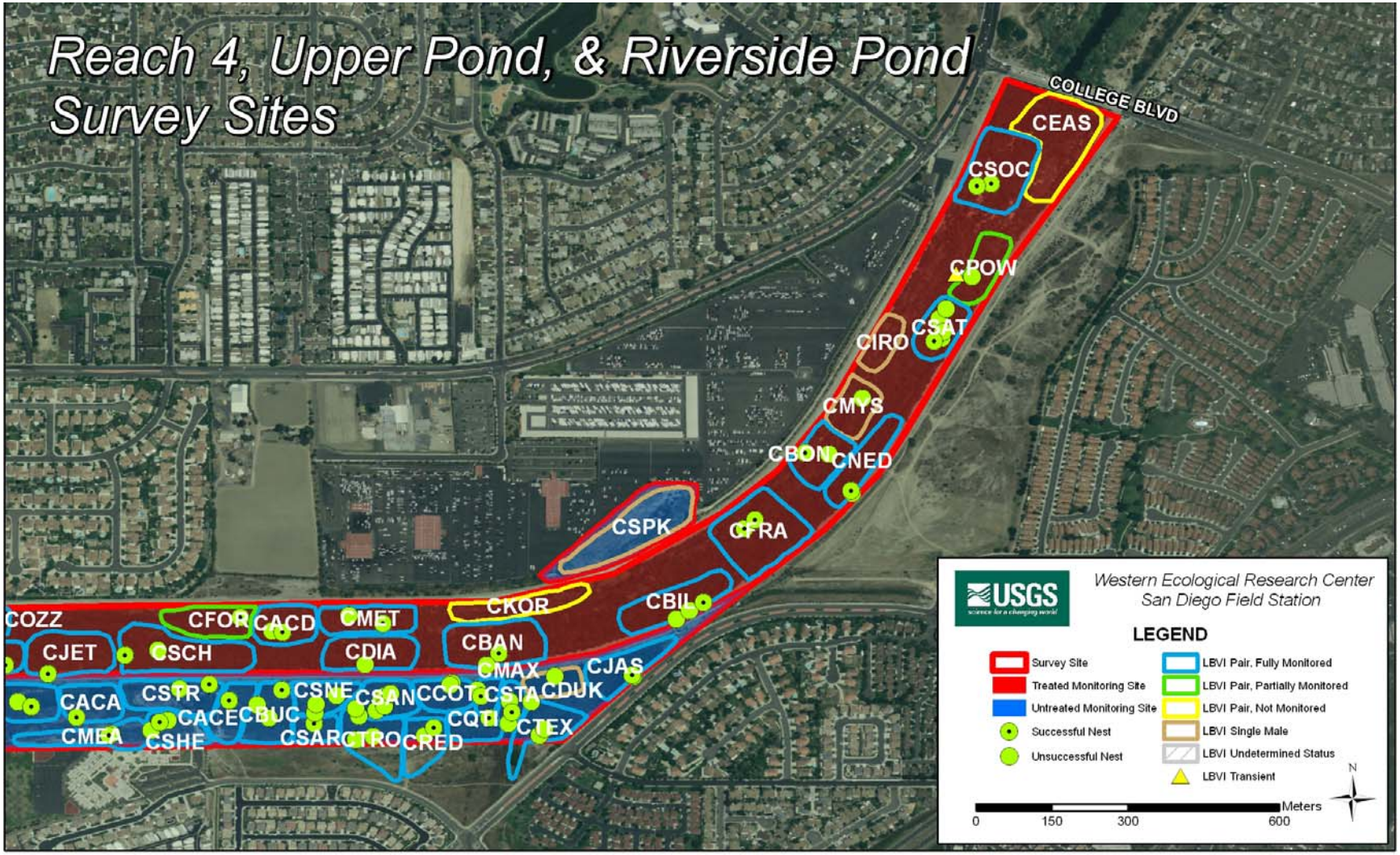

Figure 19. (b) Locations of least Bell's vireo (LBVI) territories and nests in the Reach 4 and Upper Pond survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

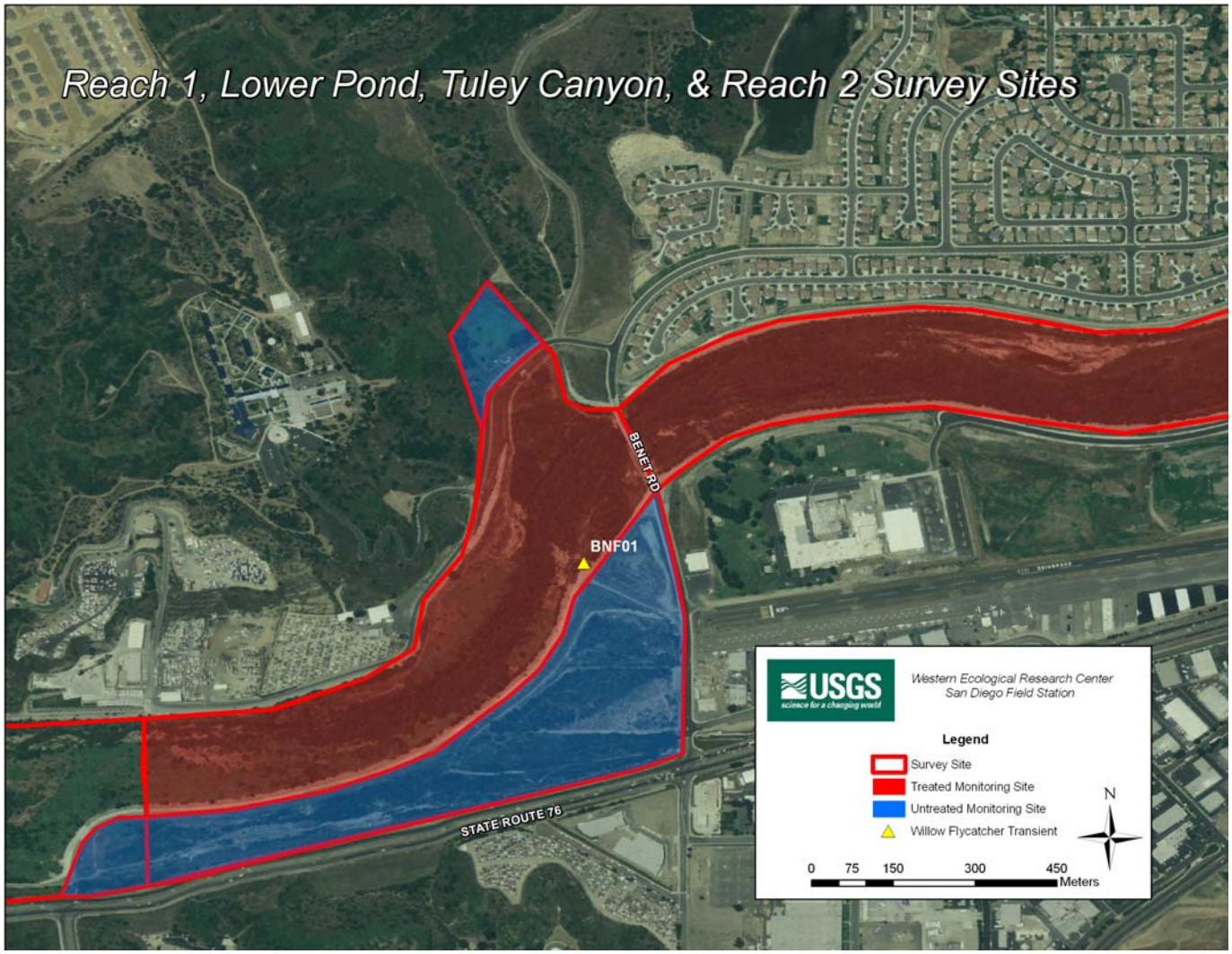

Figure 20. (a) Locations of willow flycatcher (SWFL) transients at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Figure 20. (b) Locations of willow flycatcher (SWFL) transients at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

APPENDIX 2

LOCATIONS OF VEGETATION TRANSECTS AND NEST-CENTERED VEGETATION PLOTS AT THE SAN LUIS REY FLOOD RISK MANAGEMENT PROJECT AREA, 2008

