Avian Populations on the Santa Clara River in 2005 and 2006
An Evaluation and Monitoring Tool for Habitat Restoration
Ventura County and Los Angeles County, California

January 19, 2011

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Prepared For

The Santa Clara River Trustee Council

c/o The United States Fish and Wildlife Service
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Ventura, California 93003

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Summary

This report presents results from two years of avian studies conducted in and adjacent to riparian habitat along the Santa Clara River during the breeding seasons of 2005 and 2006. The study is supported by the Santa Clara River Trustee Council which is comprised of representatives from the U. S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG). The Trustee Council was formed as part of efforts to restore and protect portions of the river following the January 17, 1994 ARCO/Four Corners oil spill on the Santa Clara River, in Los Angeles County, California. In order to conduct effective restoration planning, the trustees determined that monitoring of avian species would help to further restoration goals and, thus, allocated funds to support this project.

The study was designed to determine the abundance and distribution of: 1) the general avian community, 2) Threatened and Endangered [T & E] birds, and 3) Brown-headed Cowbirds *(Molothrus ater).* This study provides a tool to assess the efficacy of ongoing and future habitat restoration projects on the Santa Clara River. Data collected in this study provide insight into long-term avian population trends within areas surveyed intensely in the past (the lower watershed). The data also provide new baseline information within areas that have not been investigated recently (much of the upper watershed).

Knowledge of the watershed and choice of methodology are based mainly on previous damage assessment research conducted from 1994 to 2001 (Labinger and Greaves, 2001).

Results are discussed in terms of trends and factors affecting bird populations throughout the study area. Analysis of the data from the 2005-2006 study showed several clear differences between sections of the study area. First, the lower river sections (Maps 1 and 2) supported the most abundant and species rich bird community, including sensitive and endangered species. Second, the middle portion of the Santa Clara River (centered at its confluence with Piru Creek, as shown in Map 3), had the lowest abundance and species richness in the surveyed area. This middle section of the river had very limited riparian woodland habitat. These trends were particularly evident with regard to riparian obligate species. The upper section of Soledad Canyon had a relatively diverse avifauna but absolute species richness was lower.

Least Bell's vireo (*Vireo bellii pusillus*) was the most common endangered bird species found during this study period. A total of 84 male vireos were found in 2005 and 67 males in 2006. However, when comparing actual pairs, the differences between years are much less apparent with 39 pairs in 2005 and 36 in 2006. This may be an artifact of a small number of nest searches in both years since it was not the focus of the study. When least Bell's vireos were observed in an area, a nest search was conducted when there was sufficient time. Due to the limited time devoted to nest searches, only the more accessible nests were likely to be found. Least Bell's vireos were only found along the lower river sections (Maps 1 and 2). Although they are known to occur within Los Angeles County downstream of I-5, we did not survey those areas during this study. Within the surveyed areas, Least Bell's vireos were most abundant centered on the Vern Freeman Diversion (Map 1) and the Fillmore Fish Hatchery just east of Fillmore (Map 2). This latter location was surveyed mainly by John Gallo (consulting biologist) for a separate project (Gallo 2007). However, we did survey the

area and surroundings and received data from Gallo. One new breeding location was found approximately one kilometer downstream of Highway 118.

No yellow-billed cuckoos (*Coccyzus americanus occidentalis*) were observed. Southwestern willow flycatchers (*Empidonax traillii extimus*) were detected at several locations each year. In 2006 one confirmed successful breeding of this species occurred near the Fillmore Fish Hatchery (Map 2).

Habitat relationships to the overall bird community were analyzed using multiple regressions. Mean relative abundance and species richness showed significant positive correlations with willow tree and shrub cover, but with relatively low explanatory power (r-squared). In other words, the relationship is not statistically significant. Increasing percentage of *Arundo* resulted in decreases in both relative abundance and species richness. Overall habitat richness as measured by three parameters (open habitat, shrub and tree) was positively correlated with increased relative abundance of riparian obligate species but was not a factor in determining riparian obligate species richness. These results point to the complexity of the relationship between habitat parameters and species diversity, which are discussed herein.

We provide recommendations regarding restoration and preservation efforts including the following. Observations of avian populations should be quantified and analyzed statistically by conducting point counts similar to those that we conducted. The collected data should be used to measure success. As one measure for evaluating success of habitat restoration efforts on the Santa Clara River, we recommend using avi-fauna species abundance and richness within the most successful sites found during this study. Thus, for example, a successful restoration site could be defined as that which exceeds 90% of the relative abundance[1] and 90% of the species richness[2] of the most diverse area found during this study including at least 20% of the listed species (not limited to Threatened and Endangered species) and one pair of least Bell's vireo per hectare.[3]

[1] Relative abundance is calculated by dividing the total number of individuals of a species by the total number of point counts.

[2] Species richness means the number of species.

[3] The area with the highest diversity of bird species observed in this study is located between the Highway 118 Bridge and Fillmore (Map 1).

I. Introduction

On 17 January 1994, an earthquake caused the rupture of an ARCO/Four Corners oil pipeline in Santa Clarita, California causing approximately 190,000 gallons of crude oil to spill into the Santa Clara River at McBean Parkway, Valencia in Los Angeles County (Regional Map). Active river flows carried the oil approximately 16 miles downstream to the Piru Creek confluence, Ventura County where a containment dam was built. In response to the spill, the California Department of Fish and Game (CDFG) and the US Fish and Wildlife Service (USFWS) on behalf of state and federal trust resources conducted a cooperative assessment to determine potential natural resource injuries. As required under the Oil Pollution Act (OPA), a Natural Resource Damage Assessment was initiated.

The CDFG and USFWS initiated studies of macroinvertebrates, teleost fishes, herpetofauna, avifauna, and their habitats within the spill path in an effort to assess impacts from the spill and the resulting cleanup. In December of 1996 the natural resource trustees, U.S. Fish and Wildlife Service and California Department of Fish and Game, reached a $7.1 million dollar settlement with ARCO for natural resource damages arising from the spill. The Consent Decree states that the settlement money is to be used for habitat restoration, revegetation, and/or protection of areas within the Santa Clara River watershed. In order to conduct effective restoration planning, the trustees determined that additional monitoring of avian species was warranted and thus, decided to support this project.

During the course of this two-year avian study, bird populations were surveyed within specific sections of the Santa Clara River Watershed (See Regional Map) that are currently being restored, or are considered high priority for preservation and restoration based on the following plans: the Santa Clara River Enhancement and Management Plan (SCREMP 1996), the Final Restoration Plan and Environmental Assessment for the Santa Clara River ARCO Oil Spill, and The Nature Conservancy Conservation Plans for the Santa Clara River. All of these plans consider natural resource monitoring and assessment to be a critical component of effective restoration planning.

Bird populations provide an excellent tool for determining priorities and for monitoring the results of restoration efforts. As a group, birds are excellent indicator species because of their wide distribution, ease of detection, and use of a wide range of ecological niches. Conservation biologists frequently use indicators such as species diversity and abundance to characterize habitat function and potential. Particular weight is given to sensitive riparian obligate species such as least Bell's vireo (*Vireo bellii pusillus*) and southwestern willow flycatcher (*Empidonax traillii extimus*).

Conservation of sensitive species, including the state and federally listed endangered least Bell's vireo and southwestern willow flycatcher, depends on accurate knowledge of their population sizes and distribution. The Recovery Plans for both species recommend protection and management of riparian and upland habitats within the species' current and historic ranges (U.S. Fish and Wildlife Service 1998 [Draft] and 2002). Further, colonization of new or historic areas is more likely near current breeding areas. The two most important factors promoting least Bell's vireo use of a restoration site is proximity to occupied areas, and adjacent mature vegetation (Kus 1998).

Avian Surveys by Labinger and Greaves, 2005 and 2006

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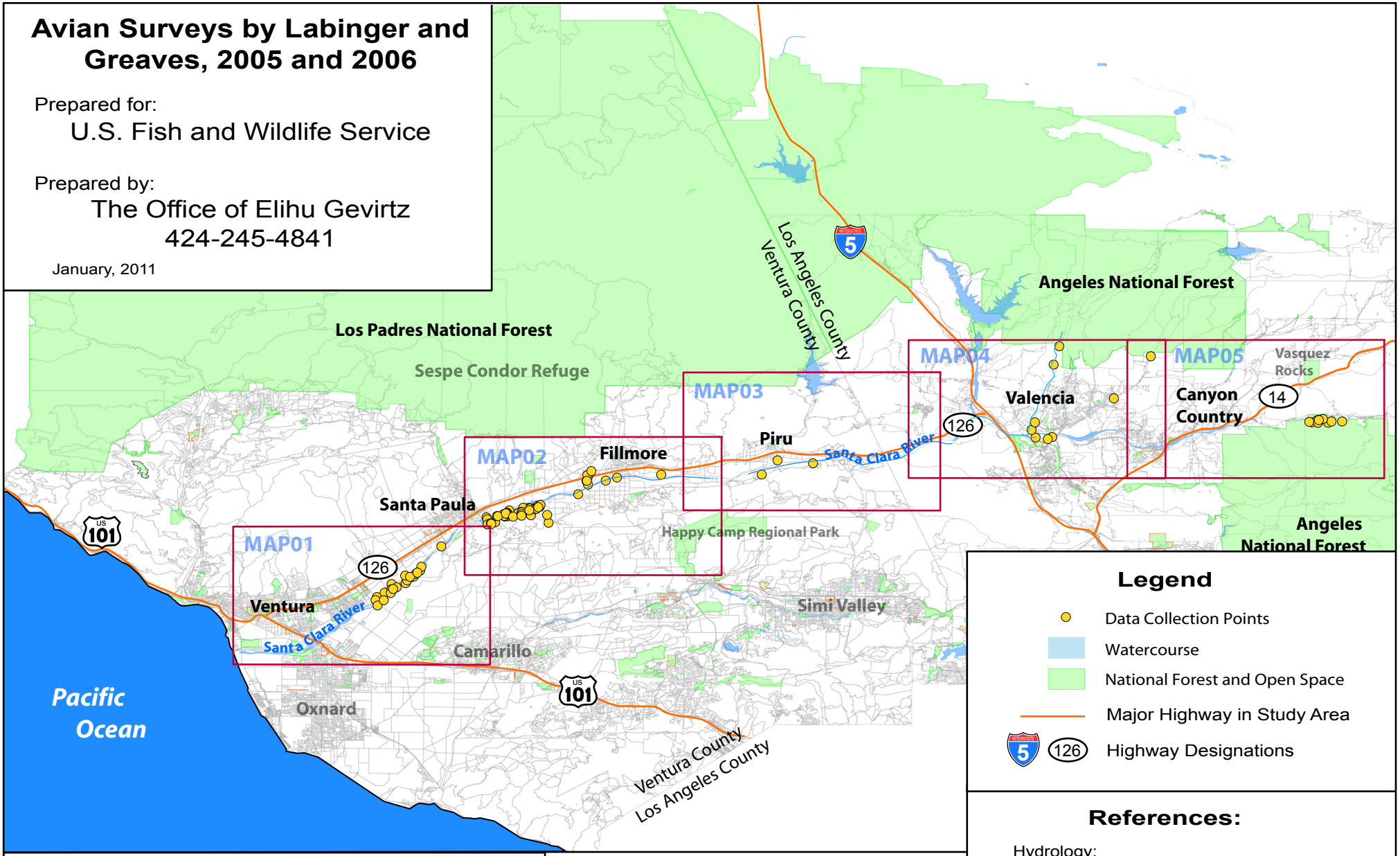

Legend

- Data Collection Points
- Watercourse
- National Forest and Open Space
- Major Highway in Study Area
- Highway Designations

References:

Hydrology:
(U.S. Census Bureau TIGERLine and USGS Aerial Photo, 2009)

National Forest and Open Space
(U.S. Census Bureau TIGERLine, 2009)

Roads and Highways
(U.S. Census Bureau TIGERLine, 2009 Google Maps)

Regional Map

showing Ventura County and Northwestern Los Angeles County

N

0 6.8 mi

Scale: 1 inch= about 6.8 miles

2. Objectives

The main objective of this study was to obtain data on avian populations as an evaluation and monitoring tool for restoration activities. These data provide critical information related to:

- Population size and distribution of T & E bird species (e.g. least Bell's vireo and southwestern willow flycatcher.
- Relative comparisons of the avian communities between specific sites.
- Brown-headed cowbird abundance and distribution in relation to specific sites, T&E species and cowbird trap locations.
- Impacts to bird populations as a result of the 2003 burned areas of the river.

Data collected in this study provide:

- Baseline information regarding long-term trends in population size and distribution of the general avian community as well as threatened and endangered species in the lower watershed. (Long-term trends can be identified by comparing data collected during this study with data collected during previously conducted intensive surveys of the lower watershed.)
- New baseline information including population sizes and avian species distribution for much of the upper watershed. (Because this area had not been surveyed recently, a current baseline for the upper watershed had been lacking.).
- Baseline information regarding the general avian community as well as threatened and endangered species use of the river that can be used to evaluate the success of existing and future habitat restoration projects.

3. Environmental Setting

The Santa Clara River is one of the largest and last rivers in southern California that does not have a dam on its main stem. (There are dams on Castaic Creek and Piru Creek which are tributaries to the river.) It stretches from east to west for approximately 140 kilometers (See Regional Map). The watershed encompasses 4,072 square kilometers and extends from the north slopes of the San Gabriel Mountains in Los Angeles County down to the Pacific Ocean at the Ventura-Oxnard Plain in Ventura County. Riparian vegetation, particularly forests, occurs patchily along the main river channel and in some areas forms a contiguous landscape with native upland habitats. Important habitat types include alkali and freshwater marsh, ponds, mulefat scrub, southern willow scrub, southern willow riparian woodland, southern cottonwood-willow riparian forest, alluvial scrub, and big sagebrush scrub. Photographs of several locations within the study area are provided in Appendix A.

The abundance and distribution of birds is directly related to the quality and quantity of available habitat. Since western riparian ecosystems are among the most productive habitats for birds in North America and among the rarest (Krueper 1992), it is not surprising

that the vegetated parts of the river support a rich diversity of birds, including a number of endangered, threatened, and sensitive species. Some of this section of the river is included within U.S. Fish and Wildlife Service Critical Habitat designation for the state and federally listed endangered least Bell's vireo. In addition to providing wildlife and aquatic habitats, riparian ecosystems provide important functions such as water purification, temperature control, nutrient transport, and wildlife corridors.

The study area included portions of the main river channel from Soledad Canyon in Los Angeles County, downstream, to the City of Saticoy in Ventura County. Specific locations within this reach of the river were studied in depth (see Methods) and are described below. The present study did not include the main areas affected by the original oil spill, which are located entirely on private property of the Newhall Land and Farming Company, one of the few stretches of the river that is contiguous with large expanses of open land comprised of varied native upland habitat types. To the south and west lies the Santa Susana Mountains covered in coastal sage scrub and oak woodland. To the north lies the Transverse Range with sage and pinyon-juniper vegetated slopes, and to the east lies the Antelope Valley that harbors elements of the Mojave Desert ecotone such as Joshua trees (*Yucca brevifolia*).

3.1 Study Areas

The entire study area is shown on the Regional Map. The study area is divided in to five different map sections (Maps 1 - 5). Each Map is approximately 12.9 miles wide. The lower part of the river (Maps 1 and 2) from Highway 118 upstream past Santa Paula includes the two reference sites that were chosen as control areas for the original damage assessment (Labinger and Greaves 1994).

Map 1

The area covered by this map extends from Highway 118 upstream to Santa Paula. The majority of this area was part of Reference Site I in the 2001 damage assessment study. Map 1 encompasses the area upstream and downstream of the Vern Freeman Diversion and the United Water Conservation District Reservoirs. The river channel here is relatively narrow with emergent wetland lining the low-flow channel and a narrow strip of rich willow woodland on either side. Over the course of this study, the bare area above the Vern Freeman Diversion became re-vegetated with willow woodland, interspersed with open water marsh and emergent wetland. The north side of the river below Vern Freeman Diversion supports a drier upland habitat, with mature Fremont and black cottonwoods and willows. These upland forests are former duck pond sites with large thickets of intermingled poison oak and giant reed, beneath an overstory of older willows. Two streams, Todd and Ellsworth Barrancas, flow into the Santa Clara River from the north.

The upstream portion of this area is contiguous with upland habitat on the south side of the river. Here the slopes of South Mountain reach the Santa Clara River and are vegetated mostly by coastal sage scrub.

Avian Surveys by Labinger and Greaves, 2005 and 2006

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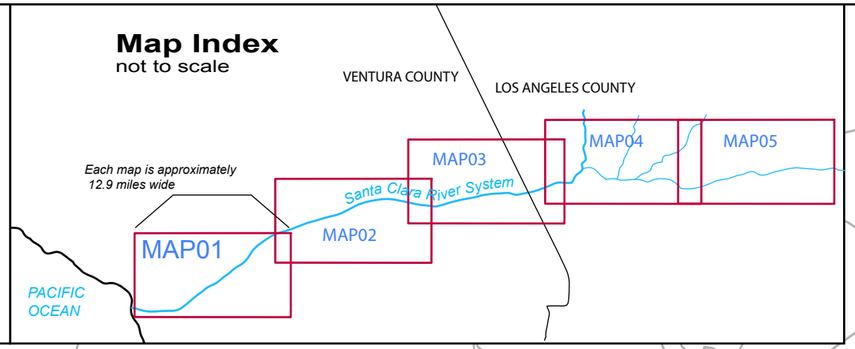

References:

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National Forest and Open Space
(U.S. Census Bureau TIGERLine, 2009)

Roads and Highways
(U.S. Census Bureau TIGERLine, 2009 Google Maps)

Legend

- Watercourse
- National Forest and Open Space
- Major Highway
- Major Road with River Crossing
- Roads paved and un-paved
- (118) State Highway Designation

Key to Observations

Identity

- Least Bell's Vireo
- SW Willow Flycatcher
- Bird of Conservation Concern (BCC), and/or State Species of Special Concern (SSC) observed
- No Sensitive Species observed

Data Collection Point Symbols

DS#
Identifies data collection point by corresponding data sheet number

Line Survey Extents Enclosed by brackets:

Survey Area shaded orange

N

0 4000 8000 1 mile

Scale: 1 inch= 4000 feet

MAP01

Map 2

Located from east of Santa Paula upstream to the Fillmore Fish Hatchery, this Map section includes Reference Site II (Santa Paula up to the Hedrick Ranch Nature Area). This section supports the widest intact riparian corridor (approximately one mile) within the study area (probably of the entire river). The large riparian woodland along the north side of the river remained fairly stable over the course of this study. Here, large mature cottonwood and willow forests are interspersed with willow thickets, coastal sage scrub, and open gravel bars. There are several ponded sections fed by up-welling where sub-surface aquifers emerge, as well as southward flowing agricultural run-off in remnants of the former main channel. In some sections in these woods, are found horse-tails (Equisetum spp.) and giant stream orchid (Epipactis gigantea). Thickets of giant reed (Arundo donax) are found throughout much of this area.

