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# **Southwestern Willow Flycatcher Breeding Site and Territory Summary—2007**

By Scott L. Durst, Mark K. Sogge, Shay D. Stump, Hira A. Walker, Barbara E. Kus, and Susan J. Sferra



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## Contents

Introduction .....	1
Additional Considerations in Using and Interpreting the Data in This Report.....	2
Subspecies Status of Each Site .....	3
Population Estimates.....	3
Data Summaries .....	4
Changes in the Number of Known Territories over Time .....	4
Numbers of Sites over Time: Surveyed vs. Estimated .....	5
Numbers of Territories over Time: Surveyed vs. Estimated .....	6
Recency of Survey Data .....	7
Distribution of Breeding Sites by Number of Territories .....	8
Distribution of Territories by State .....	10
Distribution of Territories by Drainage .....	11
Distribution of Territories by Recovery Unit and Management Unit .....	12
Elevation Range of Breeding Territories .....	14
Use of Native and Exotic Habitats .....	15
Dominant Tree Species at Breeding Sites .....	16
Administration/Management of Sites and Territories .....	17
2007 Summary .....	17
Acknowledgments.....	18
References.....	19
Appendix 1. Distribution of Flycatcher Sites and Territories by Year .....	21
Appendix 2. List of Extirpated Sites .....	25
References.....	29

## Figures

1. Estimated number of known Southwestern willow flycatcher breeding sites and territories, from 1993 to 2007 .....	4
2. Number of estimated and surveyed Southwestern willow flycatcher breeding sites from 1993 to 2007 .....	5
3. Number of estimated and surveyed Southwestern willow flycatcher territories, from 1993 to 2007 .....	6
4. Number of territories at willow flycatcher breeding sites as of 2007 .....	8
5. Graphs showing the distribution of Southwestern willow flycatcher by elevation.....	14
6. Percentage of flycatcher territories occurring within breeding sites of differing compositions of native and exotic vegetation, as of the 2007 breeding season .....	15
7. Percentage of flycatcher territories occurring within breeding sites dominated by particular tree species during the 2007 breeding season.....	16
8. Percentage of flycatcher breeding sites and territories found under different land ownership, as of the 2007 breeding season .....	17

## Tables

1. Most recent year of survey data for sites and territories included in this report, as of 2007 .....	7
2. Number of Southwestern willow flycatcher breeding sites and territories by state, as of 2007 .....	10

**3. Number of Southwestern willow flycatcher breeding sites and territories by major river drainage, as of the 2007 breeding season ..... 11**

**4. Currently known number of flycatcher breeding sites, territories, and number of territories necessary for recovery criteria, by recovery unit and management unit..... 12**

**1-1. Distribution of flycatcher sites and territories by year and state based on both estimated and surveyed values.....21**

**2-1. List of the 142 sites that at one time had Southwestern willow flycatcher territories, but were unoccupied as of the most recent survey.....25**

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## Introduction

The Southwestern willow flycatcher (*Empidonax traillii extimus*; hereafter references to willow flycatcher and flycatcher refer to *E.t. extimus*, except where specifically noted) is an endangered bird that breeds only in dense riparian habitats in parts of six Southwestern states (Arizona, New Mexico, southern California, extreme southern Nevada, southern Utah, and southwestern Colorado). Since 1993, hundreds of Southwestern willow flycatcher surveys have been conducted each year, and many new flycatcher breeding sites located. This document synthesizes the most current information available on all known Southwestern willow flycatcher breeding sites.

This rangewide data synthesis was designed to meet two objectives: (1) identify all known Southwestern willow flycatcher breeding sites and (2) assemble data to estimate population size, location, habitat, and other information for all breeding sites, for as many years as possible, from 1993 through 2007.

This report provides data summaries in terms of the number of flycatcher sites and the number of territories. When interpreting and using this information, it must be kept in mind that a “site” is a geographic location where one or more willow flycatchers establishes a territory. Sites with unpaired territorial males are considered breeding sites, even if no nesting attempts were documented. A site is often a discrete patch of riparian habitat but may also be a cluster of riparian patches; there is no standardized definition for site, and its use varies within and among states. For example, five occupied habitat patches along a 10-km stretch of river might be considered five different sites in one state but only a single site in another state. This lack of standardization makes comparisons based on site numbers problematic. Researchers for this report generally deferred to statewide summary documents or to local managers and researchers when delineating a site for inclusion in the database. However, to avoid inflating the number of sites and to establish more consistent definitions of the term “site,” adjacent and nearby sites from statewide reports were sometimes considered as a single site for the purposes of the rangewide data summary. Any combining or splitting of sites at the rangewide level was done on a case-by-case basis. Because of differences in site definitions, one should not evaluate the

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relative importance of a geographic region (such as drainage, watershed, or state) simply according to the number of flycatcher sites.

A “territory” is an exclusive defended area within a breeding site. Although detailed monitoring studies have identified unpaired territorial males and polygynous males at some flycatcher breeding sites, for the purposes of this report a territory is equivalent to the exclusive breeding area of a pair of flycatchers.

In general, the concept of territory is more similar among states and different investigators than site; thus, it is a more robust unit to use for summaries and comparisons. However, note that the definition of a polygynous territory is not consistent among states; a male polygynously paired with two females would be considered one territory in some states and two territories in other states. For each site, we referred to reports or spoke directly with researchers and managers to gather information such as management entity/agency, location (state, drainage, elevation), gross habitat type (native, exotic, or mixed; dominant tree species), and number of flycatcher territories.

Synthesizing the information on more than 200 breeding sites is challenging because annual data-collection and survey-reporting requirements are not standardized rangewide, and the nature and degree of readily available information varies widely from state to state. This is particularly true for areas such as California, where there are many flycatcher sites but surveyors are not required to submit standardized flycatcher survey forms. The lack of consistent reporting makes it difficult to determine precise survey locations, compare locations between years, standardize site names, and evaluate site-specific characteristics. It also introduces long delays in access to basic site and population information. However, California has instituted a statewide database (coordinated by the U.S. Geological Survey [USGS] San Diego Field Station) that compiles data from an array of investigators; this database has greatly aided the compilation of data at the rangewide level. Although Arizona, California, and New Mexico all compile statewide survey summaries, Colorado, Nevada, and Utah do not have coordinated statewide surveys, and data for these states are compiled at the rangewide level.

This report includes all known flycatcher breeding sites reported between 1993 and 2007. The statistics included herein are based on survey data from the most recent year during which surveys were conducted, whether flycatchers were detected or not. Therefore, data from 173 sites that were not surveyed in 2007 are still included in the site and territory tallies if they had territorial flycatchers during one or more years since 1993. This report does not include data from sites where only migrant willow flycatchers were detected.

Every effort was made to locate and include all available survey information; however, because of delays in reporting for some sites, some 2007-season survey information may not be available until after this report is published in September 2008. New 2007 survey information will be incorporated into future rangewide reports.

## **Additional Considerations in Using and Interpreting the Data in This Report**

Data from a wide variety of sources have been used in this report, and the amount of information and level of detail varied greatly among sites. Because survey methodology varied among sites and between years, these summary data should be interpreted and used keeping this variation in mind. A discussion follows of cautions to consider when using these data.

## **Subspecies Status of Each Site**

The sites entered into this database all fall within the geographic range of the Southwestern subspecies (*E.t. extimus*), as defined by Unitt (1987), Browning (1993), Sogge and others (1997), and the U.S. Fish and Wildlife Service (2002). Recent studies of flycatcher genetics (for example, Paxton, 2000) and song patterns (for example, Sedgwick, 2001) support a more southerly northern range boundary for *E.t. extimus* than was used for the 1999 summary (Sogge and others, 2000). Future research may provide more insight into subspecies range boundaries; therefore, additional sites may eventually be removed from management as *E.t. extimus*, or new geographic areas and sites could be added. This should be considered when producing updates in future years and when making rangewide comparisons among years.