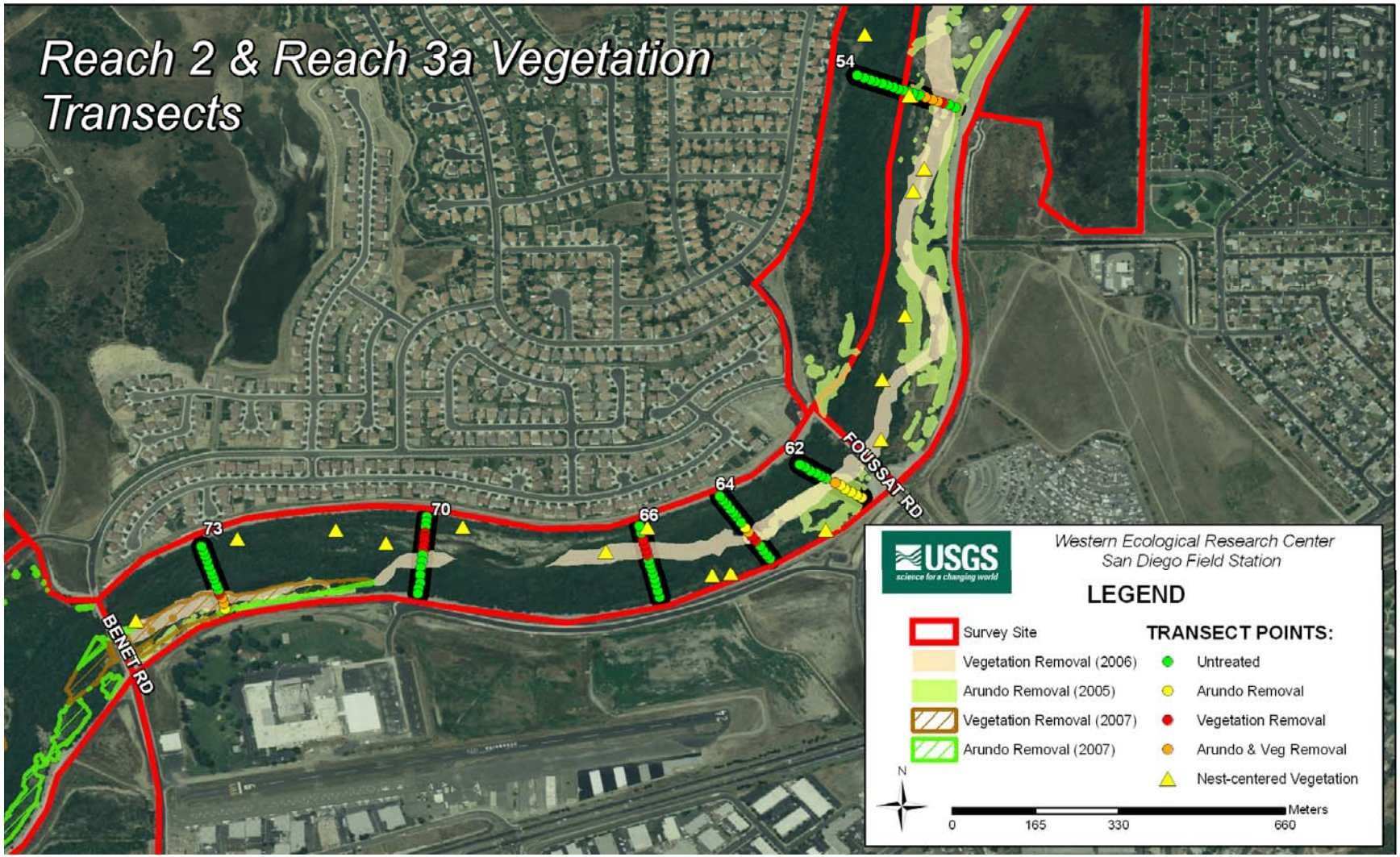

Figure 21. Locations of vegetation transects and nest-centered vegetation plots in the Reach 2 and Reach 3a survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

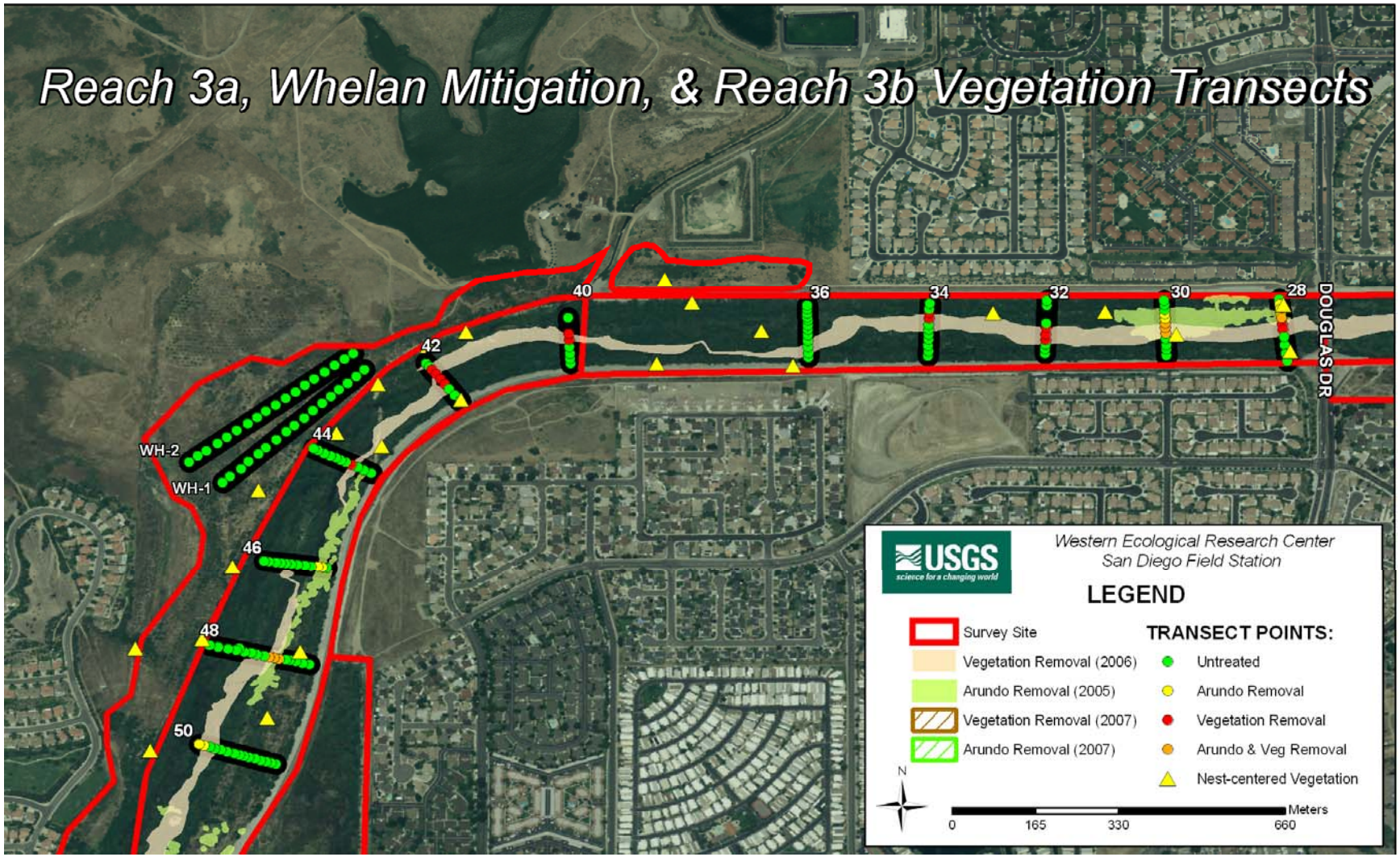

Figure 22. Locations of vegetation transects and nest-centered plots in the Reach 3a, Reach 3b, and Whelan Mitigation survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