Scouring and movement of the low flow channel to the south and to the east significantly affected habitats on the south side of the river. During the study, a large expanse of young willow thickets existed along a mile-long stretch on the south side (an area that had formerly been above river grade and supported dry-land agriculture) and on the north side below Willard Road. Land that had been in pasture above river gradient on the south side of the Santa Clara River through 1999, was covered with yerba mansa (*Anemopsis californica*) and native rushes (*Juncus* spp.) during the study. Several perched wetlands that had been used as duck ponds in the past occur here.

The Sespe Confluence, as defined here, includes a one-mile long reach of Sespe Creek from Highway 126 to its confluence with the Santa Clara River. High quality riparian habitat is restricted mostly to the Sespe Creek section. Habitat is varied and includes mature cottonwood and willow forest, mid-successional willow thickets, gravel bars, and ponded marsh. A dense Eucalyptus forest occurs along the west side of Sespe Creek. The U.S. Army Corps of Engineers removes sediments from the lower section of Sespe Creek just above its confluence with the river (California Department of Fish and Game, personal communication).

The Fillmore Fish Hatchery consists of a stretch of the Santa Clara River from the Highway 23 Bridge at Fillmore upstream approximately two miles. The river bottom is relatively wide in this section ranging from 500 to 1000 meters. As with much of the lower river system, riparian scrub and forest vegetation occurs along the edges of the low-flow channel where flood scouring is less destructive. A variety of riparian wetland habitat displaying a range of successional stages is present at the site. Much of the river bottom consists of open sand and gravel bars interspersed with emergent riparian vegetation and a meandering low-flow channel. Extensive, mature riparian forest exists along the north side of the river and is dominated by willows with interspersed Fremont and Black Cottonwoods. Freshwater marsh habitat occurs patchily throughout the forested areas and along portions of the low-flow channel and consists of small pools surrounded by bulrush and cattail. In addition, upland, dry scrub habitat is found along the western portion of the site and consists of mulefat and cactus (*Opuntia sp)*.

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Fillmore

Santa Paula

Santa Clara River

State Highway 126

Union Pacific RR

Old Telegraph Rd

Sycamore Rd

River St.

Toland Park

Line Survey June 19 2006

Line Survey June 7, 2006

Fillmore Fish Hatchery

Pyle Rd

Largo Ln

Riversdale Ave

Pasadena Ave

Barsdale Ave

Bardsdale Ave

Chambersburg Rd

Sespe St.

Stump Rd

Guberson Road

Elkins Ranch Golf Course

Hedrick Ranch

South Mountain Road

MAP 03

DS68, DS67, DS29, DS69, DS28, DS30, DS32, DS31, DS25, DS70, DS84, DS84.2, DS84.3, DS43, DS42, DS41, DS40, DS35, DS36, DS84.4, DS44, DS86, DS37, DS38, DS39, DS81, DS3, DS85, DS20, DS21, DS75, DS72, DS34, DS33, DS24, DS22, DS23, DS80, DS86.1, DS74, DS73, DS76, DS76.1, DS83, DS2, DS78, DS83.1

Map Index

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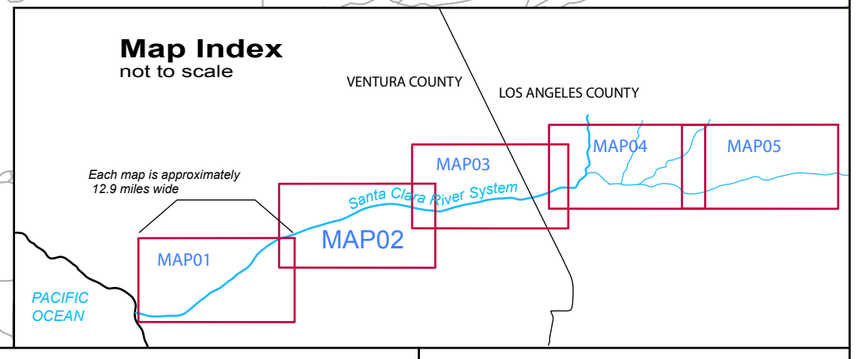

References:

Hydrology:
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National Forest and Open Space
(U.S. Census Bureau TIGERLine, 2009)

Roads and Highways
(U.S. Census Bureau TIGERLine, 2009 Google Maps)

Legend

Watercourse

National Forest and Open Space

Major Highway

Major Road with River Crossing

Roads paved and un-paved

(118) State Highway Designation

Key to Observations

Identity

Least Bell's Vireo

SW Willow Flycatcher

Bird of Conservation Concern (BCC), and/or State Species of Special Concern (SSC) observed

No Sensitive Species observed

Data Collection Point Symbols

DS#
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Line Survey Extents Enclosed by brackets:

Survey Area shaded orange

N

0 4000 8000 1 mile

Scale: 1 inch= 4000 feet

MAP02

The natural vegetation is bordered to the north by residential (northwest) and agricultural areas. Much of the agriculture directly bordering the riparian area consists of deep troughs with running water, maintaining watercress. Water is pumped from the ground at several locations, and flows through the watercress and then out to the river. Riparian areas bordering the watercress tend to be vegetated by lush vegetation. Another source of water for the Santa Clara River comes from the Fillmore Fish Hatchery, owned by the California State Fish and Game, which pumps a large quantity of water from a deep aquifer through its fish runs. This water flows out the west end of the facility into watercress fields, and then out to the river. The fish hatchery maintains a strip of native riparian vegetation along its perimeter. This area was not surveyed intensively because the area is part of a different avian study and the land is privately owned (J. Gallo, unpublished data).

Map 3

This area includes the stretch of the river from Fillmore east of the Fish Hatchery up to the Los Angeles County line. This area of the river bottom is extremely dry with limited riparian vegetation except for parts of Piru Creek that flow into the Santa Clara River. The upstream reaches of river bottom in this area are characterized by desert flora such as *Opuntia* cactus species and forbs. Survey efforts were minimal in this area because of the presence of poor quality riparian vegetation. We did not conduct surveys on the property of Newhall Land and Farming Company during this project.

Map 4

This section includes the area upstream of Highway 5 including the City of Santa Clarita. San Francisquito and Bouquet Canyon drainages join the Santa Clara River along this reach. Although much of the natural habitat in this reach is highly degraded because it occurs within an urban environment, some sections still support remnant gallery forests of cottonwoods and willows. During years between major flood events, as in 2005, willow shrub thickets grow at the confluences and along various segments. These thickets can support a wide variety of riparian birds including least Bell's vireos.

Map 5

This area extends the farthest upstream and nearly reaches the origin of the eastern watershed of the Santa Clara River. Portions of the Mohave Desert reach within miles of the Santa Clara River within the Antelope Valley.

Portions of the floodplain of the Santa Clara River fall within the Angeles National Forest. Within this meandering, narrow and mountainous section is found very high quality, mature riparian gallery forests. The riparian forests are composed of an overstory canopy of mature cottonwood and willow trees with a second mid-canopy of willow, poison oak, and blackberry shrubs. In parts of the river, the channel is broken into several braids that meander throughout, providing some marshy habitats of reeds and cattails. Much of the mountains surrounding the river support relatively high quality chaparral, oak and pine woodland and some Douglas fir trees.

Other parts of this section are highly degraded. Two rock quarries are located within the river bottom both up and downstream of the high quality habitats. Also, dispersed throughout these areas are private houses, dirt roads and ORV trails.

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Map Index

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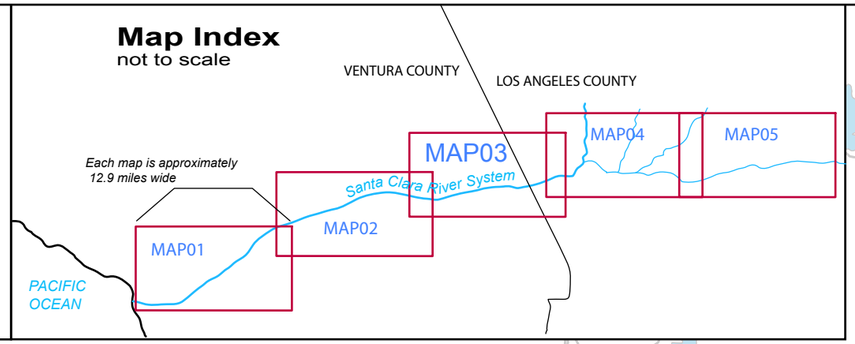

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Roads and Highways
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Legend

- Watercourse
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Data Collection Point Symbols

DS#
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Line Survey Extents Enclosed by brackets:

Survey Area shaded orange

N

0 4000 8000 1 mile

Scale: 1 inch= 4000 feet

MAP03

Avian Surveys by Labinger and Greaves, 2005 and 2006

Prepared for:

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Prepared by:

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805-965-2861

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Map Index

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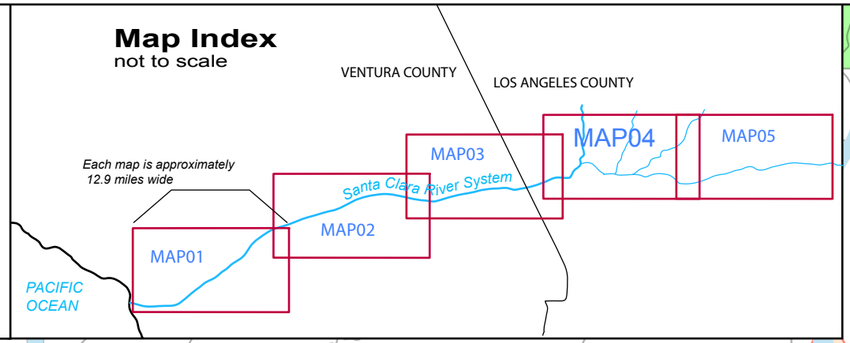

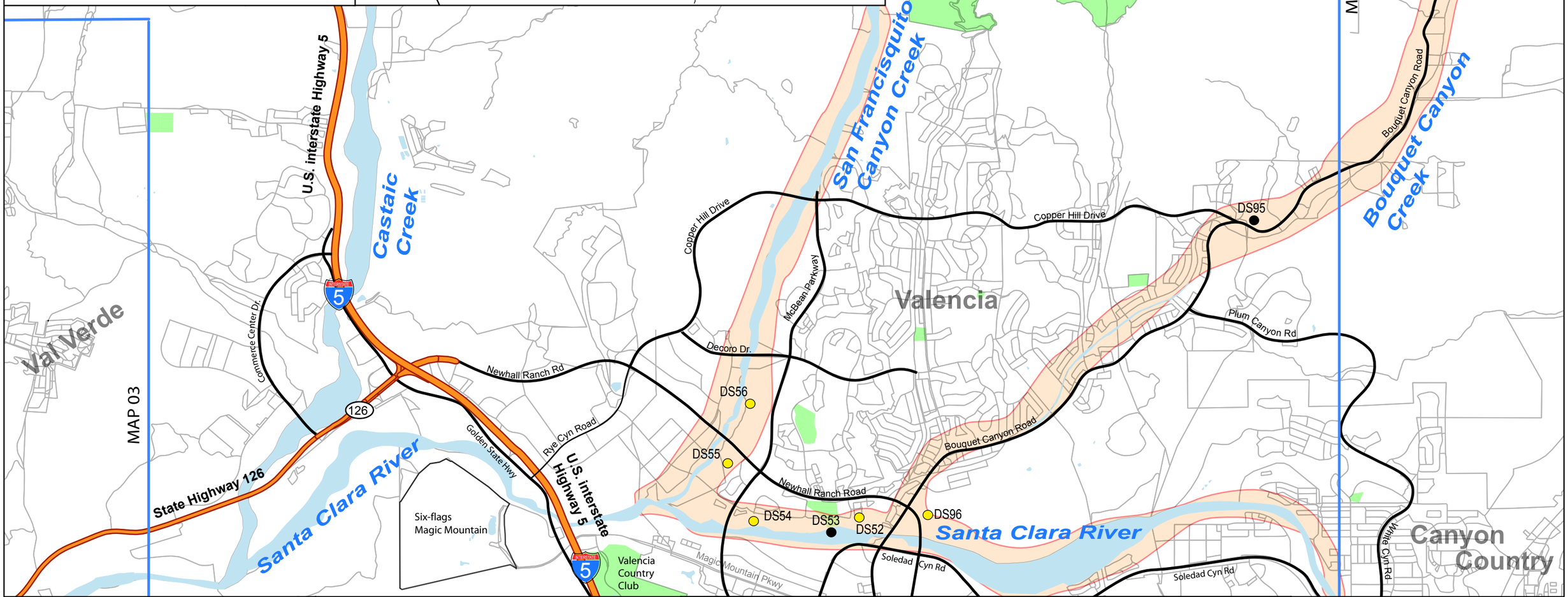

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MAP04

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Map Index

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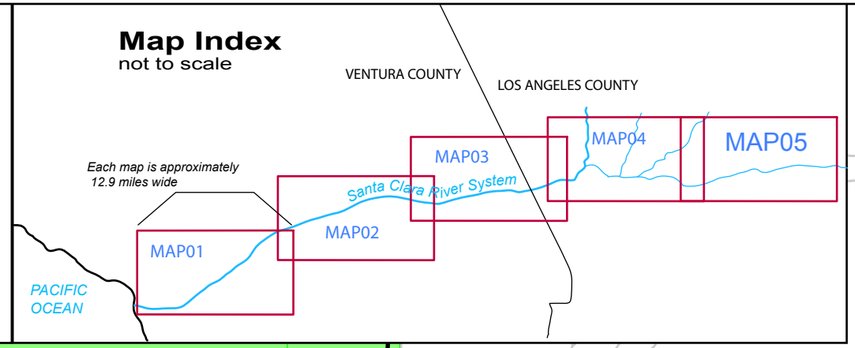

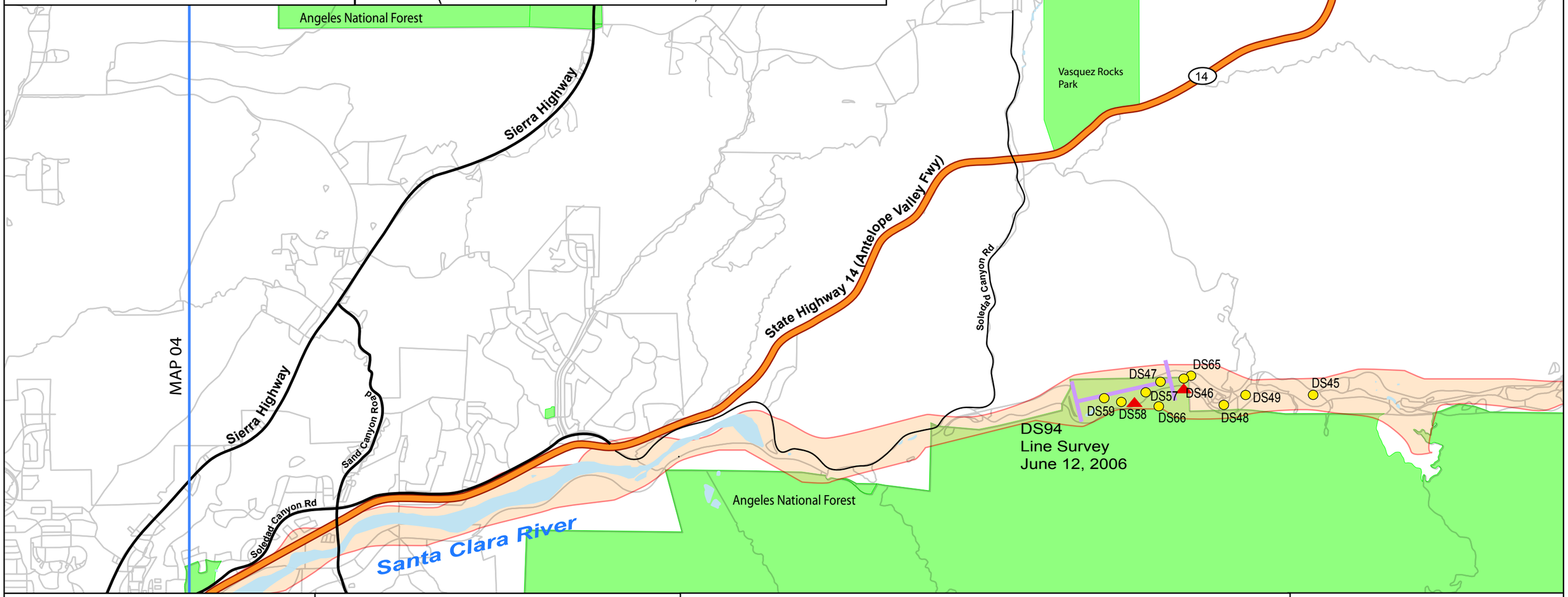

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MAP05

3.2. Effects of Fire and Flooding

In 2003, the Piru Fire burned more than 63,000 acres and the Simi Fire more than 108,000 acres. The combined total (171,000 acres) burned approximately 11% of the Santa Clara River watershed (The Nature Conservancy 2008, Ambrose no date). Three years later, in September 2006, the Day Fire burned approximately 16% (163,000 acres) of the total watershed of the Santa Clara River –(Santa Clara River Parkway website). For more than 100 years (at least) fire has been a frequent occurrence in the watershed. In fact, the Santa Clara River Parkway Project reports that "Historical records indicate that much of the Santa Clara River watershed has burned at least once since the late 19th century, with many areas of the lower watershed, including South Mountain, the lower Sespe, Hopper, and Piru Creek watersheds, burning up to 7 times in the past 142 years (Figure 1)."

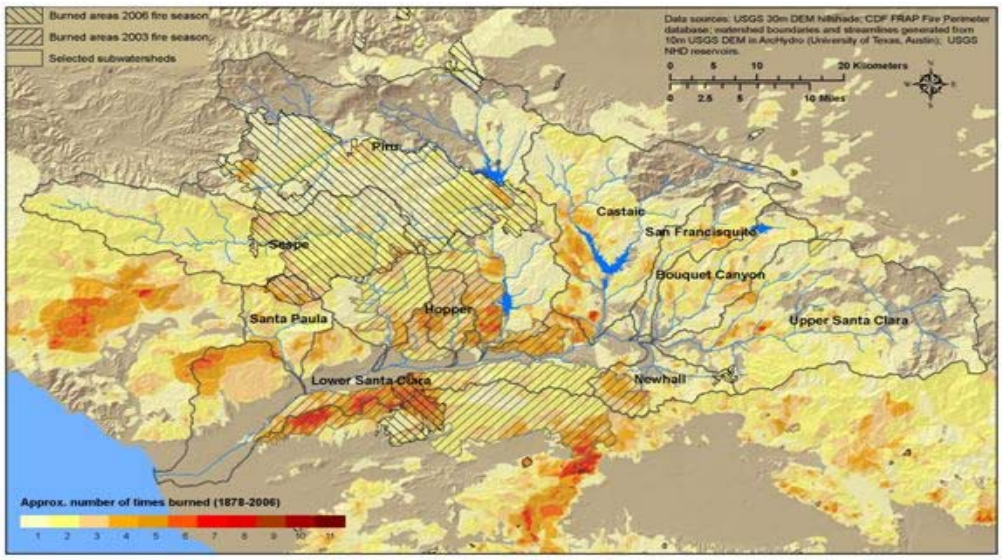


Figure1. Burn areas within the Santa Clara River Watershed 1878 - 2006. (Source: Santa Clara River Parkway Project web site).