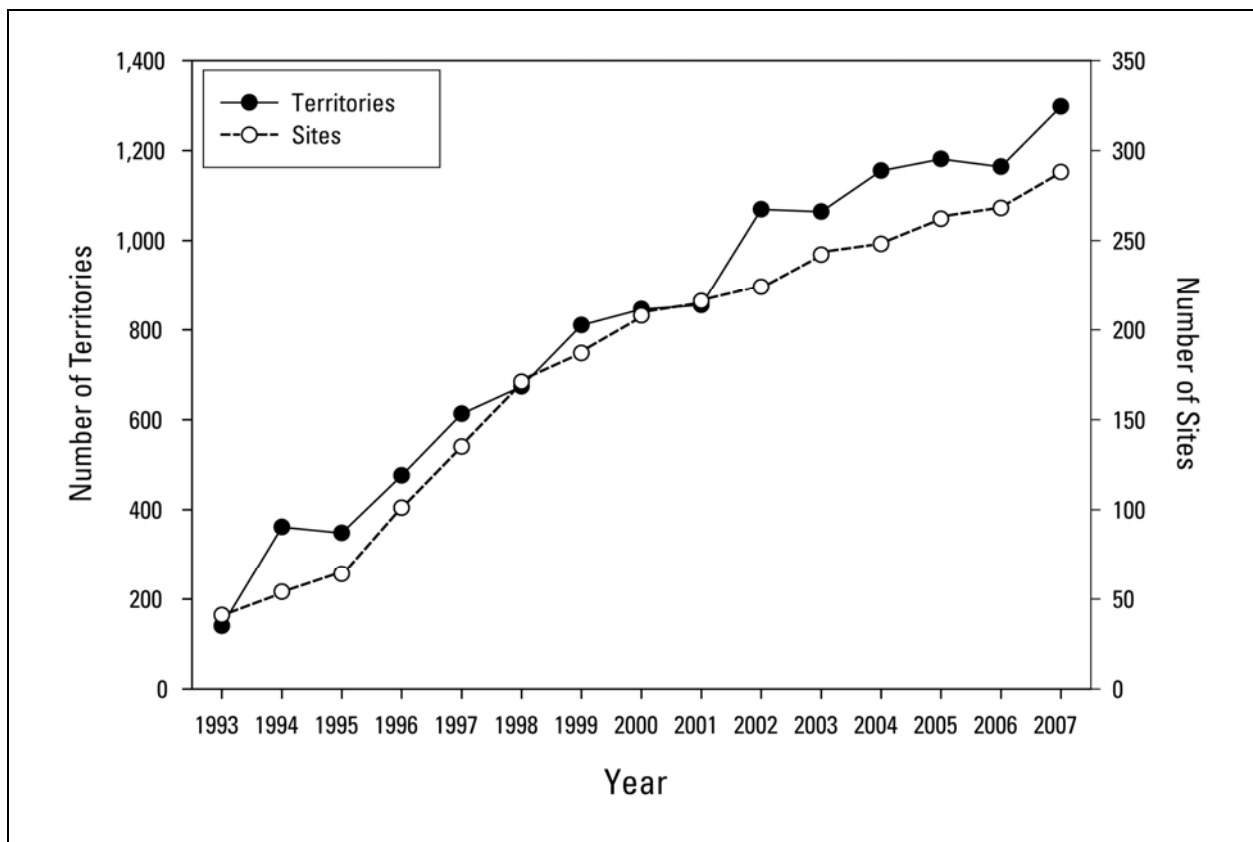
## **Population Estimates**

Population estimates are just that—estimates. Their accuracy and precision vary with survey effort, survey intent, surveyor experience, habitat density, flycatcher behavior, and even background noise levels. The population estimates reported for a site are generally the minimum number of flycatchers that are likely present based on the overall survey results; that is, if surveyors suspected the presence of 12 to 14 flycatchers, the lower (more conservative) number was used. Although estimates may be very accurate for some intensively surveyed sites, there is no method to standardize accuracy across surveys; therefore, the overall statistics presented in this report should be recognized as approximate.

## Data Summaries

### Changes in the Number of Known Territories over Time

Since 1993, extensive surveys in Arizona, California, Colorado, Nevada, New Mexico, and Utah have greatly increased the number of known flycatcher breeding sites and territories. In 1993, we collected information from 41 sites and estimated that there were 140 territories; in 2007, we compiled data from 288 sites and estimated 1,299 total territories (fig. 1). This increase should not by any means be interpreted entirely as a Southwestern willow flycatcher population increase. Rather, it is to a great extent a function of increased survey effort over time. Although population increases and decreases undoubtedly occur at some sites, movements of birds among sites and the lack of standardized surveys and reporting make it difficult to separate population trends from reporting variances. Determination of trends (positive or negative) can be made in only a few cases, and original data sources (for example, reports and survey data sheets) must be consulted when trying to elucidate population trends.

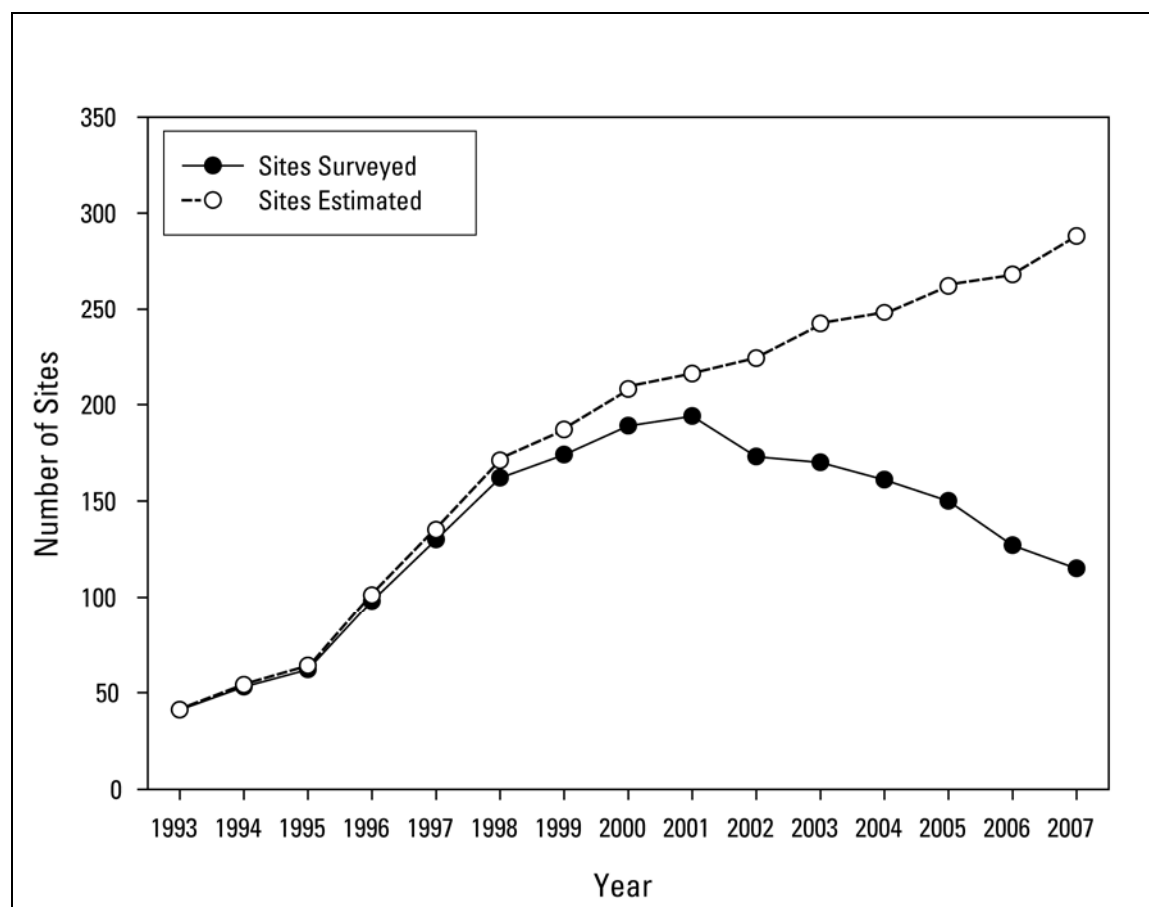


**Figure 1.** Estimated number of known Southwestern willow flycatcher breeding sites and territories, from 1993 to 2007. Numbers of sites and territories prior to 2007 have been updated as new information has become available and may be different from past reports.



## Numbers of Sites over Time: Surveyed vs. Estimated

Not all of the 288 sites where Southwestern willow flycatcher territories have been discovered over the past 15 years are surveyed every year. However, this compilation includes all sites where flycatcher territories have been detected since 1993, including sites that were not surveyed in 2007. Therefore, the total estimated number of sites (n=288) includes 115 that were surveyed in 2007 and 173 that were last surveyed in 2006 or earlier (fig. 2). The number of sites actually surveyed each year increased from 1993 to 2001, but it has been declining since then. This results in an increasing gap between the total number of estimated flycatcher sites and the number actually surveyed in the most recent year. See the section on Recency of Survey Data (below) and appendix 1 for additional details. The total number of estimated sites is the sum of sites that were actually surveyed in a given year plus the sites that were surveyed in a previous year.