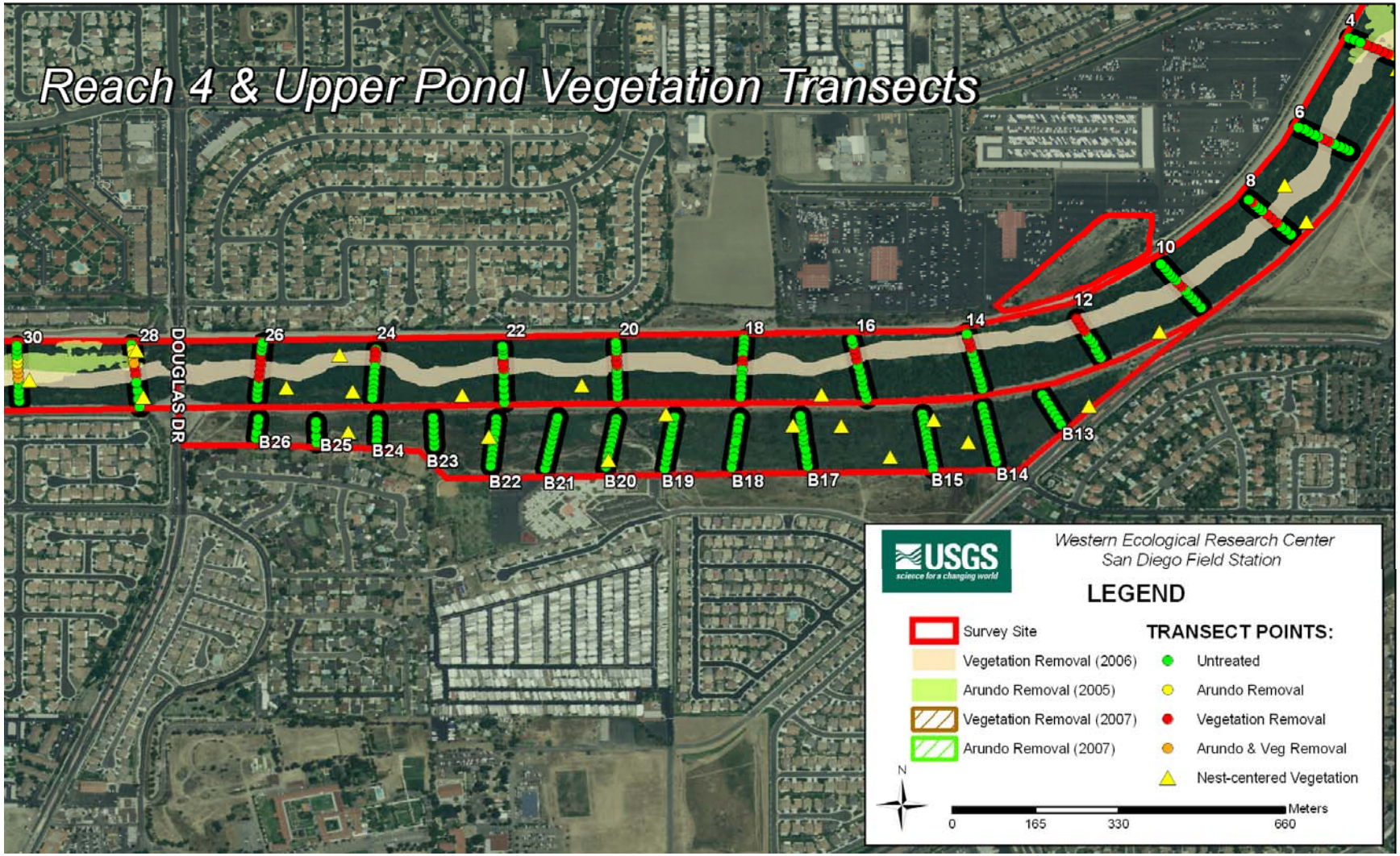

Figure 23. (a) Locations of vegetation transects and nest-centered plots in the Reach 4 and Upper Pond survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

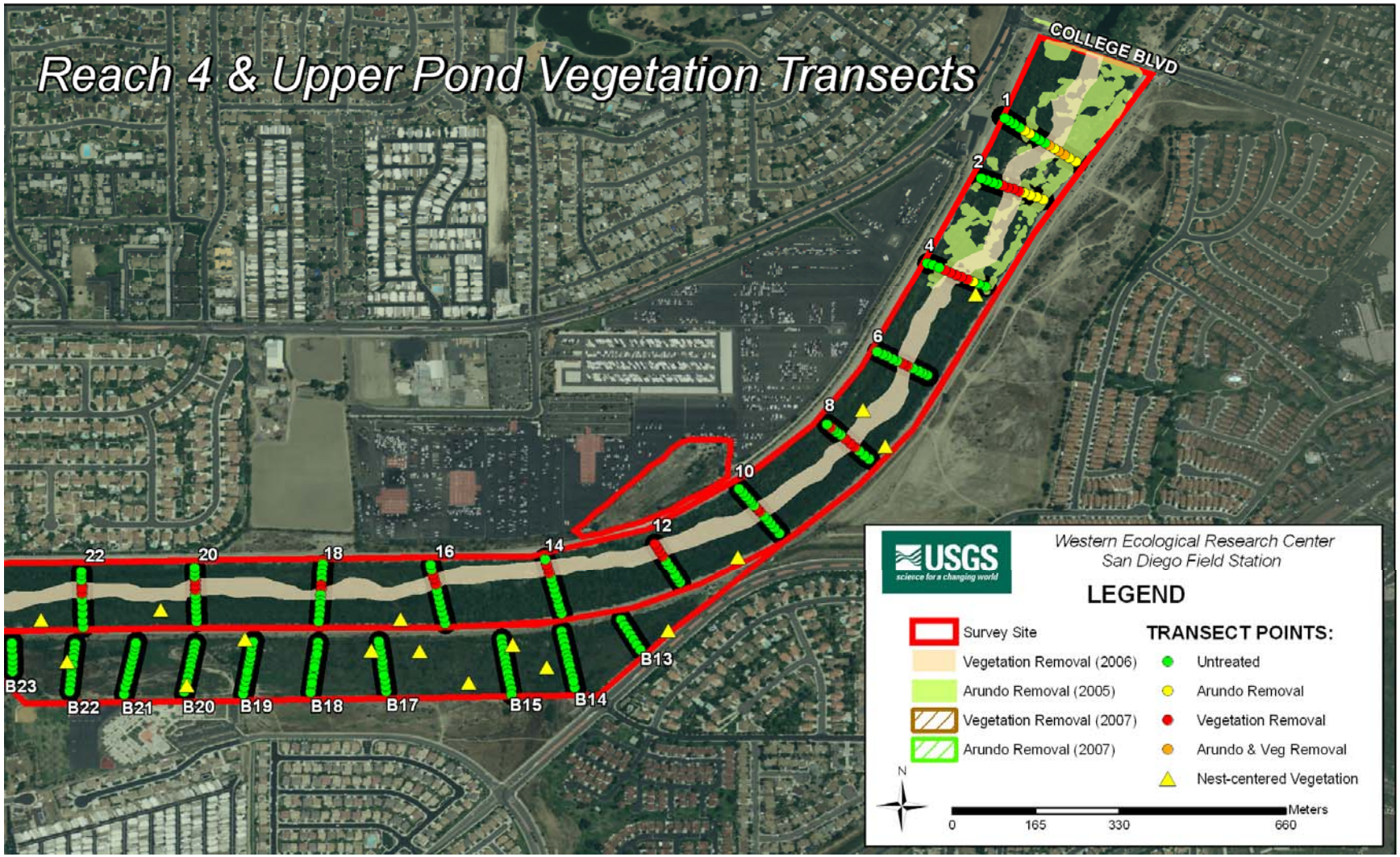

Figure 23. (b) Locations of vegetation transects and nest-centered vegetation plots in the Reach 4 and Upper Pond survey sites at the San Luis Rey Flood Risk Management Project Area, California, in 2008

APPENDIX 3

Status and nesting activities of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Nest	Monitoring[b]	Nest Fate[c]	# Fledged	Comments
Treated	BGOO	1	full	SUC	4	
Treated	BLAS	1	full	SUC	2	
Treated	BLAS	2	full	SUC	1	
Treated	BPAR	1	full	PRE		
Treated	BPAR	2	full	PRE		
Treated	BSAL	1	full	SUC	2	
Treated	BSAL	2	full	SUC	4	
Treated	BSHE	1	full	SUC	4	
Treated	BTHR	1	full	SUC	4	
Treated	BTHR	2	full	SUC	3	
Treated	CACD	1	full	PRE		Partial depredation.
Treated	CACD	2	full	SUC	4	
Treated	CBAN	1	full	SUC	4	
Treated	CBAN	2	full	PRE		
Treated	CBIL	1	full	UNK		Cause of failure unknown.
Treated	CBIL	2	full	PRE		Ant predation.
Treated	CBIL	3	full	SUC	2	
Treated	CBON	1	full	PRE		
Treated	CBON	2	full	SUC	4	
Treated	CDIA	1	full	PRE		
Treated	CEAS	1[d]	not	SUC	1	Pair observed feeding one unbanded fledgling; no nest found.
Treated	CFLO	1	full	PRE		
Treated	CFLO	2	full	SUC	3	
Treated	CFOR	1	partial	SUC	1	Male observed with one unbanded fledgling, no nest found.
Treated	CFOR	2	partial	SUC	4	
Treated	CFRA	1	full	SUC	4	
Treated	CFRA	2	full	SUC	3	
Treated	CHOO	1	full	PRE		
Treated	CHOO	2	full	PRE		
Treated	CHOO	3	full	SUC	3	
Treated	CJET	1	full	SUC	4	
Treated	CLAD	1	full	SUC	4	
Treated	CMAC	1	full	PRE		
Treated	CMAC	2	full	SUC	2	Partial depredation.
Treated	CMAC	3	full	SUC	2	Partial depredation.
Treated	CMET	1	full	PRE		
Treated	CMET	2	full	SUC	4	
Treated	CMYS	1	partial	FAL		Single male observed building a nest, but nest was never completed.
Treated	CNED	1	full	SUC	4	
Treated	CNED	2	full	SUC	3	
Treated	COZZ	1	full	SUC	4	
Treated	COZZ	2	full	SUC	3	
Treated	CPOW	2	partial	PRE		