Fires in the watershed typically contribute to subsequent flooding. "Exceptionally dramatic post-fire responses of hill slopes have been documented during winter storms in watersheds that neighbor the Santa Clara River. After the 1985 Wheeler Fire, just north of the Santa Clara River watershed, in the Ventura River basin, dry gravel contributed large volumes of sediment to the [Ventura River] channel. The area then experienced two moderate-magnitude rainstorms. After the first post-fire rainstorm, channels [in the Ventura River] aggraded (i.e. material was deposited) by 20 to 50 cm, with an estimated 90% of the channel deposits formed by post-fire sediment delivery from slopes. Roughly 90% of the deposits were then scoured away during the second post-fire rainstorm. Hence fluvial transport of the post-fire deposits was extremely effective, even though the storm flows were of only moderate magnitude." (Santa Clara River Parkway website) The scouring of the channel leaves unvegetated sections of the river and stream beds vulnerable to invasion by giant reed (*Arundo donax*) (The Nature Conservancy 2008).

Stillwater Sciences (2007) reported that the riparian corridor of the lower Santa Clara River is currently much narrower, on average, compared to the years before major dams (on Castaic and Piru Creeks) and levees were constructed. They compared the 1938 flood with other floods of the river, including the 2005 flood, and found that although the 2005 and 1938 floods were similar in magnitude, the 2005 flood inundated approximately 60% less area than the 1938 flood. They attribute the difference to the effect of levees (constructed after 1938) in constraining the floodplain and limiting the extent of riparian vegetation in the lower Santa Clara River (Stillwater Sciences 2007b).

Stillwater Sciences concluded that on the lower Santa Clara River, the strongest drivers controlling the distribution of riparian vegetation are flood disturbance (specifically flood frequency and time since last flood) and water supply, and that these factors are closely linked to the El Nino Southern Oscillation (ENSO) (Stillwater Sciences 2007b). Revegetation following the 2003 fire is shown in the photographs in Appendix A.

4. Methods

This study was designed to determine the abundance and distribution of: 1) the general avian community, 2) Threatened and Endangered species, and 3) Brown-headed Cowbird *(Molothrus ater).* Methodology and knowledge of the watershed were based mainly on previous damage assessment research conducted from 1994 to 2001 (Labinger and Greaves, 2001).

Methods employed throughout the study included point counts, general surveys, tape playback surveys for three endangered species: southwestern willow flycatcher, least Bell's vireo and western yellow-billed cuckoo). Least Bell's vireo territories were located when possible and illustrated on the maps. We assumed that a pair of vireos located in the same area during several successive visits was a nesting pair regardless of whether the nest was found. Nest monitoring efforts were limited to a few sites and not standardized throughout the project area.

All surveys were conducted by Zev Labinger and Jim Greaves in June and July 2005 and June and July 2006. The surveyed areas included the main stem of the Santa Clara River (beginning downstream and moving upstream) from State Highway 118 up to Piru Creek Confluence to Camulos, and San Francisquito Creek to the Angeles National Forest, Bouquet Canyon to Angeles National Forest, and Soledad Canyon to Ravenna. The survey did not cover the reach of the Santa Clara River on the property of the Newhall Land and Farming Company, from Rancho Camulos up to Santa Clarita.

Methods used included fixed-radius point counts (Ralph et al 1993), area-transect counts (Koskomies and Vaisanen 1991), tape playback surveys, and limited nest monitoring of least Bell's vireos. The point counts and area-transect censuses provide data on the overall bird community, emphasizing comparisons between points within and between different areas and habitat types. Tape playback and nest monitoring of least Bell's vireo and willow flycatcher provide detailed breeding data for most of their populations along the lower Santa Clara River. Brown-headed cowbirds were recorded during these censuses, as well as sex, age, and breeding behavior.

Point counts and area-transect censuses were conducted starting 15 minutes after sunrise and ending within five hours following sunrise, corresponding to peak activity of most birds.

In most riparian habitats, this methodology allowed observers to survey one approximately 5 x 1 kilometer section of river bottom per morning period. Birds are typically defending territory in early mornings and therefore highly vocal. These can be readily heard by trained observers in the field. In general bird activity decreases with increased temperatures and therefore surveying is less productive at those times. However, on cooler afternoons birds tend to be active and suitable for focused surveys and monitoring. Therefore, focused surveys and monitoring of vireo and flycatcher occasionally extended later in the day depending on ambient temperatures.

The locations of all point counts and territories of Threatened and Endangered species were recorded using a Magellan GPS, model 315. Field equipment also included 10x binoculars. All species observed were recorded on standard field data collection sheets (Appendix C). Other information that was recorded on each data sheet included: latitude and longitude (UTM), reference location relative to previous vireo and flycatcher study locations, weather (temperature, cloud cover, wind speed), vegetation types, and the approximate percent cover of each type of vegetation within the 50m radius. Because the majority of birds are detected by vocalizations, vegetation that obstructs views of the birds was not a problem. Even so, point counts were limited to birds observed by sound or sight within a 50 meter radius of the point.

4.1 Data Collection

Point Counts

In this study, point count methodology followed standardized procedures described by Ralph et al (1994). Each observer conducted point counts in June and July starting approximately 15 minutes after sunrise and ending within 4.5 hours. During each point count, the observer stood in one place for 10 minutes and recorded every bird that was observed by sight or by sound. The numbers of individuals of each species were recorded and categorized by time of observation (0-3, 3-5, 5-10 min) and distance from the observer (≤50, ≥50 m, flying). Point counts were conducted on a semi-random basis so that at least four points were counted in each area-transect (See below). This allowed for a more thorough coverage of each area (than was obtained during the ARCO surveys in which point counts were made at 500 m intervals along the Santa Clara River channel.) Flexibility was given to the surveyor to investigate different areas. In addition, points were not counted more than once although general areas were visited multiple times. This method resulted in 87 point counts in a wide variety of habitat types (See Regional Map and Maps 1 - 5). Each point count location is indicated on Maps 1 – 5 by a dot with a code next to it: DS#. The detailed results of each point count are in Appendix D. However, because there are so many types of vegetation (Appendix B) recorded in the database, the data would be illegible if all of the vegetation data were displayed. Therefore they are not shown in the hard copy of this report, but can be viewed in the electronic version.

Area-Transect Surveys

Area-transect surveys for all species were conducted during the playback surveys for sensitive species (see below)., Monitoring of least Bell's vireos was conducted after the morning point counts. Area-transect surveys differ from point count surveys in that the surveyor is moving while surveying and searching for species and other information not previously detected. Area-transect surveys also differ from point counts in that the numbers of individuals of each species is not recorded. Detailed notes were recorded of all species

detected, indicating specific location, and behavior, especially in relation to productivity such as nesting, food carrying, feeding fledglings, and territorial disputes.

These surveys were conducted mostly during morning hours between 0600 and 1200; however, some surveying and monitoring lasted into the late afternoon. All areas with appropriate habitat were surveyed at least three times during the field season of June and July. This was consistent with the seasons our previous surveys.

Playback Surveys

Specific surveys were conducted for the least Bell's vireo, southwestern willow flycatcher, and western yellow-billed cuckoo following the basic US Fish and Wildlife Service Protocol for Surveying Least Bell's Vireos (USFWS 1994, southwestern willow flycatchers (Bombay et al 2003) and yellow-billed cuckoos (Halterman 2002). This involves the use of tape-recorded playback songs to illicit responses from wild birds. The location of all individuals detected was recorded with a GPS. Follow-up monitoring was conducted for some least Bell's vireos found (see below). These surveys were conducted mostly during morning hours between 0600 and 1100, although some afternoon surveys were also made. All areas with appropriate habitat were surveyed at least three times during the field season.

Least Bell's Vireo Monitoring

A sub-sample of least Bell's vireos found during the course of the project was monitored according to U.S. Fish and Wildlife Protocol (1994). Monitoring included periodic nest checking by Greaves and Labinger (see Quality Control) to determine productivity. No nestlings were banded during this project. We also collected site-specific data including general habitat type, nest site vegetation (see Habitat Assessment below), and the occurrence and behavior of brown-headed cowbirds.

Habitat Assessment

An assessment of habitat parameters was conducted at all 87 point count locations. Percent cover of each habitat within a 50-meter radius around each point count was visually estimated by the observer before or after the point count was conducted. These parameters included: standing water; open ground; ruderal; forb (including grasses); emergent wetland; shrubs - willow sp. < 2m high, cottonwood sp. < 2m high, mulefat, giant reed, tamarisk, miscellaneous sp.; and trees (>2m) - willow sp., Fremont cottonwood (*Populus fremontii*), black cottonwood (*Populus balsamifera trichocarpa*), and other species as present. Parameters were estimated visually as percent coverage within a 50-meter radius around each point. Categories of vegetation recorded in the database are provided in Appendix B.

4.2. Statistical Analysis

Statistical analysis concentrated mostly on point count data. We calculated mean relative abundance[4] for each species from combined data of the observers. Relative abundance and species richness (number of species) were determined for each point. Normality of

[4] Mean relative abundance is calculated by dividing the total number of individuals of a species by the total number of point counts.

these two parameters was tested by plotting the residuals of the sums of squares. Both the means of relative abundance and species richness followed a normal distribution. To be conservative, we used the nonparametric F Test to test the relationships between points within and between different areas within the project area. (Ryan et al. 1985).

In this report we have expanded the statistical analysis to examine and compare multiple-year trends and relationships. The combined relative abundance and species richness data sets for the two years followed a normal distribution. Thus, we employed parametric tests such as regression analysis and ANOVAs (analysis of variance) to test for trend and relationship significance. For example, multiple regression analysis was employed to examine possible correlations between habitat parameters and avian point count data (relative abundance and species richness). Here some parameters were combined such as shrub and tree cover and used as one statistical parameter. In addition, for the habitat analysis, point count data were limited to birds detected within a 50-meter radius in order to be consistent with habitat data.

The scope of this study did not include exhaustive literature search of historical data for the study area. Most of this information is in private documents since all the Affected Area is private property. Much of the information that is available cannot be used for statistical comparisons due to differences in data collection methodology. However, we did cite important papers and sightings where applicable.

5. Results

5.1 General Bird Community

General Bird Surveys

General bird surveys consist of area transects, and all observations made between point counts and during nest monitoring. The locations of the general bird surveys are indicated by the lines on the maps. Other general bird surveys were conducted between locations of point count surveys. The locations of the general birds surveys are indicated by the lines on the maps (transects) and all areas surrounding the point counts. A total of 155 species were detected throughout the study area. All species detected during general surveys and point counts during the study period are listed in Table I. A total of 15 listed species and 5 locally rare species were documented during the study (species with asterisk in Table I).

Productivity data (number of nests and fledglings) for the general bird community were not collected in a consistent manner and with comparable effort, and therefore are difficult to analyze statistically. (However, more detailed productivity data are presented below for least Bell's vireo). We collected direct breeding evidence for 75 species. These included all of the sensitive listed species except for Allen's hummingbird. (See Sensitive Species Accounts below.)

Point Counts

The locations of the point counts are shown on the maps. All of the point count data are presented in Appendix D. Mean relative abundance and species richness did not vary significantly between years and therefore we were able to pool data for both years to increase sample size. Mean and total species richness and mean relative abundance for each Map section is presented in Table II. These two factors showed significant differences between areas, with the lower river area (Maps 1 and 2) having the highest abundances and species richness compared to the two middle sections (Maps 3 and 4).

The total species richness per map area shows a different pattern of variation between regions compared to mean richness. For example, the area depicted in Map 2 has the highest number of species even though mean species richness for this area is similar to Map 1 and less than Map 5. These differences are partly due to differences in survey size and effort since the number of point counts varied between regions and therefore a conservative comparison can only be made using mean richness. However, total species richness does have a biological relevance and therefore worth noting. For instance, effort was not significantly different between Maps 1 and 2 and thus, the difference in total species richness is likely due to the overall greater amount of high quality riparian habitat found within the area of Map 2. The highest relative abundance and number of species occurred in the upper reach within Soledad Canyon (Map 5) but this was not significantly different compared to the area of Map 1 ($F=1.63$, $P>0.22$).

Table I. Mean relative abundance of bird species detected per point. [5]

Pied-billed Grebe	Podilymbus podiceps	X	X				X
Double-crested Cormorant	Phalacrocorax auritus	X	X				X
Great Blue Heron	Ardea herodias	X	X	X	X		X
Great Egret	Casmerodius albus	X	0.5	X		X	0.5
Snowy Egret	Egretta thula	X	0.43	X			0.33
Cattle Egret	Bubulcus ibis	X	X	X			X
Green Heron	Butorides virescens	X	X	X	X		X
Black-crowned Night-Heron	Nycticorax nycticorax	X	0.43		X		0.38
White-faced Ibis	Zonotrichia leucophrys	X	X				X
Wood Duck	Aix sponsa	X					X
Green-winged Teal	Anas crecca		X				X
Mallard	Anas platyrhynchos	X	0.7		X	X	0.44
Blue-winged teal	Anas discors		X	X			X
Cinnamon Teal	Anas cyanoptera	X	X	X			X
Gadwall	Anas strepera	X			X		X
Redhead	Aythya americana	X					X
Ring-necked Duck	Aythya collaris		X	X	X	X	X
Bufflehead	Bucephala albeola		X	X			X
Duck sp		1					1
Common Merganser	Mergus merganser		X	X			X
Red-breasted Merganser	Mergus serrator		X				X
Ruddy Duck	Oxyura jamaicensis	X			X		X
Turkey Vulture	Cathartes aura	X	X	X	X	X	X
White-tailed Kite	Elanus leucurus	X	0.14	0.5	X		0.22
Northern Harrier*	Circus cyaneus		X				X
Sharp-shinned Hawk	Accipiter striatus		X				X
Cooper's Hawk	Accipter cooperii	X	0.22	X	0.25	0.67	0.28
Red-shouldered Hawk	Buteo lineatus	0.5	0.11	X	X	X	0.13
Red-tailed Hawk	Buteo jamaicensis	0.5	0.6	0.5	X	X	0.42
American Kestrel	Falco sparverius	X	X	X		X	X
Peregrine Falcon*	Falco peregrinus	X			X		X
Chukar	Alectoris chukar		X				X
California Quail	Callipepla californica	1.2	1.13	X	0.44	1.5	1.03
Virginia Rail	Rallus limicola		X				X
Sora	Porzana carolina		X	X			X
American Coot	Fulica americana		X	X		X	X
Wilson's Snipe	Charadrius wilsonia		X				X
Semipalmated Plover	Charadrius semipalmatus		X	X			X
Killdeer	Charadrius vociferus	2	0.9	1	X	X	0.94
Black-necked Stilt	Himantopus mexicanus		0.75	X			0.75
Greater yellowlegs	Tringa melanoleuca	X	X				X
Lesser Yellowlegs	Tringa flavipes	X					X
Spotted Sandpiper	Actitis macularia	1	0.5	X			0.57
Western Sandpiper	Calidris mauri		X				X
Least Sandpiper	Empidonax minimus		X	X			X
Long-billed Dowitcher	Limnodromus scolopaceus		X	X			X
Western Gull	Larus occidentalis	X	X	X	X		X
California Gull	Polioptila californica	X					X
Gull Sp.					X		X
Caspian Tern	Sterna caspia	X	X				X
Forster's Tern	Sterna forsteri	X					X
Least Tern*	Sterna antillarum	X					X
Black Tern	Childonias niger	1					1

[5] Mean relative abundance is calculated as the total number of individuals divided by the total number of point counts per area. (The two years of data are pooled.) Species detected during general surveys and transects (not during point counts) are noted with an "X". Species listed as Endangered, Threatened, or Sensitive, and locally rare breeding species are noted with an "*" after their names.

Common Name	Latin Name	Map1	Map 2	Map 3	Map 4	Map 5	Total
Band-tailed Pigeon	Columba fasciata					X	X
Eurasian Collared Dove	Sterna elegans				X		X
Mourning Dove	Zenaida macroura	1.33	0.5	1	0.17	X	0.64
Common Ground-dove	Columbina passerina	2	X				2
Greater Roadrunner	Geococcyx californianus	0.5	X	X	X		0.33
Barn Owl	Tyto alba	X	X		X		X
Northern Pygmy-Owl	Glaucidium gnoma					1	1
Lesser Nighthawk	Chordeiles acutipennis	X	X	X			X
Vaux's Swift	Chaetura vauxi		X				X
White-throated Swift	Aeronautes saxatalis		X		X	X	X
Black-chinned Hummingbird	Archilochus alexandri	X	X	X		X	X
Anna's Hummingbird	Calypte anna	0.33	0.69	X	0.5	0.5	0.57
Costa's Hummingbird*	Calypte costae		X		X	X	X
Allen's Hummingbird*	Selasphorus sasin	X	X	X	X		X
Hummingbird sp.		0.5	0.8	X	0.33	0.75	0.64
Belted kingfisher	Ceryle alcyon		X				X
Acorn Woodpecker	Melanerpes formicivorus		X		X	X	X
Nuttall's Woodpecker*	Picoides nuttallii	1	0.61		0.33	0.83	0.65
Downy Woodpecker	Picoides pubescens	0.75	0.45	X	1	0.8	0.59
Hairy Woodpecker	Picoides villosus	X	0.62		X	X	0.57
Northern Flicker	Colaptes auratus	0.5	0.55	1	X	0.33	0.5
Woodpecker Sp.			1				1
Parrot Sp.					X		X
Olive-sided Flycatcher*	Contopus borealis				1		1
Western Wood-Pewee	Contopus sordidulus		1		3	0.8	1.11
(Southwestern) Willow Flycatcher*	Empidonax trallii	1	0.17	X		1	0.44
Gray Flycatcher	Empidonax wrightii		X			X	X
Pacific-slope Flycatcher	Empidonax difficilis	0.8	0.72		X	0.56	0.67
Black Phoebe	Sayornis nigricans	1	0.78	X	0.4	0.4	0.68
Say's Phoebe	Sayornis saya	X	X	X	0.5		0.2
Vermilion Flycatcher	Pyrocephalus rubinus		X				X
Ash-throated Flycatcher	Myiarchus cinerascens	0.75	0.88	2	0.8	0.71	0.86
Cassin's Kingbird	Tyrannus vociferans	1	0.83	0.67	X	X	0.64
Western Kingbird	Tyrannus verticalis		X		1		0.25
Horned Lark	Eremophila alpestris		X	X	X		X
Tree Swallow	Tachycineta bicolor	1	2.36	1	X	X	1.97
Violet-green Swallow	Tachycineta thalassina		X	X		X	X
Northern Rough-winged Swallow	Stelgidopteryx serripennis	2	2.05	5	0.86	0.25	1.78
Cliff Swallow	Hirundo pyrrhonota	6.29	2.36	8	X	X	3.44
Barn Swallow	Hirundo rustica		0.8	2	X		0.86
Swallow Sp.						X	X
Western Scrub Jay	Aphelocoma coerulescens	X	1.21	X	0.29	1.11	0.97
American Crow	Corvus brachyrhynchos	X	1.33	2.5	X	0.5	1
Common Raven	Corvus corax	0.33	1.14	3	0.38	0.4	0.75
Oak Titmouse*	Parus inornatus		1.75	X	X	0.83	1
Common Bushtit	Psaltriparus minimus	1.33	2.17	X	0.4	0.25	1.52
White-breasted Nuthatch	Sitta carolinensis				X	X	X
Bewick's Wren	Thryomanes bewickii	1.36	1.51	1	1.18	1.92	1.5
House Wren	Troglodytes aedon		0.55	X	0.67	0.88	0.68
Marsh Wren	Cistothorus palustris		X				X
Ruby-crowned Kinglet	Regulus calendula	X	X	X			X
Blue-gray Gnatcatcher	Polioptila caerulea		X	X			X
Western Bluebird	Sialia mexicana		X	1	0.67	0.75	0.75
Swainson's Thrush	Catharus ustulatus	1.5	1.16			X	1.21
Hermit Thrush	Catharus guttatus	X	X	X			X
American Robin	Turdus migratorius	0.67	0.55	1	X	0.33	0.5
Wrentit	Chamaea fasciata	1.14	0.89	1.5	X	1.25	1
Northern Mockingbird	Mimus polyglottos	X	0.5	1	X	X	0.33
California Thrasher	Toxostoma redivivum	0.67	0.86	X	X	1.33	0.8
American Pipit	Anthus rubescens		X	X			X