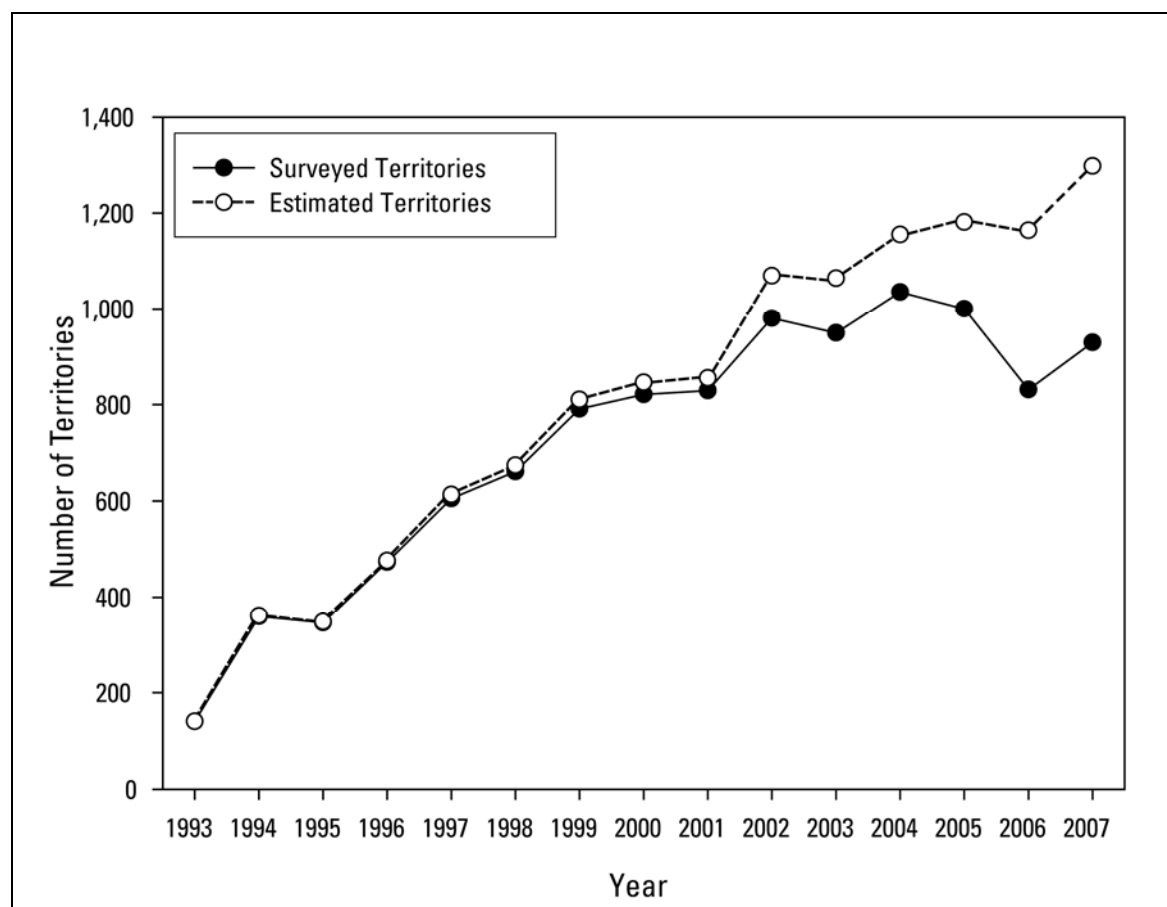


**Figure 2.** Number of estimated and surveyed Southwestern willow flycatcher breeding sites from 1993 to 2007. Numbers of sites and territories prior to 2007 have been updated as new information has become available and may be different from past reports.

### Numbers of Territories over Time: Surveyed vs. Estimated

As previously noted, not all known Southwestern willow flycatcher breeding sites are surveyed every year. For sites that were not surveyed in 2007, the number of territories reported in the most recent pre-2007 survey was used as an estimate of the number of territories currently at those sites.

In 2007, the estimated total number of territories (1,299) includes 930 detected in 2007-season surveys, plus 369 territories from sites that were last surveyed in 2006 or before (fig. 3). As with site estimates, the trend over the last several years shows an increasing gap between the number of territories known from recent surveys and the total number of estimated territories. The total number of estimated territories is the sum of territories that were actually detected in a given year plus the territories that were detected in the most recent survey in a previous year. See the section on Recency of Survey Data (below) and appendix 1 for additional details.



**Figure 3.** Number of estimated and surveyed Southwestern willow flycatcher territories, from 1993 to 2007. Numbers of sites and territories prior to 2007 have been updated as new information has become available and may be different from past reports.

## Recency of Survey Data

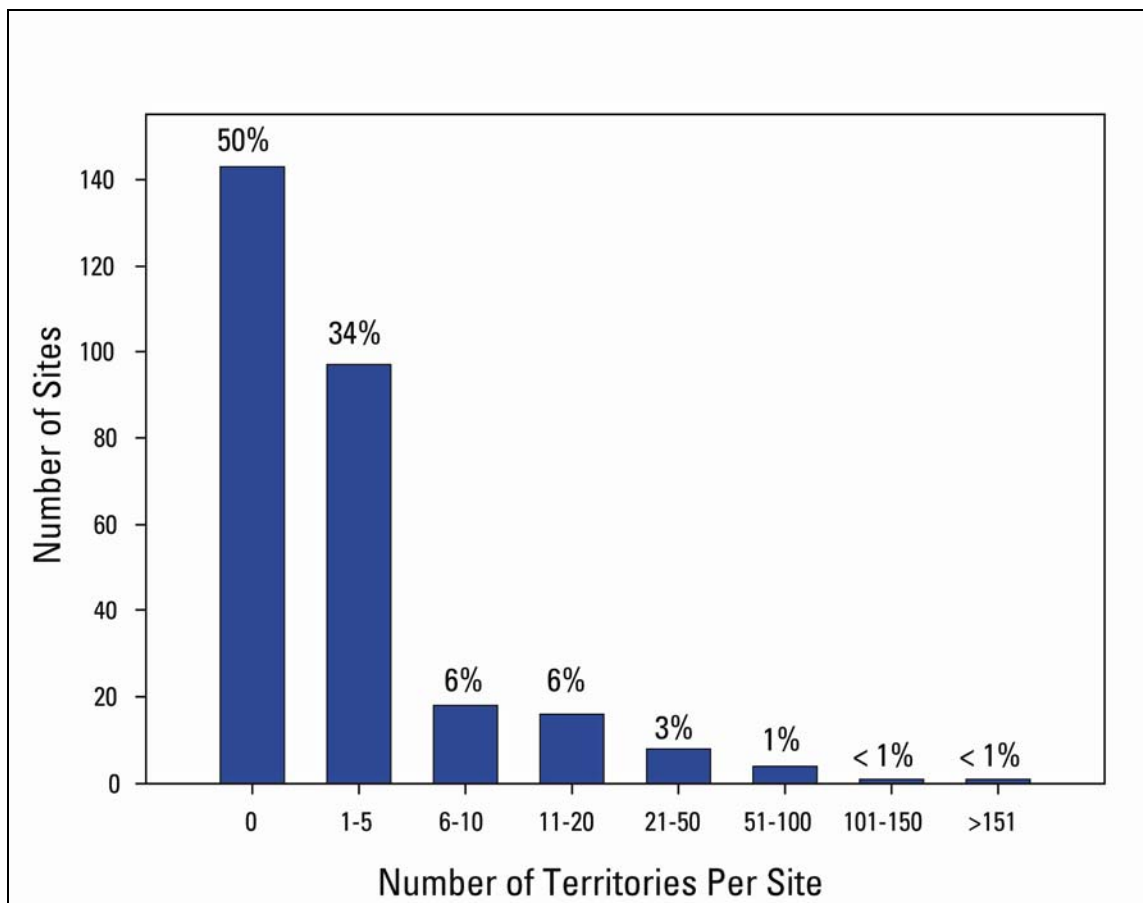
As previously indicated, the information used in this report is based on the most recent available survey data for each site. However, not all sites are surveyed every year. Of the 288 sites where Southwestern willow flycatchers have established territories since 1993, only 115 sites were surveyed in 2007 (table 1). Although estimates for some sites are based on older survey data, almost 70 percent of known sites have been surveyed since 2004, and these sites account for over 90 percent of the rangewide estimated number of flycatcher territories. Thus, all data presented in this report are based on the most recent surveys available for a given site. For 115 sites the data are from surveys conducted in 2007; however, for 173 sites the most recent data were collected before 2007.

**Table 1.** Most recent year of survey data for sites and territories included in this report, as of 2007.

Year	Number of sites	Percentage of total sites (n=288)	Number of territories	Percentage of total territories (n=1,299)
1993	1	0.3	2	0.2
1994	1	0.3	0	0.0
1995	1	0.3	1	0.1
1996	2	0.7	5	0.4
1997	4	1.4	5	0.4
1998	4	1.4	6	0.5
1999	6	2.1	6	0.5
2000	3	1.0	1	0.1
2001	29	10.1	63	4.9
2002	21	7.3	26	2.0
2003	15	5.2	5	0.4
2004	25	8.7	61	4.7
2005	29	10.1	152	11.7
2006	32	11.1	36	2.8
2007	115	39.9	930	71.6

## Distribution of Breeding Sites by Number of Territories

Most Southwestern willow flycatcher breeding sites are small, both in terms of the number of territories (hosting five or fewer territories, see fig. 4) and habitat patch size. Willow flycatcher territories have disappeared from 142 of the 288 sites tracked since 1993 (see appendix 2 for a list of extirpated sites). All but two of these sites where flycatcher territories are no longer detected comprised five or fewer territories. The two exceptions—the Colorado River inflow to Lake Mead, and the PZ Ranch on the San Pedro River—were larger sites where habitat was affected by flooding and fire, respectively. However, some extirpated sites, including Lake Mead and PZ Ranch, were subsequently recolonized by breeding flycatchers once the riparian habitat recovered.