Status and nesting activities of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Nest	Monitoring[b]	Nest Fate[c]	# Fledged	Comments
Treated	CPOW	1[d]	partial	SUC	1	Pair observed feeding one unbanded fledgling; no nest found.
Treated	CROD	1	full	SUC	4	
Treated	CROD	2	full	PRE		
Treated	CSAT	1	full	UNK		Cause of failure unknown.
Treated	CSAT	2	full	UNK		Cause of failure unknown.
Treated	CSAT	3	full	PRE		
Treated	CSAT	4	full	PRE		
Treated	CSAT	5	full	SUC	2	
Treated	CSCH	1	full	PRE		
Treated	CSCH	2	full	SUC	3	
Treated	CSOC	1	full	SUC	3	
Treated	CSOC	2	full	SUC	3	
Treated	CSPA	1	full	PRE		
Treated	CSPA	2	full	PRE		
Treated	CSPA	3	full	SUC	4	
Treated	DBOW	1	full	SUC	1	Partial depredation.
Treated	DBOW	2	full	SUC	3	
Treated	DDOL	1	full	PRE		
Treated	DDOL	2	full	SUC	4	
Treated	DDOU	1	full	SUC	4	
Treated	DDOU	2	full	SUC	3	Partial depredation.
Treated	DGWE	1	full	SUC	2	
Treated	DGWE	2	full	SUC	3	
Treated	DMAD	1	full	SUC	3	
Treated	DMAD	2	full	SUC	3	
Treated	DMES	1	full	INC		Nest building was initiated, but the nest was never completed.
Treated	DMES	2	full	SUC	3	
Treated	DMES	3	full	SUC	2	
Treated	DSAN	1	full	OTH		Three dead nestlings in intact nest. No sign of injury to nestlings.
Treated	DSAN	2	full	SUC	4	
Treated	DTOS	1	full	SUC	4	
Treated	DTOS	2	full	SUC	4	
Treated	DWHI	1	full	SUC	3	
Treated	DWHI	2	full	SUC	3	
Treated	DWIL	1	full	SUC	1	One egg unhatched, two nestlings dead in nest.
Treated	DWIL	2	full	PRE		
Treated	FAQU	1	full	SUC	4	
Treated	FAQU	2	full	SUC	3	
Treated	FNER	1	full	SUC	3	Partial depredation.
Treated	FNER	2	full	SUC	3	
Treated	FO1	1	partial	INC		Nest building was initiated, but the nest was never completed.
Treated	FO1	2[d]	partial	SUC	3	Three fledglings observed; no nest found.
Treated	FO10	1	full	SUC	4	
Treated	FO10	2	full	PRE		

Status and nesting activities of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Nest	Monitoring[b]	Nest Fate[c]	# Fledged	Comments
Treated	FO11	1	full	SUC	4	
Treated	FO11	2	full	PRE		
Treated	FO12	1	full	SUC	4	
Treated	FO12	2	full	SUC	4	
Treated	FO17	1	full	SUC	4	
Treated	FO19	1	full	PRE		
Treated	FO19	2	full	PRE		
Treated	FO19	3	full	SUC	3	
Treated	FO2	1	full	SUC	4	
Treated	FO5	1	full	SUC	3	
Treated	FO5	2	full	SUC	3	
Treated	FO6	1	full	SUC	3	
Treated	FO6	2	full	PRE		
Treated	FO7	1	full	SUC	3	
Treated	FO8	1[d]	partial	SUC	1	One unbanded fledgling observed; no nest found.
Treated	FO9	1	full	SUC	2	
Treated	FO9	2	full	SUC	3	
Treated	WANI	1	full	PRE		
Treated	WANI	2	full	PRE		
Treated	WANI	3	full	PRE		
Treated	WANI	4	full	INC		Nest building was initiated, but the nest was never completed.
Treated	WBAN	1	not	UNM		Nest found on survey.
Treated	WDOC	1	full	SUC	4	
Treated	WDOC	2	full	PRE		
Treated	WGAR	1	full	SUC	1	
Treated	WGAR	2[d]	full	SUC	1	Observed male with one fledgling; no nest found.
Treated	WGIL	1	full	SUC	4	
Treated	WGIL	2	full	SUC	3	
Treated	WH01	1	full	SUC	4	
Treated	WH20	1	full	SUC	3	
Treated	WH20	2	full	PRE		
Treated	WH21	1	full	PRE		
Treated	WH21	2	full	PRE		Ant predation.
Treated	WH22	1	full	PRE		
Treated	WH22	2	full	SUC	2	
Treated	WH22	3	full	PRE		
Treated	WH23	1	full	SUC	4	
Treated	WH23	2	full	SUC	3	
Treated	WH24	1	full	SUC	4	
Treated	WH25	1	full	SUC	4	
Treated	WH25	2	full	OTH		Nest abandoned with two eggs that never hatched. One vireo egg and one brown-headed cowbird eggshell fragment were found below the nest.
Treated	WH26	1	full	SUC	3	
Treated	WH26	2	full	PRE		
Treated	WH28	1	full	PRE		

Status and nesting activities of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Nest	Monitoring[b]	Nest Fate[c]	# Fledged	Comments
Treated	WH28	2	full	PRE		
Treated	WH28	3	full	PRE		
Treated	WH29	1	partial	PRE		
Treated	WH33	1	full	PRE		
Treated	WH33	2	full	SUC	2	
Treated	WMON	1	full	SUC	4	
Treated	WMON	2	full	PRE		
Treated	WOUT	1	full	PRE		
Treated	WOUT	2	full	SUC	2	
Treated	WOUT	3	full	UNM		Nest found during vegetation surveys.
Treated	WRAD	1	full	SUC	3	
Treated	WSHA	1	full	PRE		
Treated	WSHA	2	full	SUC	4	
Treated	WSTA	1	full	SUC	4	
Treated	WSTA	2	full	SUC	3	
Treated	WTHE	1	full	PRE		
Treated	WTHE	2	full	SUC	3	Partial depredation.
Treated	WTHE	3	full	SUC	3	
Untreated	BBAR	1[d]	not	SUC	1	Male observed feeding one fledgling; no nest found.
Untreated	BMUL	1	full	SUC	4	
Untreated	BSWE	1	full	SUC	1	
Untreated	BSWE	2	full	SUC	4	
Untreated	CACA	1	full	SUC	4	
Untreated	CACE	1	full	SUC	4	
Untreated	CBUC	1	full	PRE		
Untreated	CBUC	2	full	PRE		
Untreated	CBUC	3	full	SUC	3	
Untreated	CBUT	1	full	PRE		
Untreated	CBUT	2	full	SUC	3	
Untreated	CCOT	1	full	PRE		Ant predation.
Untreated	CCOT	2	full	PRE		
Untreated	CDUK	1	full	FAL		Single male observed building a nest, but nest was never completed.
Untreated	CJAS	1	full	SUC	4	
Untreated	CJAS	2	full	SUC	4	
Untreated	CMAX	1	full	PRE		
Untreated	CMAX	2	full	SUC	3	
Untreated	CMEA	1	full	PRE		Partially depredated.
Untreated	CMEA	2	full	SUC	3	
Untreated	CPAT	1	full	SUC	4	
Untreated	CPAT	2	full	PRE		
Untreated	CPAT	3	full	INC		Nest building was initiated, but the nest was never completed.
Untreated	CQTI	1	full	SUC	4	
Untreated	CRED	1	full	PRE		
Untreated	CRED	2	full	SUC	3	
Untreated	CSAN	1	full	INC		Nest building was initiated, but the nest was never completed.
Untreated	CSAN	2	full	PRE		