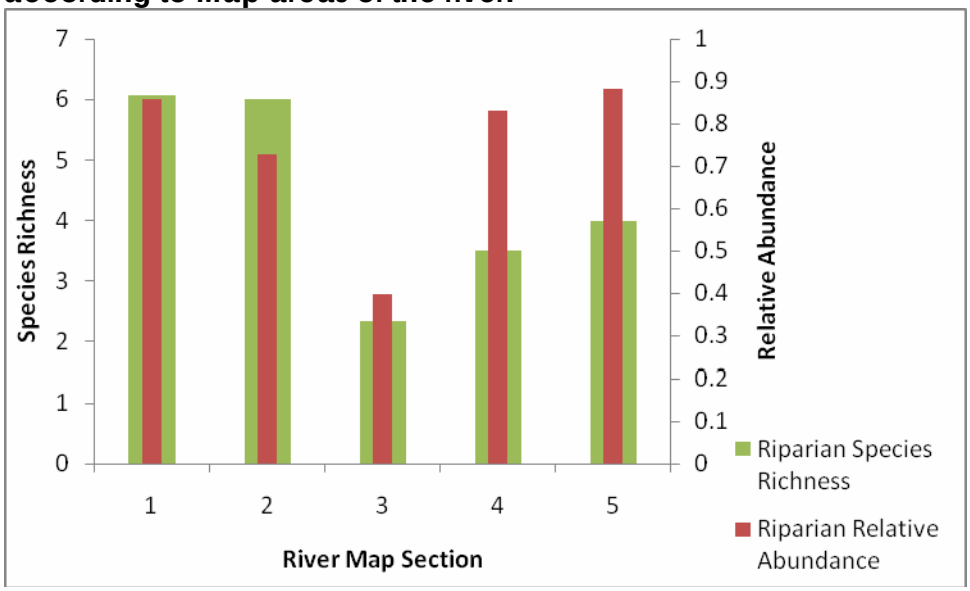
Common Name	Latin Name	Map1	Map 2	Map 3	Map 4	Map 5	Total
Cedar waxwing	Bombycilla cedrorum		X				X
Phainopepla	Phainopepla nitens		X	1	1	0.75	0.6
Loggerhead Shrike*	Lanius ludovicianus		X			X	X
European Starling	Sturnus vulgaris	X	13	X	0.2	1.33	3.43
Least Bell's Vireo*	Vireo bellii pusillus	0.65	0.78	1			0.74
Hutton's Vireo	Vireo huttoni	0.5	0.5	X		X	0.5
Warbling Vireo	Vireo gilvus	0.5	0.69	X	1	0.6	0.67
Cassin's Vireo	Tyrannus vociferans		X			X	X
Orange-crowned Warbler	Vermivora celata	X	0.7		X	1	0.67
Nashville Warbler	Vermivora ruficapilla		X			X	X
Yellow Warbler*	Dendroica petechia	2.27	1.6		0.67	0.67	1.63
Yellow-rumped Warbler	Dendroica coronata	X	X	X		X	X
Black-throated Gray Warbler	Dendroica nigrescens	X	X			X	X
MacGillivray's Warbler	Oporornis tolmiei					X	X
Common Yellowthroat	Geothlypis trichas	1.81	2	1	0.25	0.67	1.75
Hooded Warbler	Wilsonia citrina		X				X
Wilson's Warbler	Wilsonia pusilla	X	X			X	X
Yellow-breasted Chat	Icteria virens	1.55	1.29		X	X	1.33
Summer Tanager*	Piranga rubra					0.33	0.25
Western Tanager	Piranga ludoviciana	X	X	X		1	1
Black-headed Grosbeak	Pheucticus melanocephalus	1	1.5	2	1	0.5	1.26
Blue Grosbeak	Guiraca caerulea	X	0.92	2	X	X	0.72
Lazuli Bunting	Passerina amoena	2	0.8	1		X	1.13
Spotted Towhee	Pipilo erthrophthalmus	1.13	1.57	1	0.71	1.18	1.34
California Towhee	Pipilo crissalis	1	1.09	1	0.2	0.67	0.92
Rufous-crowned Sparrow	Aimophila ruficeps		X		X		X
Chipping Sparrow	Spizella passerina		0.57			X	0.57
Lark Sparrow	Chondestes grammacus		X		X		X
Savannah Sparrow	Passerculus sandwichensis	X	X				X
Song Sparrow	Melospiza melodia	2.33	2	1	1.29	1.36	1.83
Lincoln's Sparrow	Melospiza lincolnii	X	X	X			X
White-crowned Sparrow	Zonotrichia leucophrys	X	X				X
Dark-eyed Junco	Junco hyemalis	0.5	1			X	0.67
Western Meadowlark	Sternella neglecta		X	X		X	X
Yellow-headed blackbird	Icteria virens		X				X
Red-winged Blackbird	Agelaius phoeniceus	7.5	2.46	0.5	X	X	2.09
Brewer's Blackbird	Euphagus cyanocephalus	X	3.25	2		X	2.5
Great-tailed Grackle	Quiscalus mexicanus	X	0.33		X	X	0.2
Brown-headed Cowbird	Molothrus ater	X	0.6	0.5	X	1	0.6
Hooded Oriole	Icterus cucullatus	X	0.33	1	X	1	0.6
Bullock's Oriole	Icterus bullockii	0.33	X	0.5	0.67	0.75	0.48
Oriole Sp.			X	1			0.5
Purple Finch	Carpodacus purpureus	2.5	0.94		X	X	1.09
House Finch	Carpodacus mexicanus	1.11	1.73	1	1.64	1	1.45
Lesser Goldfinch	Carduelis psaltria	0.93	1.69	X	0.38	1	1.28
Lawrence's Goldfinch*	Carduelis lawrencei	X	X	X	X	1	0.33
American Goldfinch	Carduelis tristis	1	1.06	1		1	1.04
House Sparrow	Passer domesticus		X	X	X	1.67	0.63

Table II. Mean relative abundance and species richness calculated from 50m-radius point counts according to Map areas 1-5.[6]

	Map1	Map 2	Map 3	Map 4	Map 5
Mean Relative Abundance	14.13	12.67	6.67	12.17	14.64
Mean Species Richness	9.33	9.23	5.67	8.67	10.55
Total Species Richness	105	145	90	83	90

We examined the distribution of riparian obligate species to determine areas of high diversity. We included in our calculations 23 species: American Goldfinch, American Robin, Black Phoebe, Black-headed Grosbeak, Common Yellowthroat, Downy Woodpecker, Hairy Woodpecker, Hutton's Vireo, Lazuli Bunting, Least Bell's Vireo, Lesser Goldfinch, Pacific-slope Flycatcher, Purple Finch, Red-winged Blackbird, Spotted Towhee, Summer Tanager, Swainson's Thrush, Tree Swallow, Violet-green Swallow, Willow Flycatcher, Wilson's Warbler, Yellow Warbler and Yellow-breasted Chat. Mean relative abundance and species richness were calculated for all species combined for each point and year. As with the overall bird community, riparian species were significantly more diverse along the lower SCR (Maps 1 and 2) (Figure II). The lowest diversity was found in the area of Map 3 which, as mentioned above, supports limited riparian habitat. Along the upper SCR relative abundance of riparian obligate species was not significantly different from that of the lower river reflecting a higher density of fewer species.

Figure II. Mean relative abundance and species richness of 23 riparian obligate species according to Map areas of the river.

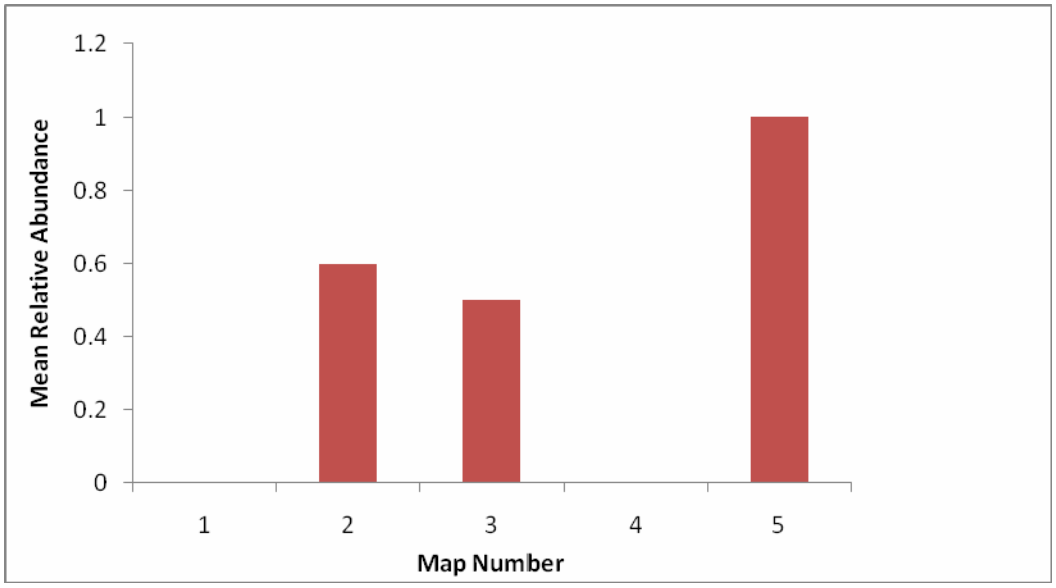


[6] Total species richness is the total number of species recorded within that area from all observations and not limited to point counts.

Brown-headed cowbirds are brood parasites that can have a significant impact on southwestern riparian bird communities. The species is apparently native to California only on the eastern side of the Sierra Nevada in pre-historic times. Since then, the species has extended its range by following agriculture and other human activities, now breeding through most of California (Grinnell and Miller 1944, McCaskie et al. 1979, Rothstein et al. 1980, Garrett and Dunn 1981). Therefore, we also analyzed cowbird relative abundance and distribution separately. Cowbird trapping efforts were conducted in Areas x,y, and z. Figure III shows the relationship between cowbird numbers and location for this study period. The data show a significant difference in cowbird numbers among locations. Map areas 1 and 4 had no cowbirds detected within point counts although it should be noted that cowbirds were observed in those areas during general area surveys. The highest number of cowbirds was found in the upper watershed within Soledad Canyon where no cowbird trapping is being conducted (see Discussion).

Cowbird parasitism was observed in the nests of five least Bell's vireos, one Pacific-slope flycatcher and a hooded oriole. All of these occurred within the lower SCR (Maps 1 and 2).

Figure III. The relationship between the mean relative abundance of brown-headed cowbirds and location (Map segment) during the study period.



We also looked at population trends in the overall bird community by comparing our 2005-6 study to the damage assessment study conducted between 1994 and 1997 and then continued as part of the restoration process through 1999. Given the differences between the methods, we limited the comparison to the lower SCR where Map 1 can be compared to Reference Site I and Map 2 can be compared to Reference Site II. Also, as the past study analyzed point count data using the means of total abundance and richness and not limited to 50m radius, the data from the current study were also converted to this calculation.

An analysis of these data shows an overall trend of decreasing mean relative abundance for all species, over the 12 year period. (Figure IV, Regression, y = -1.04x +

33.40, P>0.12, R-squared adj=0.24) and species richness (Figure IV, Regression, y = -1.47x + 29.29, P>0.06, R-squared adj.=0.39). There are, however, significant differences between sites for relative abundance trends where the area of Map 2 fluctuates greatly with a high peak occurring in 1998 (regression F=4.71, P>0.07).

This analysis does not show any significant changes in overall bird communities between 1999 and the present surveys of 2005-6 when comparing the two periods (although this is not statistically significant as the sample sizes are small). This is especially interesting in terms of the possible effects of the 2003 fire that burnt much of the lower reaches of the south bank in area Map 1 and only the southwest side of area Map 2. Much of these areas had healthy early successional riparian woodland by 2005 and was able to support a wide variety of birds except those that require mature forests such as Pacific-slope flycatcher and Swainson's thrush.

Figure IV. Mean relative abundance for Map Areas 1 and 2 for the damage assessment year (1994-1999) and the present study (2005-2006).

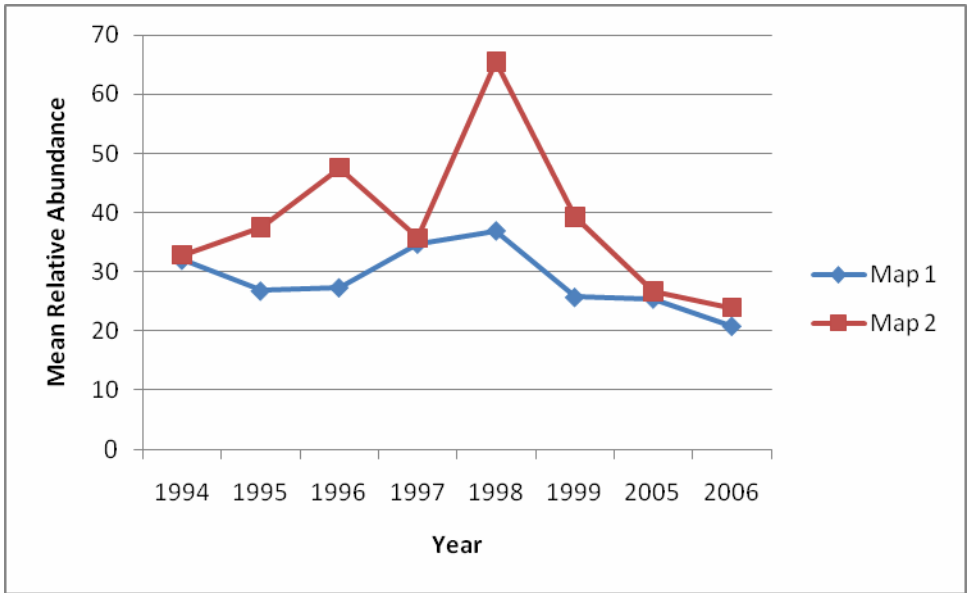
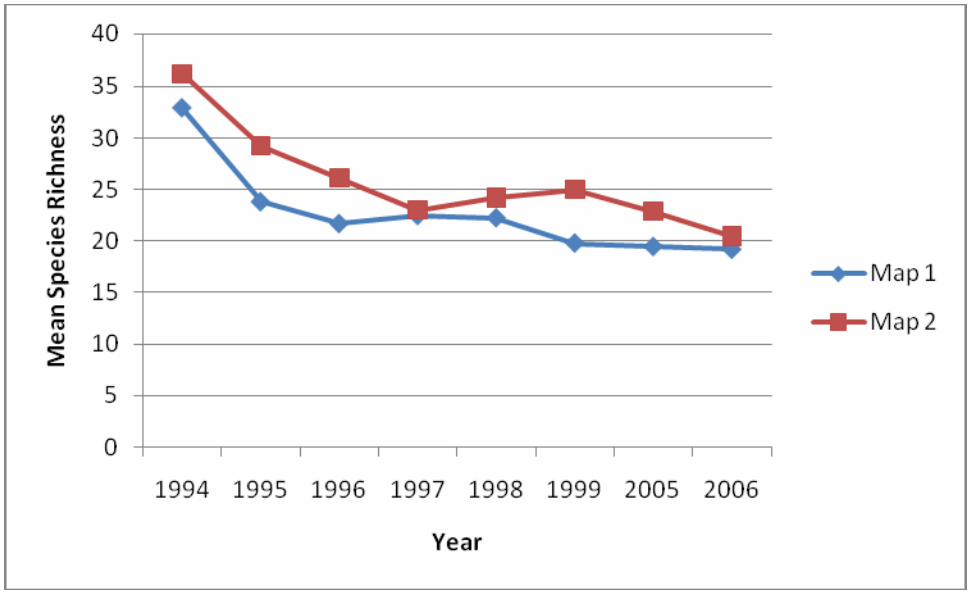


Figure V. Mean species richness for Map Areas 1 and 2 for the damage assessment year (1994-1999) and the present study (2005-2006).



5.2 Endangered and Sensitive Species

Fourteen species observed within this study are found on Federal and/or State lists (Table III). In addition to these listed species, we also encountered species that we consider to be locally rare or of local concern. In the following sections we present a general overview of the status of these species and results of this study.

Table III. Sensitive Species Observed during the study period 2005-2006.

Common Name	Genus	Species	Subspecies	Federal Status	State Status
Allen's Hummingbird	*Selasphorus*	*Sasin*		BCC	None
American Peregrine Falcon	*Falco*	*peregrinus*	Anatum	Recovered	SE, FP
California Least Tern	*Sterna*	*Antillarum*	Browni	FE	SE, FP
Costa's Hummingbird	*Calypte*	*Costae*		BCC	None
Lawrence's Goldfinch	*Carduelis*	*lawrencei*		BCC	None
Least Bell's Vireo	*Vireo*	*Bellii*	Pusillus	FE	SE
Northern Harrier	*Circus*	*Cyaneus*		None	SCC
Nuttall's Woodpecker	*Picoides*	*Nuttalli*		BCC	None
Oak Titmouse	*Baeolophus*	*Inoratus*		BCC	None
Olive-sided Flycatcher	*Contopus*	*Cooperi*		None	SSC
Southwestern Willow Flycatcher	*Empidonax*	*Traillii*	Extimus	FE	SE
Summer Tanager	*Piranga*	*Rubra*		None	SSC
Tricolored Blackbird	*Agelaius*	*Tricolor*		BCC	SSC
Yellow Warbler	*Dendroica*	*Petechia*	brewsteri	BCC	SSC
Yellow-breasted Chat	*Icteria*	*Virens*		None	SSC

Status
Federal Endangered
Federal Bird of Conservation Concern
State Endangered
State Threatened
State Species of Special Concern
State Fully Protected

SOURCES:

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia.