**Figure 4.** Number of territories at willow flycatcher breeding sites as of 2007.

In some instances, flooding and fire did not result in the total loss of flycatcher breeding habitats, although fires during the breeding seasons in Arizona at the Gila River Kearny Sewage Ponds in 2004 and San Pedro River Dudleyville Crossing sites in 2005 may have reduced suitable breeding habitat. The inundation of Roosevelt Lake and Horseshoe Reservoir in Arizona before the 2005 breeding season dramatically reduced the available riparian habitat at some sites. The long-term impact of flooding and fire at these breeding sites is unknown and should be examined through continued surveys.

Not all birds at the sites where flycatcher territories are no longer detected necessarily died—some of these birds moved to other sites where they attempted to establish breeding territories. This is known to be the case for banded flycatchers that moved from the Verde River Tuzigoot Bridge and PZ Ranch to other sites (Paxton and Sogge 1996; Paxton and others, 1997; Netter and others, 1998). We are also aware of numerous other long-distance flycatcher movements to and from Roosevelt Lake before and after its inundation (Causey and others, 2005). Some of these burned and flooded sites may eventually cycle back into occupancy by breeding flycatchers as a result of changes in habitat quality, an increase in number of nearby territories, or other unknown or undetected factors. Sixty-four sites have been recolonized after at least 1 year of zero territorial flycatcher detections, indicating that previously extirpated sites may be recolonized if conditions such as habitat quality become more suitable in the future. Some of them do currently have territories, and some have repeatedly cycled between occupied and unoccupied status.

If we exclude the sites where territories are no longer detected, the picture remains much the same—the majority of sites (97 of 173; 56 percent) have five or fewer territories. Because most of the 142 sites where birds are no longer detected had very small populations (usually only 1 or 2 territories), their loss does not greatly affect the overall rangewide territory estimates or many of the territory statistics that are reported herein.

## Distribution of Territories by State

Arizona, New Mexico, and California account for the greatest number of known Southwestern willow flycatcher sites and territories (table 2). Nevada, Colorado, and Utah account for less than 12 percent of territories, primarily because these states have few known breeding sites occurring far enough south to fall within the range of *E.t. extimus*. Texas is absent from table 2 because there were no survey data or other records to shed light on current status and distribution within that state. See appendix 1 for a version of table 2 that includes updated estimated and surveyed numbers of sites and territories by year and state.

**Table 2.** Number of Southwestern willow flycatcher breeding sites and territories by state, as of 2007.

State	Number of sites	Percentage of total sites	Number of territories	Percentage of total territories
Arizona	124	43.1	459	35.3
California	96	33.3	172	13.2
Colorado	11	3.8	66	5.1
New Mexico	41	14.2	519	40.0
Nevada	13	4.5	76	5.9
Utah	3	1.0	7	0.5
Total	288		1,299	

## Distribution of Territories by Drainage

In general, a drainage name has been designated to serve as a functional unit, rather than a defined hydrological unit, as a means to summarize site and territory information. More flycatcher territories are found along the Gila River than any other major drainage (table 3); one of the largest known populations (in the Cliff-Gila Valley, N. Mex.) contributes many of the territories within this drainage. Elsewhere in New Mexico, and in southwest Colorado, most territories are found along the Rio Grande. The primary flycatcher drainages in California are the Kern, Owens, San Luis Rey, Santa Ana, and Santa Margarita Rivers. In Arizona, most flycatchers are found along the Gila, San Pedro, and Salt River drainages. The Virgin River drainage supports the majority of flycatchers in Utah. The Virgin and Pahrana gat Rivers support most of the flycatchers in Nevada. Sites along the Colorado River are located in Arizona, California, and Utah. The scale of all drainages in the rangewide summary is not equivalent and the drainage naming convention is specific to a particular watershed.

**Table 3.** Number of Southwestern willow flycatcher breeding sites and territories by major river drainage (drainages with >1 percent of total flycatcher territories), as of the 2007 breeding season.

Drainage	Number of sites	Percentage of total sites	Number of territories	Percentage of total territories
Big Sandy River	2	0.7	22	1.7
Bill Williams River	6	2.1	17	1.3
Colorado River	41	14.2	19	1.5
Gila River	50	17.4	391	30.1
Kern River	2	0.7	14	1.1
Owens River	5	1.7	28	2.2
Pahrana gat River	4	1.4	32	2.5
Rio Grande	25	8.7	303	23.3
Salt River	6	2.1	41	3.2
San Luis Rey River	9	3.1	55	4.2
San Pedro River	19	6.6	171	13.2
Santa Ana River	30	10.4	28	2.2
Santa Margarita River	3	1.0	14	1.1
Tonto Creek	1	0.3	34	2.6
Verde River	7	2.4	14	1.1
Virgin River	8	2.8	51	3.9
All others*	70	24.3	65	5.0
Total	288		1,299	

\*All others includes drainages that had <1 percent of total territories: Agua Fria River, Agua Hedionda, Amargosa River, Canadian River, Chama River, Hassayampa River, Las Flores Creek, Little Colorado River, Meadow Valley Wash, Mimbres River, Mojave River, San Diego Creek, San Diego River, San Dieguito River, San Felipe Creek, San Francisco River, San Gabriel River, San Juan Creek, San Juan River, San Mateo Creek, Santa Clara River, Santa Cruz River, Santa Maria River, Santa Ynez River, Sulphur Creek, Sweetwater River, and Temecula Creek.

## Distribution of Territories by Recovery Unit and Management Unit

The numbers of breeding sites and territories were tallied by recovery unit and management unit (table 4), as defined in the Southwestern Willow Flycatcher Recovery Plan (U.S. Fish and Wildlife Service, 2002). Note that in some management units, the number of territories is actually less than the number of sites; this occurs where management units include primarily small sites, one or more of which no longer contains territorial flycatchers as of the most recent survey (that is, “extirpated” sites; see appendix 2).

**Table 4.** Currently known number of flycatcher breeding sites, territories (as of 2007 data), and number of territories necessary to meet U.S. Fish and Wildlife Service recovery criteria, by recovery unit and management unit.

Management unit	Number of sites	Number of territories	Recovery criteria
Basin and Mojave Recovery Unit			
Owens	5	28	50
Kern	2	14	75
Amargosa	3	1	25
Mojave	7	4	25
Salton	1	4	25
Total	18	51	200
Costal California Recovery Unit			
Santa Ynez	4	7	75
Santa Clara	12	8	25
Santa Ana	33	28	50
San Diego	24	77	125
Total	73	120	275
Gila Recovery Unit			
Verde	7	14	50
Hassayampa—Agua Fria	2	1	25
Roosevelt	7	75	50
San Francisco	4	7	25
Upper Gila	22	329	325
Gila—San Pedro	46	233	150
Santa Cruz	1	0	25
Total	89	659	650
Lower Colorado Recovery Unit			
Pahrnagat	6	40	50
Virgin	7	43	100
Little Colorado	5	9	50
Middle Colorado	20	4	25
Hoover—Parker	6	14	50
Bill Williams	9	39	100
Parker—Southern	16	1	150
International Boundary			
Total	70	150	525

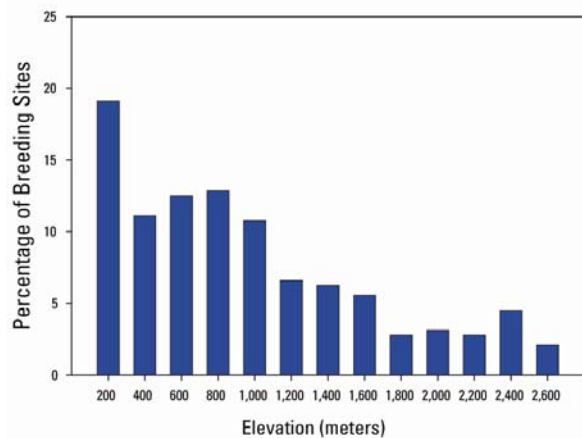


**Table 4.** Currently known number of flycatcher breeding sites, territories (as of 2007 data), and number of territories necessary to meet U.S. Fish and Wildlife Service recovery criteria, by recovery unit and management unit—Continued.