Status and nesting activities of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Nest	Monitoring[b]	Nest Fate[c]	# Fledged	Comments
Untreated	CSAN	3	full	PRE		
Untreated	CSAN	4	full	PRE		Partial depredation.
Untreated	CSAN	5	full	PRE		
Untreated	CSAR	1	full	SUC	4	
Untreated	CSCR	1	full	SUC	4	
Untreated	CSHE	1	full	PRE		
Untreated	CSHE	2	full	PRE		
Untreated	CSHE	3	full	SUC	3	
Untreated	CSNE	1	full	PRE		
Untreated	CSNE	2	full	PRE		
Untreated	CSNE	3	full	PRE		
Untreated	CSTA	1	full	PRE		
Untreated	CSTA	2	full	PRE		Two dead 7-8 day-old nestlings in nest and two blue bands on ground below nest. Nest hanging to one side.
Untreated	CSTA	3	full	SUC	4	
Untreated	CSTR	1	full	SUC	4	
Untreated	CSTR	2	full	SUC	3	One dead nestling in nest.
Untreated	CTEX	1	full	PRE		
Untreated	CTEX	2	full	PRE		
Untreated	CTEX	3	full	PRE		
Untreated	CTRO	1	full	INC		Nest building was initiated, but the nest was never completed.
Untreated	CTRO	2	full	PRE		
Untreated	CTRO	3	full	PRE		
Untreated	CTRO	4	full	INC		Nest building was initiated, but the nest was never completed.
Untreated	D157	1	full	SUC	3	Partial depredation.
Untreated	DEAR	1	full	SUC	2	
Untreated	DEAR	2	full	SUC	3	
Untreated	WALY	1	full	SUC	2	Partial depredation.
Untreated	WFID	1	full	SUC	3	
Untreated	WFID	2	full	SUC	2	
Untreated	WGRI	1	full	PRE		
Untreated	WGRI	2	full	PRE		
Untreated	WGRI	3	full	SUC	2	Partial depredation.
Untreated	WMAN	1	full	PRE		
Untreated	WMAN	2	full	SUC	4	
Untreated	WMAN	3	full	SUC	4	
Untreated	WMAR	1	partial	UNM		Nest not monitored due to nearby homeless camp.
Untreated	WOLD	1	full	PRE		
Untreated	WOLD	2	full	SUC	3	
Untreated	WOLD	3[d]	full	SUC	3	Pair observed with three fledglings; no nest found.

[a] Treated = territories located in the Channel monitoring site or Benet West; Untreated = territories located in Upper Pond and Whelan Mitigation monitoring sites as well as Tuley Canyon, Lower Pond, Park Pond, and Riverside Pond.survey sites.

[b] Monitoring: full = fully monitored territory; partial = partially monitored territory; not = not monitored.

[c] Nest Fate: FAL= nest built by unpaired male; INC = nest never completed; SUC = fledged at least one least Bell's

Status and nesting activities of least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Nest	Monitoring[b]	Nest Fate[c]	# Fledged	Comments

vireo young; PRE = nest failure caused by predation event; PAR = failure/abandonment caused by brown-headed cowbird parasitism event; OTH = reason for nest failure known, such as substrate failure; UNK = reason for nest failure/abandonment unknown; UNM = unmonitored nest.

[d] Nest not found, but fledglings were confirmed indicating a successful nest attempt.

APPENDIX 4

Banded adult least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Band Combination (Left Leg : Right Leg)[b]	Sex[c]	Age[d]	Comments
Treated	BBUT	: Mdb	M	≥ 1 yr	Banded as a nestling on the San Luis Rey River.
Treated	CSPK	: Mdb	M	≥ 1 yr	Banded as a nestling on the San Luis Rey River.
Treated	CWIL	: Mdb	M	≥ 1 yr	Banded as a nestling on the San Luis Rey River.
Treated	DMAD	: DPDP Mdb	M	≥ 2 yrs	Banded as AHY in DMAD territory in 2007.
Treated	CJET	BKLP pupu : Mdb	M	≥ 2 yrs	Banded as AHY in CJET territory in 2007.
Treated	DDOL	BWST pupu : Mdb	M	≥ 2 yrs	Banded as AHY in WGAR territory in 2007.
Treated	WGAR	Mdb : WHDP pupu	M	≥ 2 yrs	Banded as AHY in WGAR territory in 2007.
Treated	CLAD	WHDB Mdb :	M	≥ 2 yrs	Banded as AHY in CLAD territory in 2007.
Treated	CFRA	BKBK pupu : Mdb	F	≥ 3 yrs	Banded as AHY in WSPA territory in 2006.
Treated	WDOC	WHDB pupu : Mdb	F	≥ 3 yrs	Banded as AHY in WDOC territory in 2006.
Treated	WDOC	: BYST Mdb	M	≥ 3 yrs	Banded as AHY in WDOC territory in 2006.
Treated	CHOO	: YEPU Mdb	M	≥ 3 yrs	Banded as an adult prior to 2007. Combination doesn't match any in database.
Treated	DBEL	? pupu : ? Mdb	M	≥ 3 yrs	Partial resight of bands indicates this bird was banded as an adult in either 2006 or 2007.
Treated	WH20	dbdb : WHWH Msi	M	≥ 3 yrs	Banded as AHY in WH20 territory in 2006.
Treated	WDID	DBWH pupu : Mdb	M	≥ 3 yrs	Banded as AHY in WDID territory in 2006.
Treated	WTHE	DPDP Mdb : pupu	M	≥ 3 yrs	Banded as AHY in WTHE territory in 2006.
Treated	FO10	DPDP pupu : Mdb	M	≥ 3 yrs	Banded as AHY in FO2 territory in 2006.
Treated	WH26	LPBK dbdb : Msi	M	≥ 3 yrs	Banded as AHY in WH21 territory in 2006.
Treated	CMAC	LPBK pupu : Mdb	M	≥ 3 yrs	Banded as AHY in CMAC territory in 2006.
Treated	BPAR	LPLP Mdb :	M	≥ 3 yrs	Banded as AHY in BPAR territory in 2006.
Treated	CBAN	Mbk :	M	≥ 3 yrs	Banded as a nestling at Pilgrim Creek. Could not recapture this bird.
Treated	FO6	Mdb : DPWH pupu	M	≥ 3 yrs	Banded as AHY in FO6 territory in 2006.
Treated	FO5	pupu : WHWH Mdb	M	≥ 3 yrs	Banded as AHY in FO5 territory in 2006.
Treated	WGIL	pupu : YEYE Mdb	M	≥ 3 yrs	Banded as AHY in WGIL territory in 2006.
Treated	DSAN	PUPU Mdb : pupu	M	≥ 3 yrs	Banded as AHY in WSAN territory in 2006.
Treated	WANI	PUPU pupu : Mdb	M	≥ 3 yrs	Banded as AHY in WANI territory in 2006.
Treated	FO8	WHWH dbdb : Msi	M	≥ 3 yrs	Banded as AHY in FO8 territory in 2006.
Treated	CSAT	YEYE Mdb : pupu	M	≥ 3 yrs	Banded as AHY in CSAT territory in 2006.
Treated	WH33	DPWH gogo : Mdb	F	1 yr	Banded as a nestling in CPAT territory in 2007. Color bands added in 2008.
Treated	FO4	DBDP pupu : Mdb	M	1 yr	Banded as a nestling in WALY territory in 2007. Color bands added in 2008.
Treated	DGWE	DPDP gogo : Mdb	M	1 yr	Banded as a nestling in CSTR territory in 2007. Color bands added in 2008.
Treated	FO1	gogo : LPBK Mdb	M	1 yr	Banded as a nestling in FO19 territory in 2007. Color bands added in 2008.
Treated	WH25	DPDB Mdb : pupu	F	2 yrs	Banded as a nestling in CGIL territory in 2006. Color bands added in 2007.

Banded adult least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Band Combination (Left Leg : Right Leg)[b]	Sex[c]	Age[d]	Comments
Treated	DDOU	YEYE Mdb : gogo	F	2 yrs	Banded as a nestling in CLAS territory in 2006. Color bands added in 2008.
Treated	CSCH	DBDP Mdb : pupu	M	2 yrs	Banded as a nestling in CWIL territory in 2006. Color bands added in 2008.
Treated	FO19	DBWH Mdb : pupu	M	2 yrs	Banded as a nestling in WOUT territory in 2006. Color bands added in 2007.
Treated	DTOS	Mdb : PUYE pupu	M	2 yrs	Banded as a nestling in CSPA territory in 2006. Color bands added in 2008.
Treated	CROD	Mdb : WHDB pupu	M	2 yrs	Banded as a nestling in CSOC territory in 2006. Color bands added in 2007.
Treated	BGOO	: BKLP Mgo	F	3 yrs	Banded as a nestling in ES08 territory at SMR ES in 2005. Color bands added in 2008.
Treated	DWHI	Mdb : WHWH gogo	F	≥ 1 yr	Banded as an adult in 2008.
Treated	WRAN	Mdb : BWST sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	FO 7	Msi : WHWH dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CFOR	BKBK dbdb : Msi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	BBOA	BKBK Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CPOW	dbdb : DPDP Msi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CBIL	dbdb : DPWH Msi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CACD	dbdb : LPLP Msi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CFLO	dbdb : PUPU Msi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	DMES	dbdb : YEYE Msi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	DDOU	DPWH Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CSOC	gogo : YEPU Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CSPA	LPBK gogo : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	WH01	LPLP Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	DWIL	Mdb : DBWH sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	BSHE	Mdb : DPDB sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CDIA	Mdb : PUPU sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	FO12	Mdb : PUWH gogo	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CFRA	Mdb : PUWH sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	WRAD	Mdb : WHDP sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	DBOW	Mdb : WHWH sisi	M	≥ 1 yr	Banded as an adult in 2008.
Treated	WH33	Mdb : YEPU gogo	M	≥ 1 yr	Banded as an adult in 2008.
Treated	BLAS	Msi : BKBK dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	FO17	Msi : DPWH dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	FNER	Msi : YEYE dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	BGOO	pupu : WHDP Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	WOUT	PUPU Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	BTHR	PUWH gogo : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	WMON	PUWH sisi : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	DWHI	PUYE : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CNED	PUYE pupu : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	BPEA	WHWH Mdb : gogo	M	≥ 1 yr	Banded as an adult in 2008.
Treated	WH25	WHWH Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	FO11	YEPU Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	CBON	YEYE dbdb : Msi	M	≥ 1 yr	Banded as an adult in 2008.