California Department of Fish and Game 2009. State and Federally Listed Endangered and Threatened Animals of California October 2009. State of California The Natural Resources Agency Department of Fish and Game Biogeographic Data Branch California Natural Diversity Database.

California Department of Fish and Game 2009. Special Animals (883 Taxa) July 2009. State of California The Natural Resources Agency Department of Fish and Game Biogeographic Data Branch California Natural Diversity Database.

5.2.1 Sensitive Species

Great Blue Heron (*Ardea herodias*)
Great blue herons are listed on the California Natural Diversity Data Base as a species that warrants monitoring and their rookery sites are listed under the California Species of Special Concern. Along the central and south coast, breeding sites of this species are increasingly uncommon (Garrett and Dunn 1981, Lehman 1994). They require marsh, riparian and grassland for foraging and mature, tall trees for nesting.

Great blue herons were found in low numbers throughout the study area. This species is most common on the lower Santa Clara River within the segments of Maps 1 and 2, although each year both adults and juveniles were observed upstream to Santa Clarita, Los Angeles County. Many water birds are drawn to the United Water Conservation District recharge ponds that are located on the south side of the river within Map I. No nests were located but juvenile birds were found annually (one nest found in 1997 near UWCD).

Great Egret (*Casmerodius albus*)
Great egrets are listed on the California Natural Diversity Data Base as a species that warrants monitoring and rookery sites are listed under the California Species of Special Concern. Breeding sites are increasingly uncommon throughout much of southern California (Garrett and Dunn 1981). Great egrets require marsh, riparian, grassland or agricultural fields for foraging and mature, tall trees for nesting.

Great Egrets were amongst the rarest species of heron with only two individuals found only in 2005, both within Map 2, one at the Sespe Confluence and the other downstream near Santa Paula. In 1994, one juvenile was observed within Reference Site I and none there after.

White-tailed Kite (*Elanus leucurus*)
Although white-tailed kites are no longer a California Species of Special Concern, they are uncommon within the Santa Clara River watershed. Kites forage over open habitats such as marsh, grassland and savannah, and nest in trees in riparian and oak woodland. Their diet is composed primarily of small mammals.

At least two pairs of kites were found during the study: one within Map 2 between Hedrick Ranch Nature Area and the Sespe confluence; and the other between Piru Creek and the LA County line. Juveniles were also observed during both study years. During the past study (damage assessment) pairs ranged from two (1994) to six (1999). Although juveniles were observed at all these locations, nesting was documented only at:

1. Map 1 –north side of the river approximately 500m upstream of the Freeman Diversion.
2. Map 2 –south side of river at the old duck ponds.
3. Fillmore East –north side of the river, approximately 500m west of the Fish Hatchery.
4. West end of LA County - in 1998, pair fledged six juveniles.
5. Near I-5 at Magic Mountain area

Northern Harrier (*Circus cyaneus*)
The northern harrier is a California Species of Special Concern for its breeding population. Populations have declined in parts of its California range mostly due to loss of grassland and marsh habitats. Along the southern coast the species' range is highly fragmented, and many local populations have been extirpated. Irregular nesting has been documented in past year along the Santa Clara River near Santa Paula (W. Wehtje in CDFG SSC status report 2009).

One individual (probably female) was observed once in June of 2005 east of Santa Paula. Given that only one observation was recorded we assume this species did not breed within the river bottom during the study.

Peregrine Falcon (*Falco peregrinus*)
The American peregrine falcon (*F. p. anatum*) is a state listed endangered species (recovered federally). They are resident throughout the western North America nesting along coastlines, mountains, and near riparian habitat. Migrants and wintering birds boost local resident southern California populations. The species was formally much more common as a breeding species in southern California (Garrett and Dunn 1981). A reintroduction project started in the 1970s has assisted with the slow recovery of this species (Jurek 1989).

A pair of peregrine falcons bred on the cliffs of South Mountain (Map 1) during 2006. The birds were observed carrying prey to the nest cavity on several occasions. We were not able to determine the number of nestlings or if fledging was successful.

California Least Tern (*Sterna antillarum browni*)
The California least tern is a state and federally listed Endangered Species. They are migratory and breed along the west coast from the San Francisco Bay Area down to Baja California. Least terns usually breed in colonies in open areas near or on the beach, and forage for fish along the coast and inland freshwater lakes and rivers, typically estuaries. In Ventura County the two main breeding colonies are at Point Mugu and the Santa Clara River mouth.

We observed only one least tern within the study area near the United Water Conservation District (UWCD) ponds during this study (Map 1). In the past, foraging individual least terns were observed regularly in this area since they usually nest at the river mouth. In 1995, several adults and, later, juveniles were observed on the river opposite the United Water Conservation District recharge ponds. A juvenile least tern was observed being fed by an adult on the bank of one of the recharge ponds, on 20 July 1995. This was the second year of scouring flood events, when high river flows extended into June, and recharge basins were completely full. Breeding was documented in June of 1998 when a nest with two eggs, and possibly a second nest, was found at the UWCD recharge ponds (Wehtje pers. comm.). The area was checked two weeks later and no terns were found, which probably indicates failure.

Lesser Nighthawk (Chordeiles acutipennis)
The lesser nighthawk is not included under any state or federal listing. They are a locally rare species within Ventura County and considered uncommon throughout coastal southern California (Garrett and Dunn 1981, Small 1994). They are summer residents usually breeding on the ground in open dry terrain such as deserts and dry washes.

Lesser nighthawks were observed at two locations within the Santa Clara River where they have been documented regularly in the past. Although no nests or juvenile birds were observed during this study, nesting has been documented in 1994 and 1996 within the lower river area (Map 1) between the Freeman Diversion and Ellsworth Barranca. In both years each nest had two chicks, but fledging could not be confirmed. Nighthawks were observed here again in 1998, and west of Highway 118 in 1999, but no nests were found. The second location is at the Sespe Creek confluence approximately 300 meters south of Highway 126 where a nest with two eggs was found in June of 1999. All three nests were found within the open river bottom in areas of gravel and cobble with sparse vegetation. As with other open ground nesters, such nest sites are highly vulnerable to human recreation: ORVs, dirt bikes, hiking, dogs etc.

Allen's Hummingbird (*Selasphorus sasin*)
This species is listed as a Federal Bird of Conservation Concern. Allen's hummingbirds have one of the smallest breeding ranges of all U.S. hummingbirds (Audubon Watchlist 2010). They breed in a narrow strip along the Pacific coast from southwest Oregon to southern California. In southern California they are restricted to moist, well forested areas, especially riparian forests.

Allen's were found in small numbers along the lower SCR including the areas of Maps 1, 2 and 3 up to Piru. Densities were not great enough to calculate relative abundances so it is difficult to compare areas. No nests were found during this study but nesting has been documented in the past.

Costa's Hummingbird (*Calyptae coste*)
This species is listed as a Federal Bird of Conservation Concern. It occurs mainly in southern California, Arizona, Baja California, and western Mexico, but also extends into Nevada, extreme southeastern Utah, and southeastern New Mexico. Their range is expanding into new and historically occupied areas in parts of Arizona and California (Audubon Watchlist 2010).

Although this species is common in the coastal scrub surrounding much of the river, they are very uncommon within the river bottom. No individuals were detected during point counts, but birds were noted along the edge habitats between sections of Maps 1 through 3.

Nuttall's Woodpecker (*Picoides nuttalli*)
This species is listed as a Federal Bird of Conservation Concern. A permanent resident of oak woodlands, the Nuttall's Woodpecker's range barely extends outside of California. Its limited range, low density, and close association with oak woodlands and riparian zones make it vulnerable to development that encroaches on its habitat. Much of this species' biology has received only superficial or incidental attention (Audubon Watchlist 2010).

Nuttall's are common in appropriate habitat within the SCR. They were detected within all areas except for the middle river (Map 3). They were most abundant along the lower river (Map 1) with relative abundance 1.00, and least abundant near Santa Clarita area with relative abundance 0.33 on Map 4. The 2003 fire did not seem to have an adverse effect on this species and may even have been beneficial since there were many dead trees to forage and nest in.

Olive-sided Flycatcher (*Contopus borealis*)
This species is listed as a California Species of Special Concern. It is found mostly in coniferous forests. They perform one of the longest migrations of the Nearctic migrants, and are typically known as "late arrivals" appearing in the SCR watershed in the spring and as "early migrants" in the fall. Although their breeding range is quite expansive, their low density and significant population declines over the past 30 years have caused them to be listed as a Sensitive Species or Species of Concern by several state and federal agencies and conservation groups. Breeding Bird Survey (BBS) trend analyses show a significant range-wide population decline of 3.3% per year from 1966-2001. BBS data also show the highest abundances of Olive-sided Flycatchers are in western North America where the declines are steepest (Audubon Watchlist 2010).

This species was only found in Soledad Canyon along the upper reaches of the SCR (Map 5). At least one territorial male was heard singing on repeated visits during both years. This area represents the south western and low elevational limit of this species in North America.

Say's Phoebe (*Sayornis saya*)
Say's phoebes are not listed by state or federal agencies, but are considered rare breeders in Santa Barbara and Ventura Counties (Lehman 1994). They are fairly common along the south coast during the winter and as migrants. Say's phoebes are usually found in open country such as grassland, coastal sage scrub, agricultural areas and semi deserts.

Say's phoebes were observed at three locations: below Freeman Diversion (Map 1), at Sespe confluence (Map 2), and at the confluence of Bouquet Canyon and the SCR (Map 4). Breeding was confirmed at the latter location. In the past, Say's phoebes were only observed in one location within the study area: Reference Site I, at the end of Briggs Road along both sides of the river. Breeding was documented there in early June 1994 when a family group of four newly fledged birds was observed.

Horned Lark (*Eremophila alpestris)*
Horned Larks were formerly a California Species of Special Concern and are now considered locally rare (Lehman 1994). They are resident throughout California in areas of large open grassland and agricultural fields. Although large flocks can be seen during the winter, breeding appears to be uncommon in this area (Garrett and Dunn 1981).

Horned larks were rare, but observed annually during this study. In both years, they were observed at the lower river area near UWCD (Map 1) and at the Piru confluence where a flock of 15 adults and at least 10 juveniles was observed in 2006 (Map 3). In the past, they have also been observed along the agricultural fields near Castaic Junction (Map 4) and east of Santa Paula (Map 2).

Oak Titmouse (*Baeolophus inoratus*)
This species is listed as a Federal Bird of Conservation Concern. It is a resident species found from southwest Oregon through California to northwestern Baja California, Mexico, where it breeds at low to middle elevations. Though the bird clearly prefers open oak and pine-oak woodlands, populations also rely on riparian forests in arid areas such as southern California. Breeding Bird Survey (BBS) data show the Oak Titmouse and Juniper Titmouse declining 1.9% per year throughout California from 1980

through 1996. The Oak Titmouse experienced a 1.6% annual decline in the California foothills from 1966 through 1996 (Audubon Watchlist 2010).

This species was common in appropriate habitat with large mature trees, especially where oaks are present. Thus, they were detected from Santa Paula upstream to Soledad Canyon (Maps 2-5). They were very common along the Santa Clara River between Santa Paula and Sespe Creek, with relative abundance of 1.75 individuals per 50m radius point. They were least common through the middle river areas where populations were too small to be detected within the point count area. Their relative abundance was 50% less within Soledad Canyon than on the lower Santa Clara River (1.75 versus 0.83, respectively).

Loggerhead Shrike (*Lanius ludovicianus*)

The Loggerhead Shrike is a California Species of Special Concern. They are resident along the central and south coast, where numbers increase in the winter. Further inland, shrikes are locally common in open areas of grassland and scrub and are uncommon breeders along the mountains and coastal plain (Garrett and Dunn 1981, Lehman 1994).

The loggerhead shrike is rare within the study area. During this study, shrikes were only observed east of Santa Paula (Map 2) and in Soledad Canyon (Map 5) in typical dry scrub habitat. In the past, they have been observed more regularly along the lower SCR near Ellsworth Barranca (Map 1), and the only breeding record is from this area where a pair nested and fledged five chicks in 1994. The rarity of this species along the river is difficult to explain given that they are locally common breeders along the adjacent mountain ranges (Labinger, unpublished data).

Yellow Warbler (*Dendroica petechia*)

The yellow warbler is a California Species of Special Concern. This Neotropical migrant is fairly common locally in southern California in mature riparian woodlands. Numbers have been decreasing steadily throughout California, especially in northern California (CDFG 2010). This bird nests in the upper canopy of riparian trees, commonly willows.

Yellow warblers were found throughout the study area in appropriate habitat, but are significantly more common along the lower reaches of the river where relative abundance averages four times greater than at the upper reaches (2.27 Map 1 compared to 0.67 Map 5, Table l). Even within the lower river they are significantly more common within area of Map 1 compared to Map 2 (1.6 relative abundance). This general relationship held true also for the past studies. The low density of populations occurring along the upper portions of the study area is unexpected, given the extent of seemingly suitable habitat along some of these areas. Yellow warblers appear to be highly susceptible to cowbird parasitism, which may partly explain their low numbers here where cowbird trapping is limited. We have observed eight instances of yellow warblers feeding cowbird fledglings over the past decade.

Yellow-breasted Chat (*Icteria virens*)
The yellow-breasted chat is a California Species of Special Concern. This Neotropical migrant is locally common to rare in riparian woodlands of southern California. Numbers have been decreasing steadily throughout California, especially in southern California (Garrett and Dunn 1981). It nests in low, thick riparian vegetation including willows, blackberry, and other plants that form dense thickets and tangles.

Yellow-breasted chats are patchily distributed over appropriate habitat within the study area. They are slightly more common within the lower SCR where relative abundances are 1.55 (Map 1) and 1.29 (Map 2). In survey areas of within Maps 3 and 4, few birds were detected and none were within the 50m radius of the point counts (Table I). They, too, may be adversely affected by cowbirds, although actual documentation of parasitism is much less than for other species (i.e. yellow warbler, least Bell's vireo); a pair was observed feeding a fledgling cowbird at Reference Site I (Map 1) in 1996.

Summer Tanager (*Pirangra rubra*)
The Summer Tanager is listed as a California Species of Special Concern. This long-distance migrant is considered a bee and wasp specialist both in the breeding and wintering grounds. They range across the southern United States but have an extremely limited range in California where they are found patchily along southern lowland riparian.

Summer Tanagers were found only in Soledad Canyon. At least one pair was present in both years of the survey. In 2005, we documented breeding where a nest was found in a large cottonwood tree.

Chipping Sparrow (*Spizella passerina*)
This species is not listed but is a locally rare resident. In California, chipping sparrows are found most commonly in mountainous and forested areas with open, grassy ground for foraging, although small resident populations inhabit forested habitat along the south coast (Small 1994).

Chipping sparrows were detected rarely during this study with at least one pair at Sespe Confluence and one pair just east of Santa Paula (Map 2). Both of these areas are adjacent to orchards, which they seem to prefer in this region. In 1999, a pair bred in an orange tree adjacent to riparian habitat near the Fillmore Fish Hatchery. This species is a known cowbird host and populations may be suffering from parasitism.

Lawrence's Goldfinch (*Carduelis lawrencei)*
This species is listed as a Federal Bird of Conservation Concern. The breeding range of the species is confined to the Central Valley and coastal foothills of California, as well as the northern portion of Baja California. The distribution of the population within this range often varies widely from year to year; indeed, in some years the species seems to be virtually absent from its breeding range altogether, without appearing elsewhere. Movements between breeding and wintering grounds are also erratic and complex. The winter range includes southern Arizona, southwestern New Mexico, and northern Mexico. Because of these erratic movements, it is difficult to estimate precisely the densities, dynamics, and total population size. Breeding Bird Survey data between 1966 and 1993 show a downward but inconclusive trend in overall population size (Audubon Watchlist 2010).

Within the Santa Clara River bottom, this species is uncommon to rare and varies from year to year. During this study, Lawrence's goldfinches were observed at least once within each of the five segments, but only within the Soledad Canyon area were numbers large enough to be detected within the restricted 50m radius point counts. Here, their relative abundance was 1.00 birds per point. Breeding evidence was also observed here.

5.2.2 Endangered Species

Two endangered riparian species were found during this study: southwestern willow flycatcher and least Bell's vireo. The locations of all territories of these species are presented in Maps 1-5. Observations and monitoring accounts are as follows.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)
Southwestern willow flycatchers were found throughout the study period in several locations. However, the majority of these sightings were in late May and early June when willow flycatchers of several races are migrating in concentrated numbers. Singing birds were observed at United Water near Highway 118 (Map 1), Hedrick Ranch Nature Area (HRNA) (Map 2), west of the Fillmore Fish Hatchery (Map 2), and at Soledad Canyon (Map 5).

Breeding willow flycatchers were documented only at the Fillmore Fish Hatchery (FFH) in 2006 (J. Gallo, pers. comm.). This territory was more than a kilometer from a pair that nested next to the hatchery in 2000. In August 2006, Greaves accompanied Gallo to the site, and found freshly fledged juveniles from a later nest. In both 2005 and 2006, Gallo found a pair nesting in woods near the Fish Hatchery [Gallo 2006, 2007]. Elsewhere, only single bird or single-date sightings were made by Greaves (1 bird on 14 June 2005 at FFH and 1 bird on 12 July 2005 at HRNA; 1-2 birds at Hallock Drive 23 May 2006).

Least Bell's Vireo (*Vireo bellii pusillus*)
Least Bell's vireos were the most common endangered bird species found during this study. Annual population and productivity parameters for all vireo sites are presented in Table IV. Least Bell's Vireos were found in most of the places they had been encountered in past studies (Labinger and Greaves 2001). However, there were a few locations within segments of the river in which they were either almost absent (i.e., north side of the river, downstream of and at confluence of Ellsworth Barranca, Saticoy; Map 1) or in lower numbers than expected (i.e., south side of the river, between Vern Freeman Diversion Dam and Highway 118, near Saticoy (Map 1). Locations for most of these territories are marked on the Maps 1-5. The table also includes data from other vireo surveying projects but these are not shown on the Maps (downstream of Highway 118 and the Fillmore Fish Hatchery).

As with past studies, the largest and densest population of vireos occurred along the lower river section of Map 1. The main breeding area includes riparian woodland from Ellsworth Barranca up to approximately 2 kilometers upstream of the Vern Freeman Diversion near the abandoned S.P. Milling quarry. Annual trends appeared to vary significantly between subpopulations where the subpopulation within the lower reach of Map 1 increased steadily up to 2000 and then showed a sharp decline in 2005 and a further decline in 2006 (Figure VI). Although these changes may be partly due to decreased monitoring effort in the present study, it would not be expected to vary

between sites. The sub-population located upstream (Map 2-west) appears to follow a normal fluctuating population trend found in populations of other small passerines. These results may indicate a fire impact (see Discussion).