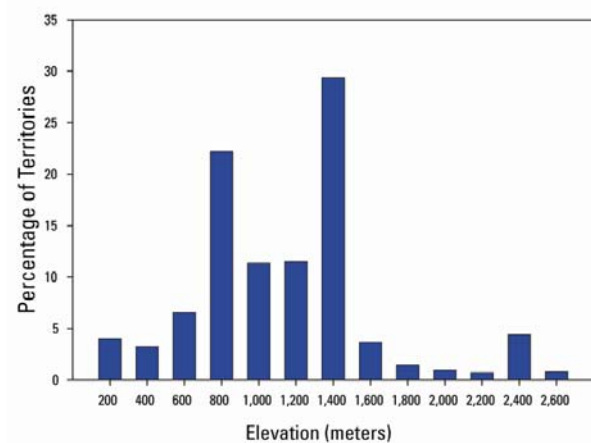
<b>Management unit</b>	<b>Number of sites</b>	<b>Number of territories</b>	<b>Recovery criteria</b>
Rio Grande Recovery Unit			
San Luis Valley	7	56	50
Upper Rio Grande	16	21	75
Middle Rio Grande	8	230	100
Lower Rio Grande	3	2	25
<b>Total</b>	<b>34</b>	<b>309</b>	<b>250</b>
Upper Colorado Recovery Unit			
San Juan	5	10	25
Powell	0	0	25
<b>Total</b>	<b>5</b>	<b>10</b>	<b>50</b>
<b>Grand total</b>	<b>288</b>	<b>1,299</b>	<b>1,950</b>

## Elevation Range of Breeding Territories

The Southwestern willow flycatcher is distributed over a wide elevation range. The majority of breeding sites occur between sea level and 1,000-m elevation (fig. 5A). Most territories are found between sea level and 1,600 m (fig. 5B), with “spikes” at 601–800 m (the Gila/San Pedro River confluence and Roosevelt Lake in Ariz.) and 1,401–1,600 m (the Cliff-Gila Valley in New Mexico). Although relatively few territories are known to occur above 2,000 m, willow flycatchers breed at four sites that are above 2,500 m.



**A.**



**B.**

**Figure 5.** Graphs showing the distribution of Southwestern willow flycatcher by elevation (200=0–200 m, 400=201–400 m, and so forth). **A.** Percentage of flycatcher breeding sites occurring at differing elevations, as of 2007 **B.** Percentage of flycatcher territories occurring at differing elevations, as of 2007.

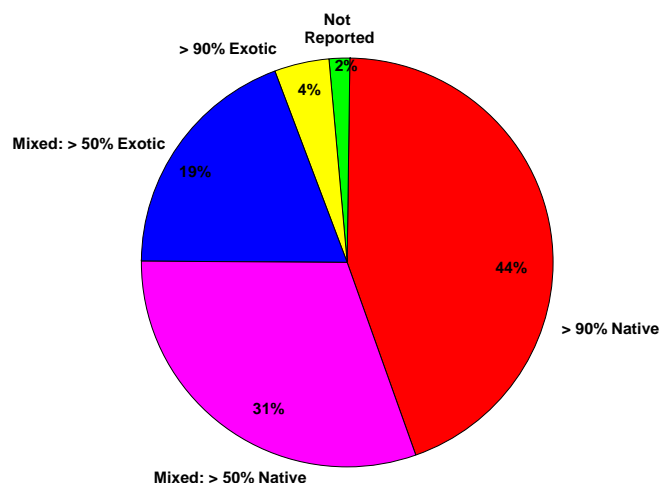
## Use of Native and Exotic Habitats

Most flycatcher breeding sites comprise spatially complex habitat mosaics, often including both exotic and native vegetation. Within a site, territories are frequently clumped or distributed near the patch edge. Thus, the vegetative composition of individual territories may differ from the overall composition of the patch. Depending on the time in the breeding season and the breeding status of an individual, flycatchers may move extensively within a breeding patch, travel between patches, or exploit resources outside of a patch (Cardinal and Paxton, 2005; Cardinal and others, 2006). Therefore, an area much larger than a territory or even a patch may be important to flycatcher breeding success and persistence at a particular site. This concept is supported by recent habitat modeling (Hatten and Paradzick, 2003; Paxton and others, 2007).

Although detailed territory-based habitat measurements are lacking for the majority of Southwestern willow flycatcher breeding sites, an attempt was made to broadly characterize the use of native and exotic habitats. The habitat was classified at each site into one of four broad categories, based on the overall species composition of the tree/shrub layer(s) of the site:

1. Native = >90 percent native vegetation
2. Mixed (>50 percent native) = 50–90 percent native vegetation
3. Mixed (>50 percent exotic) = 50–90 percent exotic vegetation
4. Exotic = >90 percent exotic vegetation

Habitat patches comprising mostly native vegetation account for fewer than half (44 percent) of the known flycatcher territories (fig. 6). Although only 4 percent of territories occur at exotic sites, another 50 percent are located within sites where the habitat includes native/exotic mixtures. Vegetation was not reported for 2 percent of the flycatcher territories. In many of these cases, exotics are contributing significantly to the habitat structure by providing the dense lower strata vegetation that flycatchers prefer.



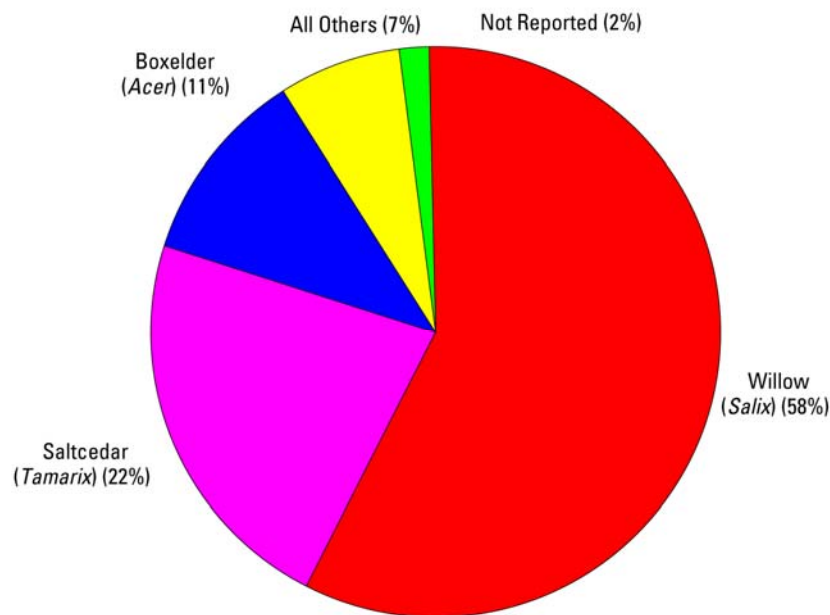
**Figure 6.** Percentage of flycatcher territories occurring within breeding sites of differing compositions of native and exotic vegetation, as of the 2007 breeding season.

## Dominant Tree Species at Breeding Sites

Because of variations in patch-level vegetation, the dominant tree species may differ over the area of a patch and an individual territory within that patch. Despite the general lack of detailed territory-based habitat measurements, it is useful to characterize the dominant tree species within known flycatcher breeding sites.

To characterize the degree to which flycatchers breed in habitats dominated by particular trees, we tallied the number of territories that occur in sites dominated by various tree species. More than half (58 percent) of territories are found at sites where willow (*Salix* spp.) is the dominant tree species (fig. 7). Saltcedar (*Tamarix* spp.) predominates at sites accounting for 22 percent of territories, and box elder (*Acer negundo*) is the dominant tree at sites for 11 percent of territories. Taken together, sites dominated by all other tree species account for only about 7 percent of territories.

The large percentage of territories located in box elder-dominated habitats might suggest that box elder sites are widely used across the Southwestern willow flycatcher's range. However, box elder-dominated breeding habitats occur only in the Cliff-Gila Valley, New Mexico (Stoleson and Finch, 2003).