Banded adult least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Band Combination (Left Leg : Right Leg)[b]	Sex[c]	Age[d]	Comments
Treated	WH21	YEYE Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Treated	FO17	Msi : PUPU dbdb	U	≥ 1 yr	Banded as an adult in 2008.
Treated	FO 9	Mdb : PUPU gogo	U	HY	Banded as a hatch-year in 2008.
Treated	WRAN	LPBK Msi : dbdb	U	HY	Banded as a hatch-year in 2008.
Untreated	CACA	: BWST Mdb	M	≥ 3 yrs	Banded as AHY in CACA territory in 2006.
Untreated	WGRI	: DBWH Mdb	M	≥ 3 yrs	Banded as AHY in WGRI territory in 2006.
Untreated	WMAN	BWST Mdb : pupu	M	≥ 3 yrs	Banded as AHY in WMAN territory in 2006.
Untreated	CBUT	BYST Mdb	M	≥ 3 yrs	Banded as AHY in CSCR territory in 2006.
Untreated	CBUT	BYST Mdb :	M	≥ 3 yrs	Banded as AHY in CSCR territory in 2006.
Untreated	CSTR	DBWH : Mdb	M	≥ 3 yrs	Banded as AHY in CSTR territory in 2006.
Untreated	DEAR	Mdb : DPDB	M	≥ 3 yrs	Banded as AHY in DEAR territory in 2006.
Untreated	CQTI	Mdb : PUPU pupu	M	≥ 3 yrs	Banded as AHY in CSAP territory in 2006.
Untreated	CMEA	pupu : DPWH Mdb	M	≥ 3 yrs	Banded as AHY in CSHE territory in 2006.
Untreated	CSCR	pupu : YEPU Mdb	M	≥ 3 yrs	Banded as AHY in CDAI territory in 2006.
Untreated	CBUC	YEPU Mdb :	M	≥ 3 yrs	Banded as AHY in CBUC territory in 2006.
Untreated	CSAR	gogo : PUWH Mdb	M	1 yr	Banded as a nestling in CSPA territory in 2007. Color bands added in 2008.
Untreated	CDUK	pupu : BKLP Mdb	M	1 yr	Banded as a nestling in CHOO territory in 2007. Color bands added in 2008.
Untreated	CCOT	pupu : DBDP Mdb	M	1 yr	Banded as a nestling in CSCH territory in 2007. Color bands added in 2008.
Untreated	BBAR	pupu : WHDB Mdb	M	1 yr	Banded as a nestling in CNED territory in 2007. Color bands added in 2008.
Untreated	W158	PUYE pupu : Mdb	M	1 yr	Banded as a nestling in WDOC territory in 2007. Color bands added in 2008.
Untreated	CTRO	WHWH gogo : Mdb	M	1 yr	Banded as a nestling in CSTA territory in 2007. Color bands added in 2008.
Untreated	CRED	Mdb : PUYE pupu	F	2 yrs	Banded as a nestling in CPOW territory in 2006. Color bands added in 2008.
Untreated	WDOB	DBDP Mdb : pupu	M	2 yrs	Banded as a nestling in WMAN territory in 2006. Color bands added in 2008.
Untreated	CSHE	LPLP Mdb : pupu	M	2 yrs	Banded as a nestling in BPAR territory in 2006. Color bands added in 2007.
Untreated	CMAX	Mdb : WHPU pupu	M	2 yrs	Banded as a nestling in CHOO territory in 2006. Color bands added in 2007.
Untreated	CBUC	LPBK Mbk :	F	5 yrs	Banded as a nestling in High Pink Flag territory at Pilgrim Creek in 2003. Color bands added in 2008.
Untreated	CSTA	BYST Mdb : pupu	M	9 yrs	Banded as a nestling in SW Benet territory in 1999. Color bands added in 2006.
Untreated	D157	: ORORMdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	UNKNOWN	DPDP gogo : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	WOLD	DPDP sisi : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	WEEB	DPWH sisi : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	CACE	gogo : BKBK Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	CSAN	Mdb : BKBK gogo	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	CSNE	Mdb : BYST gogo	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	CRED	Mdb : LPBK gogo	M	≥ 1 yr	Banded as an adult in 2008.

Banded adult least Bell's vireos at the San Luis Rey Flood Risk Management Project Area, California, in 2008.

Treatment[a]	Territory	Band Combination (Left Leg : Right Leg)[b]	Sex[c]	Age[d]	Comments
Untreated	WFID	Msi : LPBK dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	WBAN	Msi : PUWH dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	BMUL	Msi : YEPU dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	CJAS	ORORMdb :	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	WDIX	PUPU sisi : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	BSWE	PUWH Msi : dbdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	W153	WHPU sisi : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	CPAT	WHWH sisi : Mdb	M	≥ 1 yr	Banded as an adult in 2008.
Untreated	WSTA	Mdb : WHPU sisi	U	≥ 1 yr	Banded as an adult in 2008.
Untreated	W153	WHDP sisi : Mdb	U	HY	Banded as a hatch-year in 2008.

[a] Treated = territories located in the Channel monitoring site or Benet West; Untreated = territories located in Upper Pond and Whelan Mitigation monitoring sites as well as Tuley Canyon, Lower Pond, Park Pond, and Riverside Pond.survey sites.

[b] Band combo orientation on leg: left leg : right leg. Band colors: **Mbk** = black numbered federal band; **Mdb** = dark blue numbered federal band; **Msi** = silver numbered federal band; **BKBK** = plastic black; **BKLP** = plastic black-light pink split; **BKYE** = plastic black-yellow split; **BWST** = plastic blue-white striped; **BYST** = plastic black-yellow striped; **dbdb** = metal dark blue; **DBDP** = plastic dark blue-dark pink split; **DBWH** = plastic dark blue-white split; **DPDB** = plastic dark pink-dark blue split; **DPDP** = plastic dark pink; **DPWH** = plastic dark pink-white split; **LPBK** = plastic light pink-black split; **LPLP** = plastic light pink; **PUPU** = plastic purple; **pupu** = metal purple; **PUWH** = plastic purple-white split; **WHDB** = plastic white-dark blue split; **WHDP** = plastic white-dark pink split; **WHPU** = plastic white-purple split; **WHWH** = plastic white; **YEPU** = plastic yellow-purple split; **YEYE** = plastic yellow.

[c] Sex: M = Male, F = Female.

[d] Age: HY = hatch-year.

APPENDIX 5

Dispersal movement of least Bell's vireos between 2007 and 2008 at the San Luis Rey Flood Risk Management Project Area, California