Only six vireo nests were found to be parasitized by brown-headed cowbirds, four in 2005 and two in 2006. The two nests parasitized in 2006 were found in a new location for least Bell's vireo along the south side of the river, downstream of Hwy 118, across from Petit Drive. One nest was placed in an *Atriplex* shrub in the middle of a heavily-traveled access trail to the river's edge. Photographs are provided in Appendix A. A third pair nested a few hundred meters upstream, and successfully raised its four-egg brood from a relatively conspicuous nest within sight of an active Cooper's Hawk nest in which Cooper's Hawks young were raised. It was not determined if this least Bell's vireo pair nested again, but it had adequate time to do so.

This rate of cowbird parasitism was not significantly different in the 2005-06 study than brood parasitism that was observed in the late 1990s although, in 1998, there were 14 nests parasitized. However, given that we did not intensively monitor nests, it is likely that some cases of parasitism went unrecorded.

Least Bell's vireos appeared to be highly selective in their choice of territory and nesting substrate. Nesting territories were generally found in well vegetated early to mid-successional riparian habitat. Territories typically included a diversity of vegetative structure with particularly large differences in vegetation height including overstory and understory components. However, vegetation structure at the actual nest site was much less variable in terms of height and amount of shade, despite different compositions of plant species. Nest sites were frequently located near open ecotonal areas such as active and historic water channels, trails, and the outer riparian edges. Non-native species found within territories included *Arundo*, tamarisk, orange and quince.

Figure VI. The number of singing male least Bell's vireos detected annually within the lower Santa Clara River. (Map 1 breeding area includes from Highway 118 up to west Santa Paula; Map 2 includes only the western section from Santa Paula to just below the Sespe Confluence.)

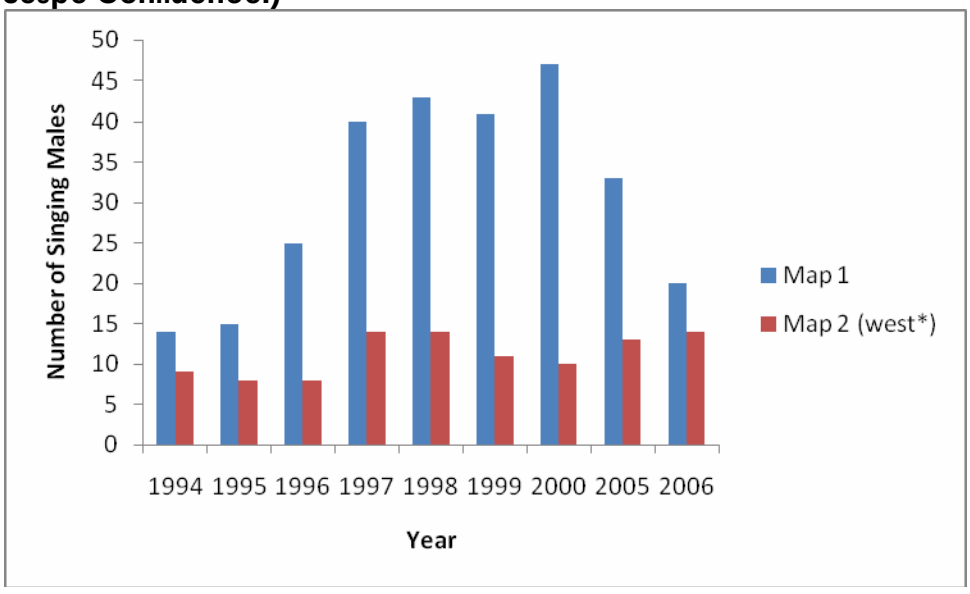


Table IV. Least Bell's vireo presence and productivity on the Santa Clara River according to location, map segment and year.

Map Segment			1	2	2	4	5	
Location	Ocean-101**	101-118**	118-Santa Paula	Santa Paula-Sespe	Sespe -East Fillmore	I-5 - Bouquet Canyon	Sand –Soledad Canyon	Total
2005								
Males	1	Not Surveyed	33	13	6 [* 37]	0	0	53 (84*)
Pairs	0	unk	20	9	3	0	0	32
Nests	0	unk	26	10	3	0	0	39
Nest success	0	unk	21	8	3	0	0	32
LBV eggs known	0	unk	62	21	8	0	0	91
Young	0	unk	47	18	8	0	0	73
Cowbirds present	0	unk	yes	yes	yes	yes	yes	0
No. Cowbird traps	0	unk	3	2	2	unk	0	7
Parasitized nest	0	unk	3	0	1	0	0	4
Cowbirds raised	0	unk	0	0	1	0	0	1
2006								
Males	Not Surveyed	5	20	14	28	0	0	67
Pairs detected	unk	3	11	11	11	0	0	36
Nests detected	unk	6	10	10	12	0	0	38
Nests success	unk	3	10	8	11	0	0	29
LBV eggs known	unk	17	26	27	0	0	0	70
Young	unk	7 [2 nests]	25	21	20	0	0	66
Cowbirds present	unk	yes	0	yes	yes	yes	yes	0
No. Cowbird traps	unk	0	3	2	2	0	0	7
Parasitized nest	unk	2	0	0	0	0	0	2
Cowbirds raised	unk	1	0	0	0	0	0	1

* 37 total males reported by John Gallo

** Reported by J. Greaves from different projects

5.3 Habitat Relationships

A wide variety of riparian habitats were found during this study. Overall, the Santa Clara River is composed primarily of an active channel that is open and sparsely vegetated even in years without scouring flood events. Given the focus of this study on riparian forested habitats, we concentrated our efforts on a relatively higher proportion of vegetated areas compared to the river as a whole.

Habitat quantity and quality did not vary much during the two years of this study, however significant differences occurred between locations. Human impacts (i.e. flood control, agriculture and development), hydrology and fire regimes (2003) were likely the most important factors determining habitat variation. Habitat types, trends, and relationships to birds are discussed below.

Habitat Relationships to Birds

Habitat types within the study area in 2005 and 2006 are divided into two main types following Holland (1986). A list of habitats recorded at the point count locations are provided in Appendix B. Habitat mapping is beyond the scope of this study. However, habitat maps are available from previous work efforts including Gevirtz, Jackson and Martins (2006) and others. Native habitats in the study area in 2005 and 2006 included:

> A –active channel, mulefat scrub, southern willow scrub, and southern willow riparian woodland.
>
> B –southern cottonwood willow riparian forest, alluvial scrub (dominant- *Atriplex lentiformis*), big sagebrush scrub (*Artemisia tridentata*), valley freshwater marsh, coastal sage scrub, and coast live oak.

These types were then categorized as common or uncommon within each section of the river:

	Map 1	Map 2	Map 3	Map 4	Map 5
Common	A	A	A	B	B
Uncommon	B	B	B	A	A

In addition, disturbed habitats existed throughout the study area and included: *Arundo* (most common), tamarisk, castor bean (*Ricinus communis*), tree tobacco (*Nicotiana glauca*), and black mustard (*Brassica nigra*).

In order to examine the relationships between birds and habitats, we used multiple regression analysis to examine each of the habitat parameters (and combinations) in relation to mean relative abundance and species richness. To do this we used a combination of different sub- parameters, such as riparian obligate bird species and a measure of habitat richness based on the presence of three main characters (open, shrub and tree). Several important results were found. The analysis showed a positive relationship between willow cover (trees and shrubs) and relative abundance as well as

species richness (Figure VII). Areas with a higher presence of willows, tended to support more species and greater abundance for each species present. Meanwhile, the presence of *Arundo* had a negative effect on bird abundance and richness as shown in Figure VIII.

Figure VII. The relationship between mean relative abundance and species richness per point and (limited to 50m radius) and total Willow percent cover (Riparian Species Richness and Willow Cover y = 0.0419x + 4.1656, R^2 = 0.1818, Riparian Bird Abundance and Willow Cover y = 0.0037x + 0.6471, R^2 = 0.1416).

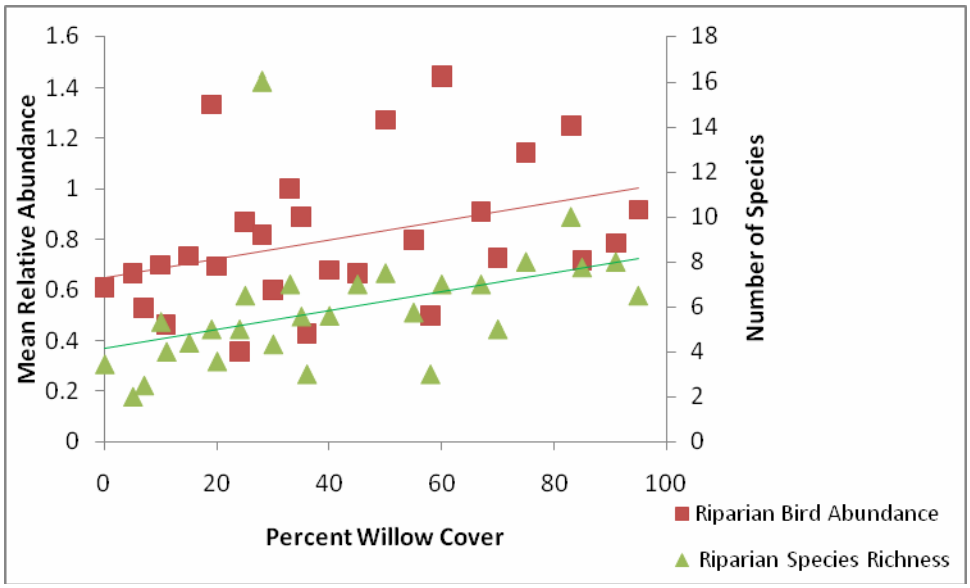
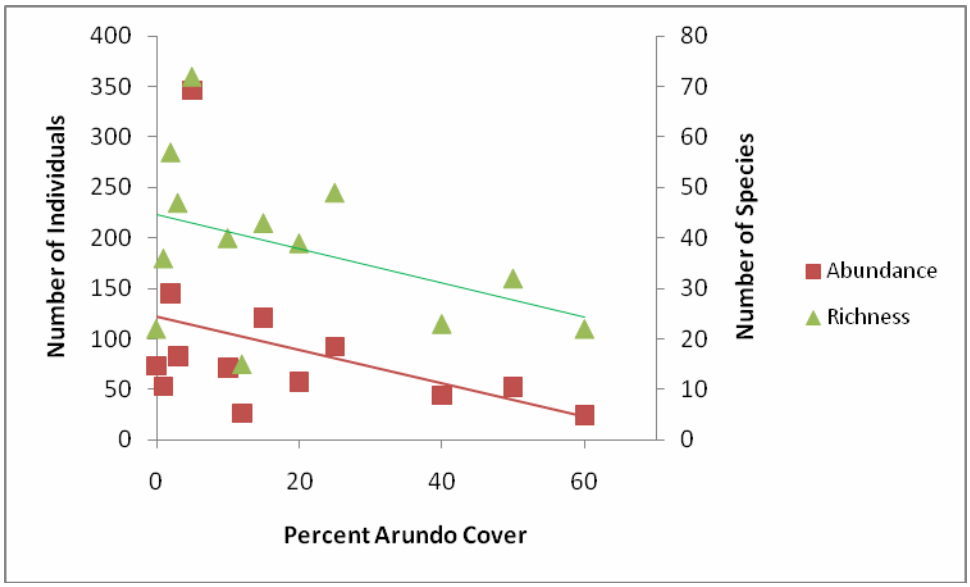


Figure VIII. The relationship between total relative abundance and species richness per point (not limited to 50m radius), and total *Arundo* percent cover (Species Richness and *Arundo* y = -0.3345x + 44.483, R^2 = 0.1718, Relative Abundance and *Arundo* y = -1.6604x + 122.35, R^2 = 0.1527).



When a large number of habitat types (habitat richness) was tested against the entire bird community per point, no clear relationship was found. However, when habitat

types were pooled into three main types (open, shrub and tree) and tested against riparian obligate bird species, we found a clear positive relationship between bird abundance and habitat richness (Figure IX). However, no clear relationship was found for species richness and habitat richness. This may be due, in part, to the fact that habitat coverage is measured only within a 50m radius around the point, while birds are using a much larger area that is not being measured. Upon closer examination of these habitat richness types, we found that open habitats (grass, forb, rock, sand) showed significant negative relationships in both relative abundance and species richness of riparian obligate bird species (Figure X).

Figure IX. The relationship between mean relative abundance and species richness of birds per point (limited to 50m radius), and habitat richness defined as the number of general riparian habitat variables present (open, shrub and tree).

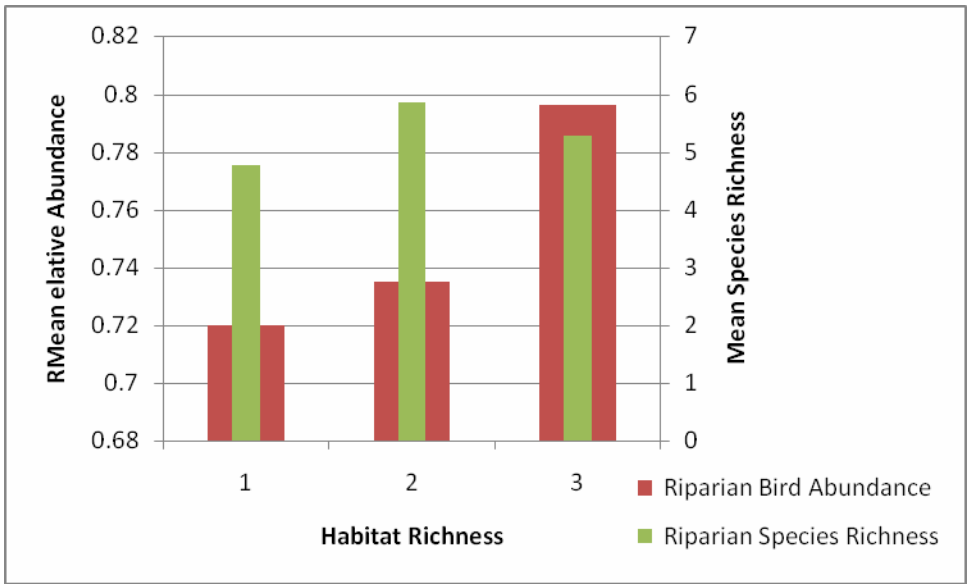
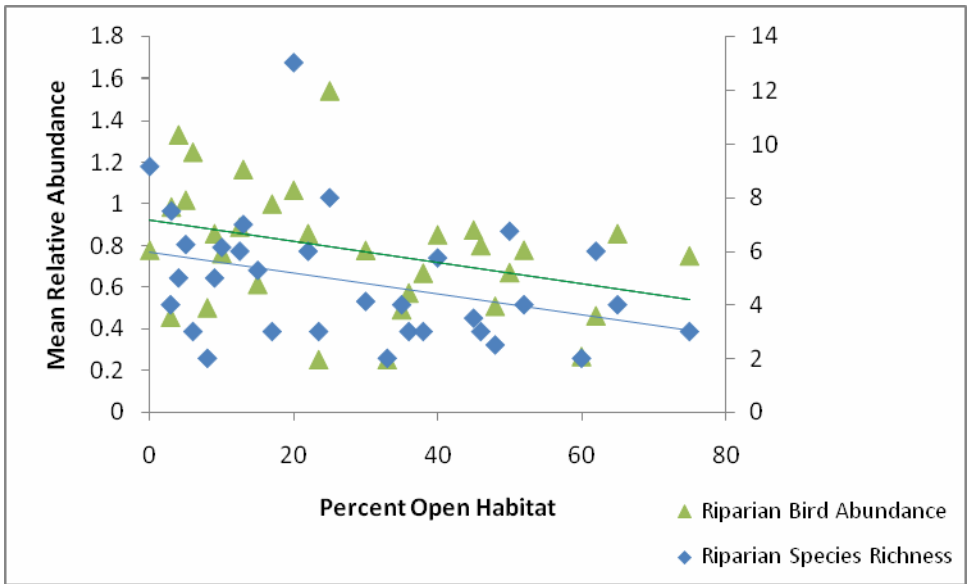


Figure X. The relationship between mean relative abundance and species richness of birds per point (limited to 50m radius), and percent open habitats (grass, forb, rock, sand) (Bird Abundance and Open Habitat y = -0.0051x + 0.9231, R^2 = 0.12; and Bird Richness and Open Habitat y = -0.0388x + 5.9777, R^2 = 0.12)



6. Discussion

General Bird Community

The study area, which includes much of the lower, and parts of the upper Santa Clara River, supported relatively high bird diversity. Diversity is the relationship between the number of species and their relative abundances within a given area. We did not assign an index of diversity for this study because of the many problems associated with such indices (Weins 1989 b). However, the parameters we focused on here: species richness and relative abundance, provided an excellent basis for understanding the bird community and changes that occurred over the past decade from the period of the damage assessment (1994-1999) through this study.

A total of 155 species was observed during this 2-year study. This is an increase of 26 species (20%) from the 6-year total recorded during the 1994 - 1999 study in which 129 species were observed. Part of this increase was due to the extension of the survey to the upper watershed where new species, such as summer tanager and olive-side flycatcher, were found. The majority of the other additional species were water birds found mostly at or near UWCD (Map 1) and rare vagrants. Overall, it appears that the number of bird species has remained relatively high over the past 12 years.

Of the 155 species found, 20 are either listed or considered locally rare, meaning that 13 percent of the species observed are listed as rare or considered locally rare. This appears to be a very high proportion of sensitive species. One level of comparison with other locations in California can be made using data from the Riparian Habitat Joint Venture (RHJV) established by the National Partners in Flight (RHJV 1998). The RHJV has identified 14 focal species whose requirements define different spatial and compositional attributes, and/or management regimes that are associated with high

quality riparian habitat. The assumption being made by RHJV is that managing for these species will meet the habitat needs of the entire community. The focal species include: Swainson's hawk (*Buteo swainsoni*), yellow-billed cuckoo, willow flycatcher, least Bell's vireo, warbling vireo, bank swallow (*Riparia riparia*), Swainson's thrush, yellow warbler, common yellowthroat, Wilson's warbler, yellow-breasted chat, song sparrow, black-headed grosbeak and blue grosbeak. Our study found 11 of these focal species present, 9 of which were breeding. This is one of the highest numbers of focal species found anywhere else in the state (Gallo et al 2000).