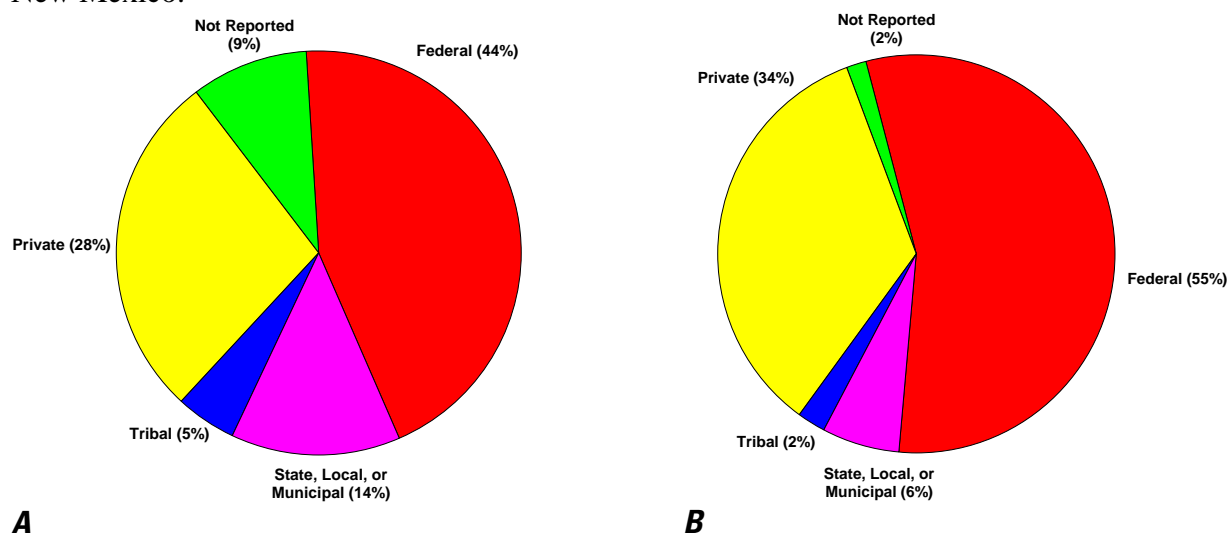
**Figure 7.** Percentage of flycatcher territories occurring within breeding sites dominated by particular tree species during the 2007 breeding season.

## Administration/Management of Sites and Territories

One factor important in conservation and recovery planning is the nature of ownership or administration of a site—for example, whether management of the site is the responsibility of private landowners, the government, or some other entity. This was examined in two ways—first by site, then by territory.

By site (fig. 8A): Of known breeding sites, 44 percent are under Federal Government administration, 28 percent are on privately owned lands, 14 percent are on lands administered by state/local/municipal governments, and 5 percent are administered by Native American tribes.

By territory (fig. 8B): Federal lands account for 55 percent of flycatcher territories; private lands account for 34 percent. This underscores the importance of working with private landowners as flycatcher conservation and recovery efforts proceed. Roughly one-third (32 percent) of the flycatcher territories found on privately owned lands are in the Cliff-Gila Valley, New Mexico.



**Figure 8.** Percentage of flycatcher breeding sites (A) and territories (B) found under different land ownership, as of the 2007 breeding season.

## 2007 Summary

Many new breeding sites and territories have been discovered since the early 1990s as a result of extensive survey efforts throughout the Southwest. In 1993, there were only 140 known territories distributed among 41 breeding sites. The current estimate (as of 2007) is 1,299 territories distributed among 288 sites (note, however, the earlier caution about lack of a standard definition for “site”).

Not all of the 288 known sites are surveyed every year. The total estimated number of known territories (1,299) is based on the most recent survey at each site. At 115 sites surveyed in 2007, there were 930 territories detected.

Most territories are found within small breeding sites (those sites with 5 or fewer territories). There are only 6 sites with 50 or more territories, though this comparison is confounded by the lack of a standard definition of site.

There are 142 sites that at one time had flycatchers since 1993, but as of 2007 do not contain flycatcher territories—almost all were small sites (five or fewer territories). Because these sites had small populations, these territory losses account for only a small percentage of known territories; however, they underscore the vulnerability of small sites.

The states of California, Arizona, and New Mexico make up 89 percent of known flycatcher territories. Nevada, Colorado, and Utah collectively have less than 12 percent of the known territories. No reporting has been received from standardized Southwestern willow flycatcher surveys in Texas; the current status of the flycatcher there is unknown.

Southwestern willow flycatchers are distributed over a wide elevation range, with most from sea level to 1,600 m, but a few sites (n=4) are located above 2,500 m.

Fewer than half (44 percent) of territories are in native habitat, and 23 percent are in habitats having a 50 percent or greater exotic vegetation component. A large percentage of the territories in native habitat occur at one site—the Cliff-Gila Valley in New Mexico. More than 90 percent of territories are in habitats where willow, saltcedar, or box elder is the dominant tree species; flycatchers breed in box elder dominated habitats only in the Cliff-Gila Valley, New Mexico.

Fewer than half (44 percent) of sites are on Federally controlled lands, and 28 percent are on private lands; these privately owned sites account for 34 percent of known territories. Approximately one-third (32 percent) of territories on privately owned sites are found in the Cliff-Gila Valley, New Mexico.

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## Appendix 1. Distribution of Flycatcher Sites and Territories by Year

Data for years prior to 2007 reflect the actual surveys conducted in the year and estimates based on the most recent surveys prior to that year. These updated numbers may differ from past reports. The estimated number of sites and territories is the sum of the actual surveys conducted in a given year plus the results of the most recent surveys conducted in previous years.

**Table 1-1.** Distribution of flycatcher sites and territories by year and state based on both estimated and surveyed values.

[Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

State	Estimated sites and territories				Surveyed sites and territories			
	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year
2007								
Ariz.	124	43.1	459	35.3	56	37.3	292	31.4
Calif.	96	33.3	172	13.2	13	8.7	32	3.4
Colo.	11	3.8	66	5.1	2	1.3	28	3.0
N. Mex.	41	14.2	519	40.0	31	20.7	507	54.5
Nev.	13	4.5	76	5.9	10	6.7	64	6.9
Utah	3	1.0	7	0.5	3	2.0	7	0.8
<b>Total</b>	<b>288</b>		<b>1,299</b>		<b>115</b>		<b>930</b>	
2006								
Ariz.	122	45.5	482	41.4	79	62.2	349	42.0
Calif.	92	34.3	184	15.8	14	11.0	44	5.3
Colo.	10	3.7	38	3.3	1	0.8	0	0.0
N. Mex.	30	11.2	371	31.9	21	16.5	361	43.4
Nev.	12	4.5	82	7.0	10	7.9	70	8.4
Utah	2	0.7	7	0.6	2	1.6	7	0.8
<b>Total</b>	<b>268</b>		<b>1,164</b>		<b>127</b>		<b>831</b>	
2005								
Ariz.	114	43.5	492	41.7	89	59.3	481	48.1
Calif.	91	34.7	186	15.7	21	14.0	47	4.7
Colo.	10	3.8	58	4.9	3	2.0	48	4.8
N. Mex.	33	12.6	374	31.7	25	16.7	365	36.5
Nev.	11	4.2	67	5.7	9	6.0	55	5.5
Utah	3	1.1	4	0.3	3	2.0	4	0.4
<b>Total</b>	<b>262</b>		<b>1,181</b>		<b>150</b>		<b>1,000</b>	
2004								
Ariz.	106	42.7	516	44.7	87	54.0	508	49.1
Calif.	89	35.9	197	17.1	33	20.5	109	10.5
Colo.	10	4.0	51	4.4	7	4.3	47	4.5
N. Mex.	29	11.7	316	27.4	22	13.7	308	29.8
Nev.	11	4.4	68	5.9	9	5.6	56	5.4
Utah	3	1.2	7	0.6	3	1.9	7	0.7
<b>Total</b>	<b>248</b>		<b>1,155</b>		<b>161</b>		<b>1,035</b>	

**Table 1-1.** Distribution of flycatcher sites and territories by year and state based on both estimated and surveyed values—Continued.

[Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

State	Estimated sites and territories				Surveyed sites and territories			
	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year
2003								
Ariz.	105	43.4	420	39.5	92	54.1	412	43.4
Calif.	85	35.1	196	18.4	38	22.4	113	11.9
Colo.	9	3.7	79	7.4	6	3.5	75	7.9
N. Mex.	29	12.0	297	27.9	22	12.9	289	30.5
Nev.	11	4.5	64	6.0	9	5.3	52	5.5
Utah	3	1.2	8	0.8	3	1.8	8	0.8
<b>Total</b>	<b>242</b>		<b>1,064</b>		<b>170</b>		<b>949</b>	
2002								
Ariz.	96	42.9	456	42.7	87	50.3	450	45.9
Calif.	73	32.6	195	18.2	38	22.0	130	13.3
Colo.	10	4.5	60	5.6	9	5.2	59	6.0
N. Mex.	31	13.8	304	28.4	27	15.6	299	30.5
Nev.	11	4.9	49	4.6	9	5.2	37	3.8
Utah	3	1.3	5	0.5	3	1.7	5	0.5
<b>Total</b>	<b>224</b>		<b>1,069</b>		<b>173</b>		<b>980</b>	
2001								
Ariz.	93	43.1	351	41.1	85	43.8	345	41.6
Calif.	83	38.4	220	25.7	73	37.6	206	24.8
Colo.	1	0.5	1	0.1	0	0.0	0	0.0
N. Mex.	24	11.1	207	24.2	21	10.8	202	24.4
Nev.	12	5.6	73	8.5	12	6.2	73	8.8
Utah	3	1.4	3	0.4	3	1.5	3	0.4
<b>Total</b>	<b>216</b>		<b>855</b>		<b>194</b>		<b>829</b>	
2000								
Ariz.	88	42.3	337	39.8	81	42.9	331	40.3
Calif.	74	35.6	185	21.9	65	34.4	171	20.8
Colo.	1	0.5	1	0.1	1	0.5	1	0.1
N. Mex.	31	14.9	257	30.4	28	14.8	252	30.7
Nev.	11	5.3	56	6.6	11	5.8	56	6.8
Utah	3	1.4	10	1.2	3	1.6	10	1.2
<b>Total</b>	<b>208</b>		<b>846</b>		<b>189</b>		<b>821</b>	
1999								
Ariz.	93	49.7	295	36.4	88	50.6	290	36.7
Calif.	66	35.3	193	23.8	60	34.5	184	23.3
Colo.	0	0.0	0	0.0	0	0.0	0	0.0
N. Mex.	22	11.8	300	37.0	20	11.5	295	37.3
Nev.	5	2.7	17	2.1	5	2.9	17	2.1
Utah	1	0.5	5	0.6	1	0.6	5	0.6
<b>Total</b>	<b>187</b>		<b>810</b>		<b>174</b>		<b>791</b>	

**Table 1-1.** Distribution of flycatcher sites and territories by year and state based on both estimated and surveyed values—Continued.

[Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

State	Estimated sites and territories				Surveyed sites and territories			
	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year
1998								
Ariz.	98	57.3	223	33.1	95	58.6	221	33.4
Calif.	41	24.0	137	20.3	37	22.8	131	19.8
Colo.	1	0.6	1	0.1	1	0.6	1	0.2
N. Mex.	21	12.3	262	38.9	19	11.7	257	38.9
Nev.	8	4.7	30	4.5	8	4.9	30	4.5
Utah	2	1.2	21	3.1	2	1.2	21	3.2
<b>Total</b>	<b>171</b>		<b>674</b>		<b>162</b>		<b>661</b>	
1997								
Ariz.	68	50.4	188	30.7	67	51.5	188	31.1
Calif.	38	28.1	118	19.2	36	27.7	115	19.0
Colo.	3	2.2	35	5.7	3	2.3	35	5.8
N. Mex.	20	14.8	243	39.6	18	13.8	238	39.3
Nev.	5	3.7	18	2.9	5	3.8	18	3.0
Utah	1	0.7	11	1.8	1	0.8	11	1.8
<b>Total</b>	<b>135</b>		<b>613</b>		<b>130</b>		<b>605</b>	
1996								
Ariz.	46	45.5	145	30.5	45	45.9	145	30.7
Calif.	27	26.7	118	24.8	26	26.5	117	24.7
Colo.	0	0.0	0	0.0	0	0.0	0	0.0
N. Mex.	25	24.8	208	43.7	24	24.5	206	43.6
Nev.	2	2.0	3	0.6	2	2.0	3	0.6
Utah	1	1.0	2	0.4	1	1.0	2	0.4
<b>Total</b>	<b>101</b>		<b>476</b>		<b>98</b>		<b>473</b>	
1995								
Ariz.	26	40.6	84	24.1	25	40.3	84	24.3
Calif.	18	28.1	89	25.6	18	29.0	89	25.7
Colo.	0	0.0	0	0.0	0	0.0	0	0.0
N. Mex.	18	28.1	172	49.4	17	27.4	170	49.1
Nev.	1	1.6	1	0.3	1	1.6	1	0.3
Utah	1	1.6	2	0.6	1	1.6	2	0.6
<b>Total</b>	<b>64</b>		<b>348</b>		<b>62</b>		<b>346</b>	
1994								
Ariz.	26	48.1	111	30.7	26	49.1	111	30.9
Calif.	10	18.5	84	23.3	10	18.9	84	23.4
Colo.	0	0.0	0	0.0	0	0.0	0	0.0
N. Mex.	18	33.3	166	46.0	17	32.1	164	45.7
Nev.	0	0.0	0	0.0	0	0.0	0	0.0
Utah	0	0.0	0	0.0	0	0.0	0	0.0
<b>Total</b>	<b>54</b>		<b>361</b>		<b>53</b>		<b>359</b>	

**Table 1-1.** Distribution of flycatcher sites and territories by year and state based on both estimated and surveyed values—Continued.

[Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

State	Estimated sites and territories				Surveyed sites and territories			
	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year	Number of sites	Percentage of total sites by year	Number of territories	Percentage of total territories by year
1993								
Ariz.	18	43.9	33	23.6	18	43.9	33	23.6
Calif.	7	17.1	75	53.6	7	17.1	75	53.6
Colo.	0	0.0	0	0.0	0	0.0	0	0.0
N. Mex.	16	39.0	32	22.9	16	39.0	32	22.9
Nev.	0	0.0	0	0.0	0	0.0	0	0.0
Utah	0	0.0	0	0.0	0	0.0	0	0.0
<b>Total</b>	<b>41</b>		<b>140</b>		<b>41</b>		<b>140</b>	

## Appendix 2. List of Extirpated Sites

These are labeled “extirpated” sites, although it is important to recognize that a particular site could become occupied again in the future. If flycatchers are detected at any site in subsequent years, that site will no longer be considered extirpated and will be removed from this list. In past years, 64 sites that were unoccupied for 1 or more years were subsequently reoccupied by flycatchers.

**Table 2-1.** List of the 142 sites that at one time had Southwestern willow flycatcher territories, but were unoccupied as of the most recent survey (zero territories for 1 or more years).

[The most recent survey year is indicated. Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

Site name	Site code	State	Year	Reference
Agua Fria River—Waddell Dam	AFWADA	Ariz.	2007	Stump, written commun., Mar. 2008
Agua Hedionda—Macario Canyon	AHMACA	Calif.	2001	Kenwood, 2008
Amargosa River—Oasis Valley—Springdale	AMOVSP	Nev.	2007	Klinger and Furtek, 2008
Ash Meadows NWR—Carson Slough	AMAMCS	Nev.	2007	Klinger and Furtek, 2008
Bill Williams—Cave Wash	BWCAVE	Ariz.	2007	McLeod, written commun., Apr. 2008
Bill Williams Buckskin	BWBUCK	Ariz.	2006	Graber and others, 2007
Bill Williams Delta Marsh Edge	BWDEMA	Ariz.	2007	McLeod, written commun., Apr. 2008
Bill Williams Gemini	BWGEMI	Ariz.	2007	McLeod, written commun., Apr. 2008
Bluewater Creek	RIBLUE	N. Mex.	2007	Leonard, written commun., Mar. 2008
Canebrake Preserve	KECANE	Calif.	2003	Kenwood, 2008
Colorado River—Adobe Lake	COADOB	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Big Hole Slough	COBHSL	Calif.	2007	McLeod, written commun., Apr. 2008
Colorado River—Cibola SW Landing Strip	COCIBO	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Clear Lake	COCLLA	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Draper Lake	CODRAP	Calif.	2007	McLeod, written commun., Apr. 2008
Colorado River—Ehrenberg	COEHRE	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Ferguson Lake	COFERG	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Gila Confluence 1	COGILA	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Grand Canyon RM 28-29	COGC29	Ariz.	2005	English and others, 2006
Colorado River—Grand Canyon RM 50-51 L	COGC50	Ariz.	2005	English and others, 2006
Colorado River—Grand Canyon RM 65.3 L	COGC65	Ariz.	2004	Munzer and others, 2005
Colorado River—Grand Canyon RM 71 L	COGC71	Ariz.	2005	English and others, 2006
Colorado River—Grand Cyn RM 246 L	CO246L	Ariz.	2006	Graber and others, 2007
Colorado River—Grand Cyn RM 259.5 L	CO259L	Ariz.	2005	English and others, 2006

**Table 2-1.** List of the 142 sites that at one time had Southwestern willow flycatcher territories, but were unoccupied as of the most recent survey (zero territories for 1 or more years)—Continued.