2007 Adult/Natal Territory ID	2008 Territory ID	Dispersal Distance (km)	Dispersal Type[a]	Band Combination[b]	Age in 2007[c]	Sex[d]
CNED	BBAR	6.0	Treated to Untreated	pupu : WHDB Mdb	HY	M
CSCH	CCOT	0.5	Treated to Untreated	pupu : DBDP Mdb	HY	M
CHOO	CDUK	1.2	Treated to Untreated	pupu : BKLP Mdb	HY	M
CSPA	CSAR	0.9	Treated to Untreated	gogo : PUWH Mdb	HY	M
WSTA	CTRO	0.2	Untreated to Untreated	WHWH gogo : Mdb	HY	M
CSTR	DGWE	0.9	Untreated to Treated	DPDP gogo : Mdb	HY	M
FO19	FO1	0.4	Treated to Treated	gogo : LPBK Mdb	HY	M
WALY	FO4	1.4	Untreated to Treated	DBDP pupu : Mdb	HY	M
WDOC	W158	1.1	Untreated to Untreated	PUYE pupu : Mdb	HY	M
CPAT	WH33	2.6	Untreated to Treated	DPWH gogo : Mdb	HY	F
ES08	BGOO	6.2	Santa Margarita River to SLR	: BKLP Mgo	3 yrs	F
BPAR	BPAR	0.0	--	LPLP Mdb :	≥ 3 yrs	M
CACA	CACA	0.0	--	: BWST Mdb	≥ 1 yr	M
Unknown	CBAN	3.2	Pilgrim Creek to SLR	Mbk :	≤ 5 yrs[e]	M
CBUC	CBUC	0.0	--	YEPU Mdb :	≥ 3 yrs	M
HI PINK FLAG	CBUC	2.5	Pilgrim Creek to SLR	LPBK Mbk :	5 yrs	F
CBUT	CBUT	0.0	--	BYST Mdb	≥ 3 yrs	M
CSPK	CFRA	0.2	Untreated to Treated	BKBK pupu : Mdb	≥ 3 yrs	F
CHOO	CHOO	0.0	--	: YEPU Mdb	≥ 3 yrs	M
CJET	CJET	0.0	--	BKLP pupu : Mdb	≥ 2 yrs	M
CLAD	CLAD	0.0	--	WHDB Mdb :	≥ 2 yrs	M
CMAC	CMAC	0.0	--	LPBK pupu : Mdb	≥ 3 yrs	M
CHOO	CMAX	1.1	Treated to Untreated	Mdb : WHPU pupu	2 yrs	M
CMEA	CMEA	0.0	--	pupu : DPWH Mdb	≥ 3 yrs	M
CPOW	CRED	1.3	Treated to Untreated	Mdb : PUYE pupu	2 yrs	F
CSOC	CROD	2.2	Treated to Treated	Mdb : WHDB pupu	2 yrs	M
CSAT	CSAT	0.0	--	YEYE Mdb : pupu	≥ 3 yrs	M
CWIL	CSCH	1.5	Treated to Treated	DBDP Mdb : pupu	2 yrs	M
CSCR	CSCR	0.0	--	pupu : YEPU Mdb	≥ 3 yrs	M

Dispersal movement of least Bell's vireos between 2007 and 2008 at the San Luis Rey Flood Risk Management Project Area, California

2007 Adult/Natal Territory ID	2008 Territory ID	Dispersal Distance (km)	Dispersal Type[a]	Band Combination[b]	Age in 2007[c]	Sex[d]
CSHE	CSHE	0.0	--	LPLP Mdb : pupu	2 yrs	M
CSTA	CSTA	0.0	--	BYST Mdb : pupu	9 yrs	M
CSTR	CSTR	0.0	--	DBWH : Mdb	≥ 3 yrs	M
WGAR	DDOL	0.5	Untreated to Treated	BWST pupu : Mdb	≥ 2 yrs	M
BLAS	DDOU	4.0	Untreated to Treated	YEYE Mdb : gogo	2 yrs	F
DEAR	DEAR	0.0	--	Mdb : DPDB	≥ 3 yrs	M
DMAD	DMAD	0.0	--	: DPDP Mdb	≥ 2 yrs	M
DSAN	DSAN	0.0	--	PUPU Mdb : pupu	≥ 3 yrs	M
CSPA	DTOS	0.7	Treated to Treated	Mdb : PUYE pupu	2 yrs	M
FO 2	FO10	0.1	Treated to Treated	DPDP pupu : Mdb	≥ 3 yrs	M
FO19	FO19	0.0	Treated to Treated	DBWH Mdb : pupu	2 yrs	M
FO5	FO5	0.0	--	pupu : WHWH Mdb	≥ 3 yrs	M
FO 6	FO6	0.0	--	Mdb : DPWH pupu	≥ 3 yrs	M
FO 8	FO8	0.0	--	WHWH dbdb : Msi	≥ 3 yrs	M
WANI	WANI	0.0	--	PUPU pupu : Mdb	≥ 3 yrs	M
WDID	WDID	0.0	--	DBWH pupu : Mdb	≥ 3 yrs	M
CMAN	WDOB	0.9	Untreated to Untreated	DBDP Mdb : pupu	2 yrs	M
WDOC	WDOC	0.0	--	: BYST Mdb	≥ 3 yrs	M
WDOC	WDOC	0.0	--	WHDB pupu : Mdb	≥ 3 yrs	F
WGAR	WGAR	0.0	--	Mdb : WHDP pupu	≥ 2 yrs	M
WGIL	WGIL	0.0	--	pupu : YEYE Mdb	≥ 3 yrs	M
WGRI	WGRI	0.0	--	: DBWH Mdb	≥ 3 yrs	M
WH20	WH20	0.0	--	dbdb : WHWH Msi	≥ 3 yrs	M
WH25	WH25	0.0	--	DPDB Mdb : pupu	2 yrs	F
WH26	WH26	0.0	--	LPBK dbdb : Msi	≥ 3 yrs	M
WMAN	WMAN	0.0	--	BWST Mdb : pupu	≥ 3 yrs	M
WTHE	WTHE	0.0	--	DPDP Mdb : pupu	≥ 3 yrs	M

[a] Treated = territories located in the Channel monitoring sites; Untreated = territories located in Upper Pond or Whelan Mitigation monitoring sites.

[b] Band combo orientation on leg: left leg : right leg. Band colors: **Mbk** = black numbered federal band; **Mdb** = dark blue numbered federal band; **Msi** = silver numbered federal band; **BKBK** = plastic black; **BKYE** = plastic black-yellow split; **BWST** = plastic blue-white striped; **BYST** = plastic black-yellow striped; **dbdb** = metal dark blue; **DBDP** = plastic dark blue-dark pink split; **DBWH** = plastic dark blue-white split; **DPDB** = plastic dark pink-dark blue split; **DPDP** = plastic dark pink; **DPWH** = plastic dark pink-white split; **LPBK** = plastic light pink-black split; **LPLP** = plastic light pink; **PUPU** = plastic purple; **pupu** = metal purple; **PUWH** = plastic purple-white split; **WHDB** = plastic white-dark blue split; **WHDP** = plastic white-dark pink split; **WHPU** = plastic white-purple split; **WHWH** = plastic white; **YEPU** = plastic yellow-purple split; **YEYE** = plastic yellow.

[c] Age: HY = hatch-year, AHY = after hatch-year.

[d] Sex: M = Male, F = Female.

[e] Bird was banded as a nestling sometime between 1999 and 2003 at Pilgrim Creek.

APPENDIX 6

Dispersal movement of least Bell's vireos between 2007 and 2008 from the San Luis Rey River to other Drainages in California.

2007 Drainage / Treatment Type/ Natal Territory ID[a]	2008 Drainage/Territory ID	Dispersal Distance (km)	Band Combination[b]	Age in 2007[c]	Sex[d]
San Luis Rey River / Unknown	San Dieguito River/SD07	33.0[e]	: Mdb	Unknown	F
San Luis Rey River / WestGird3	San Dieguito River/SD07	33.0[e]	Mdb : BYST	1 yr	M
San Luis Rey River / Guajome	Morrell Canyon, Lake Elsinore / LAEL1	49.0	pupu : WHPU Mdb	1 yr	M
San Luis Rey River / Unknown	Otay River / OT02	75.0[e]	Mdb:	Unknown	M
San Luis Rey River / Unknown	Agua Hedionda Creek / AHC02	11.0[e]	Mdb:	Unknown	M
San Luis Rey River / UNT / CBUC	Santa Margarita River / MCAS 10	8.0	YEYE pupu : Mdb	HY	M
San Luis Rey River / UNT / WSTA	Santa Margarita River / HW08	11.1	: WHPU Mdb	HY	F
San Luis Rey River / UNT / WALY	Las Flores Creek / LL18	12.2	PUWH pupu : Mdb	HY	M
San Luis Rey River / TRT / FO7	Santa Margarita River / BGL	6.8	pupu : ORORMdb	HY	M
San Luis Rey River / TRT/ WTHE	Santa Margarita River / ES07	4.7	YEYE gogo : Mdb	HY	M
San Luis Rey River / TRT / WOUT	Santa Margarita River / AE25	7.2	Unbanded[f]	1 yr	M
San Luis Rey River / TRT / BTHR	Santa Margarita River / YB15	4.5	PUOR Mdb : pupu	1 yr	M
San Luis Rey River / Unknown	Santa Margarita River / HW28	8.2[e]	Mdb :	$\geq$ 2 yr	F
San Luis Rey River / Unknown	Santa Margarita River / OCM	8.8[e]	Mdb :	$\geq$ 2 yr	M
San Luis Rey River / Unknown	Santa Margarita River / LN10	12.3[e]	: Mdb	$\geq$ 1 yr	M
San Luis Rey River / Unknown	Santa Margarita River / FR01	8.0[e]	: Mdb	$\geq$ 1 yr	M
San Luis Rey River / Unknown	Santa Margarita River / NC03	5.3[e]	: Mdb	$\geq$ 1 yr	M
San Luis Rey River / Unknown	Santa Margarita River / BN03	3.6[e]	: Mdb	$\geq$ 1 yr	M
San Luis Rey River / Unknown	Aqua Hedionda,/ Calavera Hills	9.6	Mdb :	Unknown	M

[a] Treated (TRT) = territories located in the Channel monitoring site; Untreated (UNT) = territories located in Upper Pond or Whelan Mitigation monitoring sites.