The overall bird community varied among different locations (Map areas) but varied little between the two years of the study. One of the most significant findings was that relative abundance, species richness, and the number of sensitive species was greatest along the lower river (Maps 1 and 2). This is not surprising given the fact that these areas support the largest extent of riparian woodland compared to the upper river portions. In addition, this analysis excludes the middle portions of the river located from the LA County line upstream, just past I-5, where much high quality riparian habitat still exists. These findings are also in agreement with the 6-year damage assessment work that found the lowest area (Map 1, Reference Site I) had the overall highest abundance and richness throughout all years except 1997 when Reference Site II (Map 2) had slightly higher number of species (Labinger and Greaves 2000). The lower part of the river appears to benefit from proximity to the ocean and to the United Water Conservation District ponds. Both of these factors are probably responsible for the higher number of water birds and wading birds found in this section such as double-crested cormorant and the endangered least tern.

This finding also points to another important result: high diversity riparian habitats along the lower river appear to be generally stable over the past decade in terms of relative abundance and species richness of birds. However, there are some negative trends that are discussed below.

Understanding the factors that determine the temporal and spatial attributes of bird communities is extremely complex and beyond the scope of this study (Weins 1989a and b). In general, differences in bird communities between locations should be related to habitat parameters such as vegetation, hydrology, soils, microclimate, and human impacts (adjacent land use, flood control, livestock grazing, etc.); whereas, annual differences are likely related to weather variables such as precipitation, flooding, fire and temperature. All of these factors are discussed below in section *4.3 Factors Affecting Riparian Bird Populations.*

6.2 Endangered Species

Western yellow-billed cuckoo

The yellow-billed cuckoo is listed state endangered and has no federal endangered status. This species is an insectivorous neotropical migrant. It occurs throughout North America and is divided into eastern (*C. a. americanus*) and western subspecies. Western yellow-billed cuckoos arrive late in the season at the end of June through the beginning of July and stay until late August and September (Laymon & Halterman 1987). In general, this species requires broad woodlands of even-aged growth, preferring older growth cottonwoods or other canopied riparian woodlands for breeding sites (Gaines and Laymon 1984). Highly specific foods occurring in cyclic

infestations (such as hairy caterpillars and tree frogs) are also important determinants in cuckoo distribution and productivity (Laymon & Halterman 1987).

Historically cuckoos were widespread in the state, but have declined to only three small populations (Gaines & Laymon 1984). They are extremely rare within the study area having been detected in 2 of the 6 years of the earlier assessment study (1997 and 1998) at two locations along the upper portion of the study area: Magic Mountain and above McBean Freeway, Valencia. Given the timing and short duration of these observations, we assume that the individuals were migrants and not breeding. Although detailed historical data are lacking from the South Coast region, cuckoo breeding has been documented along the Santa Clara River (Willet 1933). More recently, a cuckoo was observed between 23 June and 4 July 1979, on the Santa Clara River within the area affected by the oil spill (Webster in Garret & Dunn 1981). A dead cuckoo was found in the parking lot at Magic Mountain on 3-5 July 1981 (specimen at CSU Northridge, California; Laymon pers. comm.). Finally, in July 1992, a cuckoo was heard within this section (Holmgren, M. - UCSB pers. comm.).

Stillwater Sciences estimated that there were 139 acres (56 ha) of potential habitat for western yellow-billed cuckoo in 2007. Vegetation included in this estimate includes cottonwood-willow forest, and mixed willow and riparian scrub, using a minimum patch size of 37 acres (15 ha) based on Laymon and Halterman 1989. Stillwater estimated 390 acres (158 ha) of potential habitat if minimum patch size is ignored (Stillwater Sciences 2007a).

Yellow-billed cuckoos were not detected during this study. During the present study, we did not have access to survey within the area where cuckoos had been observed in the past, but we were able to survey excellent, appropriate habitat within Soledad Canyon.

Recolonization to the Santa Clara River area may in part be hindered by habitat loss and disturbance. The area near Magic Mountain where a cuckoo was found in 1997 was severely impacted during the subsequent winter floods. Before 1998, this was one of the broadest stretches of riparian woodland along the river, including many older growth Fremont cottonwoods. Presumably to protect the rapidly eroding northeast bank, a large swath of forest (approximately 50m wide and 500m long) was bulldozed, and tall dikes built up along its sides (see discussion of dike impact below). Although it is difficult to say whether these activities were the main cause of cuckoos being absent in subsequent years, such habitat loss is a critical problem for this species. Cuckoo distribution and possible breeding within the study area has not been adequately assessed due to limited late season surveys. As this species has a later arrival and breeding chronology than least Bell's vireos, more intensive surveys and monitoring of appropriate habitat are required later in the season (July and August).

Southwestern willow flycatcher

The willow flycatcher is a small, insectivorous neotropical migratory species ranging broadly from the east coast through most of the lower 48 states and parts of Canada. Willow flycatchers breed in a variety of wet habitats, particularly swamps and riparian thickets, especially willow (Garrett & Dunn 1981). Formerly widespread in the southwest and sporadically distributed in California, the species has declined in recent decades.

There are three recognized subspecies of willow flycatcher in California (all are State Endangered), of which the southwestern race (listed as Federally Endangered in 1995) is the most likely to occur in coastal southern California (Schlorff 1990). A few small populations persist in coastal southern California, including one on the Santa Ynez River, Santa Barbara County (Unitt et al. in prep), and one on the Santa Margarita River in San Diego County (Buck, pers. comm.). On the Santa Clara River, at least one pair bred successfully at the Fillmore Fish hatchery in 2000.

Stillwater Sciences estimated that there were 2,125 acres (860 ha) of potential habitat for southwestern willow flycatcher throughout the lower Santa Clara River and in the lower reaches of Piru, Santa Paula, and Sespe Creeks in 2007. Based on USFWS observations, habitat included cottonwood-willow forest, mixed willow and riparian scrub, and mixed riparian forest (USFWS 2005a). Potential habitat below 100 feet (30m) elevation above mean sea level was excluded from the estimate (Stillwater Sciences 2007a).

Willow flycatchers were found in small numbers during the study. The majority of these birds were migrants passing through; however, at least one pair successfully fledged young near the Fillmore Fish Hatchery in 2006 (Map 2). Several of these sightings are at locations that support excellent breeding habitat and are within the species historic breeding range (see below).

Least Bell's vireo

Least Bell's vireo is a small insectivorous neotropical migrant, which nests in the low vegetation associated with thickets of willow and mulefat in riparian woodlands. The least Bell's vireo is one of the four subspecies of *Vireo bellii* recognized in North America (Brown 1993). Formerly widespread in California, the species underwent a dramatic decline in abundance and range during the first half of the 20th century (Grinnell and Miller 1944, Gaines 1977). It was designated an endangered species by the California Fish and Game Commission in 1980 (CDFG 1986) and was listed as endangered by the Federal government in 1986 (USFWS 1986). Critical Habitat was designated by the USFWS and included the Santa Clara River from 2.4 km east of Piru Creek (Ventura County) upstream to the junction of Old and Rye Canyon roads (Valencia, Los Angeles County).

The species arrives in late March through April and departs from late August through September. Nest building usually begins several days after pair formation. Nests are typically placed in the fork of a shrub, small tree or in weeds, suspended within a meter of the ground (range 0.3 – 2.0m this study) in dense scrub vegetation found in or adjacent to the river bottom (Gray and Greaves 1984).

The historic breeding range of least Bell's vireos extended throughout the lowland valleys of California, USA, and northern Baja, Mexico (Wilbur 1979 and 1980). The present breeding range is limited to about 50 locations, from Santa Barbara County south to San Diego County, where the majority of the U.S. population is found (Franzreb 1989). Annual surveys were conducted from 1991 through 1994 as part of a cowbird-trapping program along the lower river in Ventura County (SEB 1991, 1992, 1993). The species was intensively monitored and data on nesting and productivity on the Santa Clara River were collected during the damage assessment study from 1994-1999 and again in 2000 (Labinger and Greaves 2001).

Least Bell's vireos appeared to be highly selective for nesting territories, compared to the habitat types available. In general, territories were similar to those found elsewhere in southern California consisting of early successional cottonwood/willow forest, southwestern willow woodland, and mulefat scrub. The most important features that appear in most vireo territories are: (1) the presence of dense cover within 1-2 meters of the ground, where nests are typically placed; and (2) a dense, stratified canopy for foraging (USFWS 1998). Although plant species appears to be less important than structure, four willow species are the most common tree and shrub plants within 10m of the average nest site (Labinger and Greaves 2000). The most specific level of selection was for nest placement. Of the 21 species of plants used by the vireos during this study, the species preferred willow species for placing their nests. The structurally similar mulefat was the next most selected nest substrate. In 1998, relatively more nests were placed in *Toxicodendron* and *Arundo* and less in mulefat. This shift may have been precipitated by prior El Nino scouring floods and may reflect choice of sites "away" from the scoured river bottom. Both of these plant species are found in more upland areas and *Arundo* survives well even within floodwaters.

In terms of least Bell's vireo, the main purpose of the present study was to determine presence or absence of the species in known population centers and in areas, such as the upper watershed of the river that have not been well surveyed in the past. However, due to specific limitations of the study, we were not able to achieve a complete population estimate for least Bell's vireo on the river. Given the scope of this study and non-protocol vireo surveys (8 surveys, 10 days between site visits), several areas were only partially surveyed. These included the river downstream of Hwy 118, Saticoy, and between Fillmore and Piru where little habitat exists and repeated surveys were probably not warranted anyway. Furthermore, the entire Newhall Land and Farming segment of the river from the LA County line up to I-5, a reach of approximately 7 miles was not surveyed at all due to access limitations.

Stillwater Sciences estimated that there were 2,524 acres (1,022 ha) of potential habitat for LBVs throughout the lower Santa Clara River and lower Piru, Santa Paula, and Sespe Creeks in 2007. Vegetation included in this estimate includes "the full extent of cottonwood-willow forests as foraging habitat, and mixed riparian and willow scrub as nesting habitat" based on Goldwasser (1981), USFWS (1998a), Kus (2000), and Labinger and Greaves (2001a) - (Stillwater Sciences 2007a).

During the present study in 2005 and 2006, Least Bell's vireo continued to be the most common of the rare, threatened, or endangered species found. Productivity could not be accurately determined since nests were not actively monitored. However, on the basis of these limited data, productivity appeared to be consistent with past more detailed studies in which fledglings were observed with adults and/or nests with eggs were found. No LBVs were found within the newly surveyed upper portions of the study area (Maps 4 and 5). This was not surprising considering that much of the river habitat within these areas, especially in the vicinity of Santa Clarita, was highly degraded. Excellent habitat for LBVs existed within Soledad Canyon but much of it was patchily distributed and isolated from other vireo populations making colonization difficult.

The main LBV populations along the lower river have fluctuated annually with trends varying greatly between subpopulation sites. The two main population areas that were also adequately surveyed included most of the area in Map 1 from 118 up to west Santa Paula and the western portion of Map 2 from Santa Paula up to the Sespe

confluence. Annual trends since 1994 show significant differences between subpopulations in which the population within the lower reach of Map 1 increased steadily up to 2000 and then showed a sharp decline in 2005 and then again in 2006. The area upstream (Map 2-west) appears to follow a normal fluctuating population trend. Although these changes may be partly due to decreased monitoring effort in the present study, effort did not vary between sites and, thus, these annual trends are probably related to other factors.

The declining population trends may be related to fire impacts. The 2003 fire burned much of the south bank of the river along the lower section of Map 1. This area showed a significant decrease in singing male vireos in 2005 compared to 2000 before the fire. Although we did not detect any significant changes in overall bird community parameters such as relative abundance and species richness, it is likely that LBVs are more sensitive to such changes. The habitat in these burned areas had grown into early successional shrubby habitat but the vegetation was dense and may not be suitable for vireos that prefer some open understory. Some of the burn areas have revegetated with dense stands of *Arundo* which is also not suitable for vireos.

Least Bell's vireo populations elsewhere in the state appear to have shown a similar variation between locations. McGraw (2006) summarized breeding vireo populations by location which showed marked increases for some subpopulations such as: Prado Basin (Santa Ana River)-47 (1995) to 813 (2005) pairs; Camp Pendelton (Santa Margarita River)-168 (1990) to 827 (2005) pairs; whereas the upper Santa Ynez River (Santa Barbara County) population has decreased from 45 pairs in 1995 to 11 in 2001. Overall growth in least Bell's vireo populations within the U.S. have increased from approximately 300 pairs (1974-1985, Franzreb 1989) to over 2,600 pairs in 2005 (McGraw 2006).

These population increases of LBVs have been attributed, in part, to removal of cowbirds from habitats near major breeding populations and improved protection of riparian woodlands along major rivers of southern California (USFWS 1998). Although these factors have undoubtedly assisted LBVs and other riparian species (see Brown-headed Cowbird section below); they do not explain why some areas have little or no population growth. A case in point is the western area of Map 1 east of Santa Paula. Cowbird control has been of equal effort to the lower river site (Map 1) and the extensive habitat has actually increased over the past decade.

During the past study (Labinger and Greaves 2000), productivity was significantly lower here than at the lower section of Map I. This declining trend appears to be continuing. Productivity between locations should be more related to habitat quality than habitat availability. Low productivity can be the result of low abundance of prey items (insects), high predation rates (including cowbird parasitism), poor microhabitat conditions (ambient temperature, humidity), or a combination of these factors (Weins 1989a). We did not measure any of these factors, and cannot conclude anything about their relative impacts here. However, the data clearly show marked differences between locations indicating that evaluating habitat quality based on vegetation coverage alone is not adequate for predicting functional values.

Cowbird parasitism occurred at least 6 times during the 2-year study. This is not significantly different than past studies along the river except for 1997 when 14 parasitized nests were found. Most parasitism observed in 2005 and 2006 occurred along the lower river section (Map 1). Interestingly, cowbirds were not detected within

the point counts for this lower river section (Map 1). It may be that cowbirds are not well monitored by point counts since they do not hold traditional territories. On the other hand, a small population of cowbirds may still impact vireos if they are a preferred host. The low number of cowbird traps along the river may ultimately lead to a decline in least Bell's vireo numbers. More detailed study, comparable to the past work of Labinger and Greaves, needs to be conducted to make a better determination. (See also discussion of brown-headed cowbirds below.)

6.2 Factors Affecting Riparian Bird Populations

Riparian bird populations are influenced by a complex number of natural and anthropogenic factors. Natural factors such as weather, vegetation, soils and hydrology can greatly influence annual trends in species diversity, productivity and distribution. Human activities are creating long-term impacts that can be particularly devastating to riparian obligate species in the western United States. The decline of such species is believed to be the result of habitat loss and degradation from agriculture, pesticides and herbicides, livestock grazing, water diversion projects and continued urbanization of riparian corridors (Krueper 1993). In addition, brood parasitism by brown-headed cowbirds appears to be suppressing productivity of host species such as least Bell's vireos, and may hinder the re-colonization of former breeding areas (McGraw 2006). This is evident for least Bell's vireos during this study where cowbirds have hindered vireo nest success by laying eggs in and parasitizing early nests. Important factors affecting riparian bird communities during this study are discussed below in more detail.

Habitat and weather

Habitat and weather are inter-related, fundamental elements that determine a bird community. Here we discuss the natural aspects of these factors although with global warming and long-term human impacts on riparian systems, it would be difficult to differentiate them completely.

A wide variety of riparian habitats were found during this study. Overall, the Santa Clara River is composed primarily of an active channel that is open and sparsely vegetated even in years without scouring flood events.

Aspects of the habitat considered particularly important to avian communities include vegetation diversity, structure, and size of habitat (Weins 1989a). The results of this study indicate that differences in bird populations between locations were related more to quality than to the quantity of riparian habitat. For example, the area depicted in Map 2 supports the largest amount of riparian vegetation, but has lower relative abundance, avian species richness (per point) and significantly lower densities of least Bell's vireo compared to other areas. However, the sections with the lowest bird diversity were also the least vegetated (Maps 3 and 4). Although human impacts within these areas confound the situation, it appears that vegetation diversity and structure are the key elements determining bird species richness, abundance and distribution.

Habitat loss and degradation

Riparian habitat has suffered proportionately greater losses in California than any other habitat type. Since the 1850s it is estimated that over 95 percent of California's wetlands have been lost (USFWS 1998). Riparian woodland flood plains were and still are cleared primarily for agricultural use. Urban, commercial, recreational and highway

developments tend to be centered near riparian areas, eliminating or severely encroaching on riparian habitat. Development within the floodplain necessitated flood control projects such as dikes and channelization. Water flows above and below ground are also impeded and/or depleted by dams and groundwater pumping causing loss and vegetative changes of wetland habitats.

Loss of upland and wintering habitats are also negatively affecting riparian bird populations. Biological diversity is closely linked to habitat diversity. Riparian woodland surrounded by native upland habitat provides buffer and increased foraging opportunities for many riparian obligate bird species. We observed least Bell's vireos commonly foraging and occasionally nesting in upland scrub habitats adjacent to riparian habitat. Most of the riparian obligate birds breeding along the Santa Clara River winter in Central and South America. Habitat destruction and degradation is undoubtedly impacting many species wintering and breeding in these areas, although data are lacking (Sherry and Holmes 1993).

Destruction of habitat results in fragmented patches of remaining habitat. Depending on the species, these fragmented patches can physically isolate bird populations that are then vulnerable to local and range wide extinctions due to catastrophic events (e.g. flooding) and inability to recolonize. Decreased gene flow has also been shown to result in deleterious inbreeding (Soulé 1980). This is particularly important along the Santa Clara River where much of the riparian habitat is patchily distributed. For example, a catastrophic event near the Freeman Diversion could potentially wipe out half of the least Bell's vireo population occurring along the river.

In addition to loss of habitat, riparian communities are impacted by a host of factors that degrade the habitat. The impacts of these factors may be difficult to detect since the vegetative aspects of the habitat are intact (i.e. visually similar to high quality habitat). In fact, this is one of the compelling reasons for using indices such as bird species diversity to assess habitat functionality. Major factors contributing to habitat degradation include pollution, invasive nonnative plant and animal species, increased native predators, livestock grazing, human recreation, flood control projects, and groundwater pumping (SCRPSC 1996).

Riparian areas have typically been used as drainage areas for wastewater and agricultural runoff that may contain high concentrations of nitrates, salts, pesticides and herbicides. Impacts from agriculture and wastewater disposal range from increasing density of vegetation (concentrated organic waste) to loss of vegetation from concentrated salts and herbicides. Pesticides can directly affect birds and indirectly by reducing their food supply (e.g. invertebrates and vertebrate species; Gard et al. 1993). We have no direct data on such sources of pollution, although they do occur throughout the study area. Another source of pollution has been from oil spills Two of these incidents include the 1991 ExxonMobil oil spill near Castaic Junction, and the 1994 ARCO oil spill near McBean Parkway in Santa Clarita (the basis of this study), both in Los Angeles County. Both spills involved oil contamination, subsequent removal of vegetation, and dead and oiled wildlife. The avian damage assessment (1994-1997) revealed significant impacts from the oil spill and clean-up operations on birds, particularly water birds, in which killdeer and spotted sandpipers were much less common within the Affected Area compared to the reference sites during the first few years after the spill (Labinger and Greaves 2000).