[b] Band combo orientation on leg: left leg : right leg. Band colors: **Mdb** = dark blue numbered federal band; **pupu** = metal purple; **BKLP** = plastic black-light pink split; **BYST** = plastic black-yellow striped; **gogo =** metal gold; **ORORMdb =** plastic orange; **PUOR =** plastic purple-orange split; **PUWH =** plastic purple-white split; **WHPU** = plastic white-purple split; **YEYE =** plastic yellow.

[c] Age: HY = hatch-year.

[d] Sex: F = Female, M = Male.

[e] Distance measured from 2008 territory to the closest location on the San Luis Rey River where banding has been conducted (i.e., approximately 400m northeast of College Road) (USGS, unpublished data).
[f] Band was removed because bird had avian pox on both feet and one leg was injured.

APPENDIX 7

GPS coordinates (Decimal Degrees; WGS84) for the start and end points (Quad) of each vegetation transect sampled at the San Luis Rey Flood Risk Management Project Area in 2006-2008. Quad indicates the distance in meters along a transect.

Site	Transect ID	Quad	X-West	Y-North	Transect Bearing
Reach 4	1	5	-117.29912	33.24834	Bearing=304 degrees
Reach 4	1	145	-117.30033	33.24907	
Reach 4	2	5	-117.29964	33.24763	Bearing=310 degrees
Reach 4	2	115	-117.30074	33.24805	
Reach 4	4	5	-117.30067	33.24607	Bearing=300 degrees
Reach 4	4	105	-117.3017	33.24649	
Reach 4	6	5	-117.30167	33.24445	Bearing=300 degrees
Reach 4	6	105	-117.3026	33.2449	
Reach 4	8	5	-117.30274	33.24299	Bearing=314 degrees
Reach 4	8	105	-117.30349	33.24361	
Reach 4	10	5	-117.30434	33.24167	Bearing=330 degrees
Reach 4	10	125	-117.30506	33.24246	
Reach 4	12	5	-117.30612	33.24078	Bearing=330 degrees
Reach 4	12	95	-117.30656	33.24148	
Reach 4	14	5	-117.30823	33.24023	Bearing=352 degrees
Reach 4	14	115	-117.30851	33.24	
Reach 4	16	5	-117.3103	33.24005	Bearing=358 degrees
Reach 4	16	115	-117.31056	33.2411	
Reach 4	18	5	-117.31255	33.23992	Bearing=358 degrees
Reach 4	18	115	-117.31248	33.24111	
Reach 4	20	5	-117.31473	33.24009	Bearing=2 degrees
Reach 4	20	115	-117.31476	33.24105	
Reach 4	22	5	-117.31675	33.23999	Bearing=2 degrees
Reach 4	22	105	-117.31678	33.24098	
Reach 4	24	5	-117.3191	33.24006	Bearing=2 degrees
Reach 4	24	105	-117.31904	33.24093	
Reach 4	26	5	-117.32116	33.24006	Bearing=2 degrees
Reach 4	26	115	-117.32106	33.24105	
Reach 3b	28	5	-117.32325	33.23991	Bearing=0 degrees
Reach 3b	28	105	-117.32339	33.24101	
Reach 3b	30	5	-117.32537	33.24037	Bearing=0 degrees
Reach 3b	30	115	-117.32544	33.24099	
Reach 3b	32	5	-117.32756	33.24004	Bearing=0 degrees
Reach 3b	32	15	-117.3275	33.24013	
Reach 3b	32	25	-117.3276	33.24018	
Reach 3b	32	35	-117.32754	33.24025	
Reach 3b	34	5	-117.32965	33.24	Bearing=0 degrees
Reach 3b	34	105	-117.32968	33.24073	
Reach 3b	36	5	-117.33178	33.23997	Bearing=0 degrees
Reach 3b	36	115	-117.3318	33.2409	

GPS coordinates (Decimal Degrees; WGS84) for the start and end points (Quad) of each vegetation transect sampled at the San Luis Rey Flood Risk Management Project Area in 2006-2008. Quad indicates the distance in meters along a transect.

Reach 3b	38	5	-117.3339	33.23991	Dropped transect in 2007 because of lack of treated points.
Reach 3b	38	105	-117.33395	33.24077	
Reach 3a	40	5	-117.33602	33.23986	Bearing=0 degrees
Reach 3a	40	95	-117.33606	33.24068	
Reach 3a	42	5	-117.33802	33.23924	Bearing=332 degrees
Reach 3a	42	105	-117.33866	33.23998	
Reach 3a	42	115	-117.33872	33.24006	
Reach 3a	44	5	-11.33963	33.23798	Bearing=296 degrees
Reach 3a	44	105	-117.34059	33.23835	
Reach 3a	46	5	-117.34036	33.23622	Bearing=278 degrees
Reach 3a	46	115	-117.34148	33.23634	
Reach 3a	48	5	-117.34067	33.2345	Bearing=284 degrees
Reach 3a	48	165	-117.34229	33.23481	
Reach 3a	50	5	-117.34127	33.23273	Bearing=286 degrees
Reach 3a	50	145	-117.34264	33.23309	
Reach 3a	54	5	-117.34311	33.2295	Bearing=286 degrees
Reach 3a	54	175	-117.3448	33.23004	
Reach 2	62	5	-117.34478	33.22253	Bearing=304 degrees
Reach 2	62	125	-117.34586	33.22306	
Reach 2	64	5	-117.34641	33.22144	Bearing=326 degrees
Reach 2	64	145	-117.3473	33.22255	
Reach 2	66	5	-117.34839	33.22074	Bearing=346 degrees
Reach 2	66	135	-117.34877	33.2222	
Reach 2	70	5	-117.35272	33.22096	Bearing=6 degrees
Reach 2	70	145	-117.35252	33.22219	
Reach 2	73	5	-117.35612	33.22054	Added this transect in 2007.
Reach 2	73	135	-117.35654	33.22166	
Upper Pond	B13	5	-117.30713	33.24002	Bearing=172 degrees
Upper Pond	B13	65	-117.30683	33.23959	
Upper Pond	B14	5	-117.30823	33.23991	Bearing=172 degrees
Upper Pond	B14	115	-117.30807	33.23901	
Upper Pond	B15	5	-117.3093	33.23978	Bearing=172 degrees
Upper Pond	B15	105	-117.30912	33.23888	
Upper Pond	B15	115	-117.30912	33.2388	
Upper Pond	B17	5	-117.31148	33.23974	Bearing=172 degrees
Upper Pond	B17	105	-117.31135	33.23885	

GPS coordinates (Decimal Degrees; WGS84) for the start and end points (Quad) of each vegetation transect sampled at the San Luis Rey Flood Risk Management Project Area in 2006-2008. Quad indicates the distance in meters along a transect.

Upper Pond	B18	5	-117.31256	33.23971	Bearing=182 degrees
Upper Pond	B18	105	-117.3127	33.23883	
Upper Pond	B19	5	-117.31372	33.23972	Bearing=182 degrees
Upper Pond	B19	105	-117.31391	33.23874	
Upper Pond	B20	5	-117.31475	33.2397	Bearing=182 degrees
Upper Pond	B20	105	-117.31495	33.23881	
Upper Pond	B21	5	-117.3158	33.23972	Bearing=182 degrees
Upper Pond	B21	105	-117.31602	33.2388	
Upper Pond	B22	5	-117.31689	33.23969	Bearing=182 degrees
Upper Pond	B22	95	-117.31699	33.23885	
Upper Pond	B23	5	-117.31802	33.23968	Bearing=182 degrees
Upper Pond	B23	55	-117.318	33.2392	
Upper Pond	B24	5	-117.31901	33.23964	Bearing=182 degrees
Upper Pond	B24	45	-117.31902	33.2393	
Upper Pond	B25	5	-117.32011	33.23963	Bearing=182 degrees
Upper Pond	B25	35	-117.3201	33.23927	
Upper Pond	B26	5	-117.3211	33.23955	Bearing=182 degrees
Upper Pond	B26	35	-117.32118	33.23925	
Whelan Mitigation	WH-1	5	-117.33969	33.23975	Bearing=345 degrees
Whelan Mitigation	WH-1	325	-117.34222	33.237744	
Whelan Mitigation	WH-2	5	-117.33989	33.24004	Bearing=345 degrees
Whelan Mitigation	WH-2	345	-117.34281	33.23811	