Invasive nonnative plant and animal species impact native species through competition and predation. The giant reed (*Arundo*) was the most abundant nonnative plant species found at the study area. Dense thickets tended to be located along dry and/or disturbed areas such as dikes. These thickets had very low bird diversity. However, a low to moderate mixture of giant reed with native willow woodland supported high bird diversity in some areas such as at area Map 1. In such areas, giant reed was also used for nesting, as noted by at least 16 nests of least Bell's vireo, and several other species such as Anna's hummingbird, bushtit, and common yellowthroat (Labinger and Greaves 2000). Non-native animals included dogs, cats, European starlings, and house sparrow. Feral and free-roaming dogs and cats are major predators of nesting birds and were observed at most locations. These, along with increased densities of native predators such as scrub jays, raccoons, coyote etc. tended to be associated with human development and were all common throughout the study area.

Livestock grazing destroys low vegetation, compacts and dries wetland soil, and provides foraging areas for brown-headed cowbirds (Bock et al. 1993). Cattle grazing occurred during this study mainly along the upper river (Map 5). Cowbird abundances were highest in these areas as well as parasitism rates. Vireos nesting at the Salt Creek site (Affected Area) were most successful in 1995 when cattle had been removed; the habitat was not trampled and few cowbirds were observed. However, cattle grazing resumed in 1996 and, by 1999, LBVs were no longer using the site. On at least two occasions, vireo nests were destroyed directly by cattle collisions.

Direct and indirect manipulations of the river's water flow have affected much of the Santa Clara River. The United Water Conservation District's Freeman Diversion is a small dam structure that diverts down river flows for water recharge ponds. Major dams within the watershed (e.g. Piru and Castaic reservoirs) further contain and restrict flows. Levees, berms and bank stabilization structures constrain approximately half of the river's banks (SCRPSC 1996). Such structures reduce upland riparian woodland, constrain the channel width and create faster flows that tend to scour the low-flow channel in narrowed reaches and cause aggregation of sediments in wider areas. Many of the agricultural berms made of soil are dominated by non-native species, particularly *Arundo*. Groundwater pumping occurs throughout the Santa Clara watershed reducing underground aquifers that are especially important to riparian woodland outside of the low-flow channel. The extent and level of subsurface water are critical components of western riparian systems (Krueper 1993). In addition to supporting healthy, lush vegetation, the added moisture creates high humidity required by invertebrates (bird prey base) and nesting birds (especially during incubation, Welty 1982).

Impacts of Fire

It does not appear that the 2003 fire will have had long-term, impacts to the overall riparian bird community in the study area. However, we did note a significant decrease in least Bell's vireo territorial males within the lower burn areas (See Figure 1.) indicating that they were probably impacted. These areas should be surveyed again to determine the long-term effects of the fire. While many old trees were burned out, and where *Arundo* was co-dominant, the latter did not seem to be the only species able to recover from the fire, as witnessed from along South Mountain Road during 2005 and 2006 (and subsequently 2007 and 2008). By 2005, small shrubby thickets began to appear in burned areas that looked dead. Many of the burned areas were, again,

dominated by *Arundo*, as regrowth occurred but in some areas, *Arundo* was replaced by willows and mulefat.

This recovery of native vegetation, in areas where *Arundo* was predominant, may have resulted from a combination of scouring after the floods, which removed burned over *Arundo* and deposited seeds and stems of native vegetation. One example of floods doing the work of restoration ecologists is found at HRNA, where a flood during the same period completely removed the thickets of thistle that grew in a field; the area is now lush, canopied young willow woodland with naturally vegetated openings (Jackie Worden, pers. comm.).

However, the area at the south end of Mission Rock Road seems to have taken longer to recover from the fire, and *Arundo* has actually filled in some parts of that minor section, supplanting the native mulefat and willow that co-dominated prior to the fire. During 2005, due to heavy floods and cooler spring, birds seemed in lower numbers in the entire area, including those sections not burned to the west but upstream of Vern Freeman Diversion. In 2006, we did not access the area until June, after which some resident species may have finished breeding, but during which least Bell's vireo and other migratory birds were still breeding. Both least Bell's vireo with older fledged young and Lazuli buntings were found to be still nesting.

Brown-headed Cowbirds

The brown-headed cowbird is a brood parasite that lays its eggs in the nest of a host species. The host species raises the cowbird chick, generally at the expense of the host's young. Cowbird chicks hatch sooner and grow quicker than most hosts and occasionally eject host eggs and chicks. In addition, female cowbirds will sometimes remove and/or destroy host eggs before laying their own eggs. Over 130 species of birds have been documented as cowbird hosts (Friedmann et al. 1977).

Brown-headed cowbirds are a native species to North America, but a relatively new immigrant to the western United States (Friedmann 1963). Cowbirds underwent a rapid increase in range and numbers following the rural development of the west in the early 20th century. Cowbird concentrations are particularly high near riparian areas where a combination exists of high host density coupled with adjacent foraging areas created by land-use practices. In the southwest, rural areas tend to be near water, providing excellent cowbird foraging areas such as dairies, livestock grazing, equestrian centers, golf courses and parks. In fact, the distance between foraging and breeding areas can be a critical factor in determining the abundance and impact of cowbirds to specific host populations. Cowbirds have been recorded to travel up to 7 kilometers between breeding and foraging areas (Rothstein et al. 1984). Managing these foraging areas can be effective tool in controlling cowbird impacts.

During this and past studies we have documented cowbird parasitism in least Bell's vireo, Hutton's vireo, hooded oriole, yellow warbler, common yellowthroat, yellow-breasted chat, and song sparrow. The endangered least Bell's vireo is a common host species and readily accepts cowbird eggs (see above; USFWS 1998).

Parasitism was observed during this study only within the lower reaches of the river (Maps 1 and 2). Cowbirds have been trapped within these areas annually since the early 1990s (Griffith Wildlife Biology 2009). Cowbird populations appear to be low here as indicated by the point count data where abundances were greatest along the upper SCR sections (Maps 4 and 5; Figure III). We did not find a significant correlation

between cowbird abundance and vireo presence. Parasitism rates found here are relatively low compared to past studies, with up to 20 percent parasitism (McGraw 2006). Female cowbirds also reduce productivity through nest abandonment, inadequate incubation cycle, and damage to eggs and nest by female cowbirds. An added benefit of cowbird trapping is that it assists other host species populations. One notable exception, however, appears to be the southwestern willow flycatcher. This species has not responded as dramatically to cowbird trapping as the least Bell's vireo and appears to be limited by other factors (Rothstein pers. comm.).

Cowbird removal is also cited as the one of the main factors responsible for increases among several of the larger southern California vireo population (e.g. Santa Margarita, Santa Clara; (USFWS 1998). An annual cowbird control program along the lower reaches of Santa Clara River, initiated by California Department of Fish and Game in 1991 (SEB 1993), appears to have positively affected least Bell's vireo productivity from Fillmore downstream to Saticoy. Trapping data are presented in Table V from 1993-2006 (Griffith Wildlife Biology 2009). The numbers below pertain only to trapping during the breeding season (directly impacting breeding birds) on the lower SCR (ocean to Santa Paula) and the middle SCR (Santa Paula to Piru), although some trapping has been conducted on the upper SCR (upstream of Piru) and during the winter. Traps were also operated on the upper SCR near I-5 in 2002-2004.

It should be noted however that despite long-term cowbird trapping and apparently small populations of breeding cowbirds within the lower Santa Clara River, parasitism is continuing to impact vireos and other riparian birds. In view of this information the cowbird trapping program should be re-evaluated as to effectiveness and appropriate remedial measures taken such as determining when, where and how best to remove or decrease cowbird impacts in terms of vireo breeding success.

Table V. Number of male, female, and juvenile brown-headed cowbirds removed during the breeding season from the Santa Clara River, 1993-2006 (Griffith Wildlife Biology 2009).

Year	Number of Traps [a]	Trapping Period [b]	Number of Cowbirds Captured				Number Per Trap	M:F Ratio
			Male	Female	Juv	Total		
1993	12	4/? - 7/31	523	293	241	1057	88.08	1.78
1994	12	4/13 - 6/30	247	195	18	460	38.33	1.27
1995	8	5/5 - 7/9	140	65	38	243	30.38	2.15
1996	8	4/1 - 6/15	304	141	2	447	55.88	2.16
1997	8	4/1 - 6/12	460	245	0	705	88.13	1.88
1998	no trapping							
1999	10	4/14 - 6/25 [d]	432	313	4	749	74.90	1.38
2000	10	4/1 - 7/3	451	134	47	632	63.20	3.37
2001	10	4/3 - 6/28	450	181	16	647	64.70	2.49
2002	7	4/9 - 7/31 [e]	482	412	71	965	137.86	1.17
2003	7	4/1 - 7/15	192	159	33	384	54.86	1.21
2004	7	4/1 - 7/15	361	203	41	605	86.43	1.78
2005	7	4/1 - 7/15	248	180	47	475	67.86	1.38
2006	15	4/1 - 7/14	469	389	60	918	61.20	1.21
Total	**121**		**4759**	**2910**	**618**	**8287**	**70.14**	**1.79**

a. Trapping areas on the Santa Clara River include the lower SCR (Pacific Ocean to Santa Paula), the middle SCR (Santa Paula to Piru), and the upper SCR (upstream of Piru). This table includes only data from the breeding season, and only from traps operated from the lower and middle SCR. Traps were also operated on the upper SCR near I-5 in 2002-2004.

b. Non-breeding-season trapping also done in 2002-2003 (12/26 to 2/13); 2003-2004 (12/13 to 2/13); 2004-2005 (11/1 to 12/31 2004); 2005-2006 (1/27 to 3/27 2006); 2006-2007(7/15 to 12/1 and 1/29 to 3/31), 2007 (7/15 to 11/1), and 2008 + 2009 (7/15 to 11/30).

7. Restoration Recommendations

The processes required for restoring natural habitats are poorly understood, despite much research and experimentation. Kruczynski (1990) suggests that mitigation restoration should be designed to replace "all the ecological functions provided by the destroyed wetlands such as wildlife habitat, water quality, flood storage, and water quantity functions". However, most restoration projects are measured in terms of acreage planted which is seemingly simple and cost-effective, with few follow-up studies to determine effectiveness and success. We feel that this is problematic and that functionality should play a key role in developing a restoration project (Holmgren et al. 1993).

Habitat "function" refers to those processes that are necessary for the natural maintenance of an ecosystem. Complete documentation of all types of functions is difficult and seldom attempted. We suggest relying on indicators such as species diversity and abundance to characterize habitat function and potential. In particular, we have delineated areas of high bird diversity defined here as high relative abundance and number of bird species, with particular weight given to sensitive riparian obligate species such as the least Bell's vireo. As a group, birds are excellent indicators because of their wide distribution, easy detectability, and use of a wide range of ecological niches. The *Draft Least Bell's Vireo Recovery Plan* (USFWS 1998) calls for the protection and management of riparian and upland habitats within the species' current and historic range. In addition, colonization of new or historic areas is more likely near current breeding areas. B. Kus (USFWS 1998) found that the two most important factors promoting least Bell's vireo use of a restoration site was proximity to occupied areas and adjacent mature vegetation. Thus, priority should be given to restoration sites that are closest to existing breeding sites for vireos.

Detailed restoration recommendations were described in an earlier report that summarized 6 years of damage assessment studies and restoration planning studies (Labinger and Greaves 2000). One of the major outcomes of the present study is that it clearly shows that despite regular flood events and other natural fluctuations (including fires) the high diversity areas along the river remain relatively intact and stable. As such, we feel that our original restoration recommendations are still valid and useful (see summarized list below that includes the new areas surveyed in this study). Furthermore, this stability of the high priority sites should allow a high probability of successful restoration and preservation. Given that many restoration projects have failed in the past (Warner and Hendrix 1984) we suggest that restoration planning and implementation include:

- Thorough research into site selection
- Defining and reviewing "success" (see below)
- Careful review of restoration techniques
- Long-term site monitoring and maintenance
- Long-term protection from invasive plants and animals

Defining and reviewing "success" of restoration sites is a critical aspect of restoration activities. To determine success, observations should be quantified and analyzed statistically by conducting point counts similar to those that were conducted during this study.

We recommend that success of habitat restoration efforts on the Santa Clara River be defined according to bird species abundance and richness that is similar to the most successful sites found during this study. Thus, for example, a successful restoration site could be defined as that site which supports a bird community that exceeds 90% relative abundance and species richness of the most diverse site found during this study. (The area with the highest diversity of bird species observed in this study is the length of riparian habitat located between the Highway118 bridge and Fillmore (Map 1). At least twenty percent of the total species richness of a successful restoration site should be listed species (not limited to Threatened and Endangered Species). A successful restoration site should also support one pair of least Bell's vireo per hectare.

Whether this is the standard of success that is adopted or some other standard, the standard should be evaluated to see if it is indeed a useful measure of success, and whether changes should be made to the standard.

Regarding the impact of cowbird parasitism, another important conclusion from the present study is that despite long-term cowbird trapping that has successfully reduced the size of breeding cowbirds populations within the lower Santa Clara River, parasitism is continuing to impact vireos and other riparian birds. In view of this finding, the cowbird trapping program should be re-evaluated as to effectiveness. Appropriate remedial measures should be considered such as increased trapping effort along the lower river and additional habitat restoration adjacent to nesting areas of least Bell's vireo and other sensitive species.

In addition to the information provided here, restoration planning should work in tandem with other on-going efforts for the Santa Clara River such as those of The Coastal Conservancy, The Nature Conservancy, and mitigation projects by CalTrans and private landowners (e.g. Hedrick Ranch Nature Area and Newhall Land and Farming Company).

7.1 Summary list of priority restoration activities:

Priority is given first to protection and management of existing areas of high bird diversity including endangered species, then to enhancement of areas adjacent to these high diversity locations, and finally, to restoration of historic riparian habitat. Sites are prioritized (from highest to lowest) as follows:

1. Map 1 – west of Santa Paula downstream to Highway 118.
2. Map 2 East Fillmore –Approximately 2 mile section east of Highway 23 (including the Fillmore Fish Hatchery).
3. Map 2 (west) – east of Santa Paula from Balcom Canyon downstream to the Santa Paula.
4. Area affected by the oil spill, Section 1 (not surveyed in this study)–From below Valencia Water Treatment Plant downstream to Castaic Junction (below Magic Mountain).
5. Map 5- Soledad Canyon including high quality mature riparian habitats.
6. Affected Area, Section 4 (not surveyed in this study)–From ½ mile downstream of the Las Brisas Bridge upstream approximately 2 miles.
7. Affected Area, Section 3 (not surveyed in this study)–From Chiquito Canyon downstream approximately 3 miles.
8. Area between Highway 101 and Victoria Avenue (not surveyed in this study).
9. Area between Highways 118 and 101 (partially surveyed this study).
10. Affected Area, Section 2 (not surveyed in this study)–Castaic Junction to approximately ½ mile downstream of Castaic Creek confluence.
11. The Sespe Confluence - From Highway 126 Bridge down to the Santa Clara River.

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APPENDIX A

PHOTOGRAPHS

Photos	
Photo #	
1	
Location	
Santa Clara River upstream of Vern Freeman Diversion	
Description	
Mature willow forest and emergent wetland vegetation adjacent to open water, June 2005. Photo by ZL.	
Photo #	
2	
Location	
Lower Santa Clara River, base of South Mountain.	
Description	
Regrowth of vegetation adjacent to lower river following 2003 fire, June 2005. Photo by ZL.	

Photos	
Photo #	
3	
Location	
Santa Clara River south bank below Vern Freeman Diversion,_____. South Mountain in background.	
Description	
Regrowth of vegetation following 2003 Fire, July 2006. Photo by ZL.	
Photo #	
4	
Location	
North side of Santa Clara River above the Vern Freeman Diversion_	
Description	
Vegetative regrowth following 2003 Fire, July 2006. Photo by ZL.	

Photos	
Photo # **5** **Location** Santa Clara River near Piru Creek **Description** Arundo and fennel growth after 2003 Fire, June 2005. Photo by ZL.	
Photo # **6** **Location** Santa Clara River near Saticoy **Description** Third nest by least Bell's vireo was successful after Cowbird had been raised in first nest. July 2006. Photo by JG.	

Photos	
Photo #	
7	
Location	
Santa Clara River near Saticoy	
Description	
Least Bell's vireo female feeding brown-headed cowbird nestling June 2006. Photo by JG.	

Photo #	
8	
Location	
Soledad Canyon	
Description	
Breeding Summer Tanager June 2006. Photo by JG.	

Photos	
Photo #	
9	
Location	
Santa Clara River at Sespe Creek Confluence	
Description	
Open river bottom habitat in area of high flows, June 2005. Photo by ZL.	
Photo #	
10	
Location	
Santa Clara River at Balcom Canyon	
Description	
Side channel on north side of river with mature willow and cottonwood forest. July 2006. Photo by ZL.	

APPENDIX B

VEGETATION RECORDED AT POINT COUNT LOCATIONS

Vegetation Recorded At Point Count Locations

Category	Specific Type	Code
Trees-Native	Alder	AI
Trees-Native	Coast Live Oak	AO
Trees-Native	Coast Live Oak/Coastal Sage Scrub	W
Trees-Native	Cottonwood	AH
Trees-Native	Sycamore	AG
Trees-Native	Willow	O
Trees-Native	Willow Tree	P
Trees-Non-Native	Eucalyptus	AS
Trees-Non-Native	Locust	AR
Trees-Non-Native	Pine	AP
Trees-Non-Native	Tamarisk	AS
Shrubs-Wet	Cottonwood Shrub	AN
Shrubs-Wet	Mulefat	N
Shrubs-Wet	Sandbar Willow Shrub	AV
Shrubs-Wet	Willow Shrub	Q
Shrubs-Dry	Castor Bean	AK
Shrubs-Dry	Coastal Sage Scrub	V
Shrubs-Dry	Dry Scrub (Polygonum, Atriplex, Ocotillo and Opuntia,Yucca, Yerba Santa +)	AJ
Shrubs-Dry	Oak Scrub	AU
Shrubs-Dry	Other Shrubs (Elderberry, etc)	AF
Arundo	Arundo	M
Forbs	Emergent Wetland (sedges & rushes)	R
Forbs	Forbs	Z
Forbs	Poison-Oak	AV
Unvegetated	Cobble	AL
Unvegetated	Mud	AT
Unvegetated	Sand/Gravel	AL
Unvegetated	Sandy/Open	S
Unvegetated	Slope/Rocky Slope	U
Unvegetated	Ruderal	AA
Unvegetated	Water	T
Unvegetated	Woody Debris	AM
Agriculture	Orchard	AD
Agriculture	Row Crops	AC
Agriculture	Pasture	AE
Development	Dam	AX
Development	Road	AB

APPENDIX C

SAMPLE FIELD DATA COLLECTION SHEETS

APPENDIX D

2005-2006
AVIAN SURVEY RESULTS
DATABASE

The detailed vegetation data that were recorded at each point count location have not been printed, but are available in the electronic form of the database.