[The most recent survey year is indicated. Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

Site name	Site code	State	Year	Reference
Colorado River—Grand Cyn RM 263-262 L	CO263L	Ariz.	2004	Munzer and others, 2005
Colorado River—Grand Cyn RM 265-263 L	CO265L	Ariz.	2003	Smith and others, 2004
Colorado River—Grand Cyn RM 268-264 R	CO268R	Ariz.	2004	Munzer and others, 2005
Colorado River—Grand Cyn RM 268-265 L	CO268L	Ariz.	2003	Smith and others, 2004
Colorado River—Grand Cyn RM 270-268 L	CO270L	Ariz.	2003	Smith and others, 2004
Colorado River—Grand Cyn RM 272-268 R	CO272R	Ariz.	2004	Munzer and others, 2005
Colorado River—Grand Cyn RM 273-270 L	CO273L	Ariz.	2002	Smith and others, 2003
Colorado River—Grand Cyn RM 277-273 L	CO277L	Ariz.	2007	Stump, written commun., Mar. 2008
Colorado River—Hoge	COHOGE	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Lake Mead Delta	COMEAD	Ariz.	2007	Stump, written commun., Mar. 2008
Colorado River—Martinez lake	COMALA	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Miles 257.5 to 257.0 R	CO257R	Ariz.	2005	English and others, 2006
Colorado River—Mittry Lake	COMITT	Ariz.	2007	McLeod, written commun., Apr. 2008
Colorado River—Picacho East	COPICA	Calif.	2007	McLeod, written commun., Apr. 2008
Colorado River—Taylor Lake	COTAYL	Calif.	2005	Kenwood file, May 2007
Colorado River—Trampas Wash	COTRAM	Calif.	2005	Kenwood file, May 2007
Colorado River—Walker Lake	COWALK	Calif.	2005	Kenwood file, May 2007
Colorado River Blankenship	COBLAN	Ariz.	2006	Graber and others, 2007
Coyote Creek	CNCOYO	N. Mex.	2007	Leonard, written commun., Mar. 2008
Coyote Creek—Guadalupe Bridge	CNGUBR	N. Mex.	2007	Leonard, written commun., Mar. 2008
Coyote Creek—Guadalupe North	CNGUNO	N. Mex.	2007	Leonard, written commun., Mar. 2008
De Luz Creek—Camp Pendleton	SMDELU	Calif.	2006	Kenwood file, May 2007
Gila River—Dysart Road	GIDYSA	Ariz.	2003	Smith and others, 2004
Gila River—Earven Flat	GIEAFL	Ariz.	2005	English and others, 2005
Gila River—Fort Thomas Bridge	GIFTBR	Ariz.	1994	Paradzick and others, 2001
Gila River—Fortuna Wash	GIFOWA	Ariz.	2007	McLeod, written commun., Apr. 2008
Gila River—GRN 033	GIGN33	Ariz.	2006	Graber and others, 2007
Gila River—GRS005	GIGS05	Ariz.	2007	Stump, written commun., Mar. 2008
Gila River—GRS009	GIGS09	Ariz.	2007	Stump, written commun., Mar. 2008
Gila River—GRSN031	GIGI31	Ariz.	2006	Graber and others, 2007
Gila River—Guthrie	GIGUTH	Ariz.	2006	Graber and others, 2007
Gila River—San Jose	GISAJO	Ariz.	2001	Smith and others, 2002

**Table 2-1.** List of the 142 sites that at one time had Southwestern willow flycatcher territories, but were unoccupied as of the most recent survey (zero territories for 1 or more years)—Continued.

[The most recent survey year is indicated. Ariz. = Arizona; Calif. = California; Colo. = Colorado; N. Mex. = New Mexico; and Nev. = Nevada.]

Site name	Site code	State	Year	Reference
Gila River—Smithville Canal	GISMIT	Ariz.	1997	McCarthy and others, 1998
Gila River—Solomon NW	GISONW	Ariz.	2007	Stump, written commun., Mar. 2008
Gila River—Whitlow Dam	GIWHDA	Ariz.	2006	Graber and others, 2007
Gila River GRN010	GIGN10	Ariz.	2007	Stump, written commun., Mar. 2008
Gila River GRN011	GIGN11	Ariz.	2000	Paradzick and others, 2001
Gila River GRN015	GIGN15	Ariz.	2002	Smith and others, 2003
Gila River GRN020 (Kelvin Bridge)	GIGN20	Ariz.	2007	Stump, written commun., Mar. 2008
Gila River GRS012	GIGS12	Ariz.	2007	Stump, written commun., Mar. 2007
Gila River GRS013	GIGS13	Ariz.	2003	Smith and others, 2004
Gila River GRS015	GIGS15	Ariz.	2002	Smith and others, 2003
Holcomb Creek—Little Bear Springs	MOLBRS	Calif.	2004	Kenwood, 2005
Kanab Creek—Town of Kanab	COKANB	Utah	2007	Day, 2008
Lake Havasu—Neptune	COHAVA	Ariz.	2006	Graber and others, 2007
Las Flores Creek	LFLAFL	Calif.	2007	Kenwood file, Apr. 2008
Meadow Valley Wash—Site 1	MVMV01	Nev.	2006	Klinger and Furtek, 2007
Mimbres River—Highway 152 to San Juan	MIDISE	N. Mex.	2007	Leonard, written commun., Mar. 2008
Mojave River—Oro Grande	MOORGR	Calif.	2004	Kenwood file, Sept. 2005
Mojave River, Upper Narrows	MOUPNA	Calif.	2006	Kenwood file, May 2007
Mojave River, Victorville I-15	MOVICT	Calif.	2004	Kenwood file, Sept. 2005
Nelson Reservoir	LCNERE	Ariz.	2006	Graber and others, 2007
Pahrnagat River—Crystal Springs	PACRSP	Nev.	2007	Klinger and Furtek, 2008
Parkview Fish Hatch	CHPARK	N. Mex.	2001	Williams, written comm., 2002
Rio Grande—Casa Colorado	RIRGCC	N. Mex.	2007	Leonard, written commun., Mar. 2008
Rio Grande—Hot Creek SWA	RIHTSW	Colo.	2004	Ecosphere Environmental Services, 2006
Rio Grande—San Acacia to Bosque Refuge	RIRGSA	N. Mex.	2007	Leonard, written commun., Mar. 2008
Rio Grande Orilla Verde	RIORIL	N. Mex.	2007	Leonard, written commun., Mar. 2008
Rio Grande Taos Junction Bridge	RITAOS	N. Mex.	2007	Leonard, written commun., Mar. 2008
Rio Grande Velarde-El Guique	RIELGU	N. Mex.	2002	Williams, written commun., Mar. 2003
Rio Grande Velarde-Garcia Acequia	RIGARC	N. Mex.	2007	Leonard, written commun., Mar. 2008
Rio Grande Velarde-La Canova	RILACA	N. Mex.	2007	Leonard, written commun., Mar. 2008

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Site name	Site code	State	Year	Reference
Rio Grande Velarde-La Rinconada	RILARI	N. Mex.	2007	Leonard, written commun., Mar. 2008
Salt River—School House Point N	SRSCHN	Ariz.	2006	Graber and others, 2007
Salt River—School House Point S	SRSCHS	Ariz.	2006	Graber and others, 2007
Salt River Inflow—Roos Lk: Lakeshore	SRLAKE	Ariz.	2006	Graber and others, 2007
San Diego Creek—Laguna Lakes	SGLALA	Calif.	2004	Kenwood, 2004
San Dieguito River	SDSADI	Calif.	2004	Kenwood, 2005
San Gabriel River	SBSAGA	Calif.	2005	Kenwood, 2006
San Juan Creek—Canada Gobernadora	SUCAGO	Calif.	2004	Kenwood, 2005
San Juan Creek—La Novia Bridge	SUNOBR	Calif.	2005	Kenwood, 2006
San Juan River—Shiprock	SJSHIP	N. Mex.	1999	Fitzgerald, unpub. data
San Luis Rey River—Agua Caliente Creek	SLACCR	Calif.	2001	Kenwood, 2008
San Luis Rey River—Guajome Lake	SLGUAJ	Calif.	2007	Kenwood, 2008
San Luis Rey River—Pilgrim Creek	SLPILG	Calif.	2007	Kenwood, 2008
San Luis Rey River, Couser Cyn	SLCOUS	Calif.	2003	Kenwood, 2005
San Pedro River—Apache Powder Rd	SPAPPO	Ariz.	2004	Munzer and others, 2005
San Pedro River—Bingham Cienega	SPBICI	Ariz.	2005	English and others, 2006
San Pedro River—Cagage Wash	SPCAWA	Ariz.	2005	English and others, 2006
San Pedro River—Hereford Bridge	SPHEBR	Ariz.	2006	Graber and others, 2007
San Pedro River—Indian Hills	SPINHI	Ariz.	2005	English and others, 2006
San Pedro River—Malpais Hill	SPMAHI	Ariz.	2005	English and others, 2006
San Pedro River—Soza Wash	SPSOWA	Ariz.	2003	Smith and others, 2004
San Pedro River, SR 90	SPSR90	Ariz.	2006	Graber and others, 2007
Santa Ana River—Bear Creek	SABEAR	Calif.	2004	Kenwood, 2005
Santa Ana River—City Creek	SACICR	Calif.	2002	Kenwood, 2005
Santa Ana River—Deer Creek	SADEER	Calif.	2004	Kenwood, 2005
Santa Ana River—East Etiwanda Creek	SAEECR	Calif.	2001	Kenwood, 2006
Santa Ana River—Featherly Regional Park	SAFEAT	Calif.	2001	Kenwood, 2005
Santa Ana River—La Cadena to Waterman	SALACA	Calif.	2004	Kenwood, 2005
Santa Ana River—Metcalf Creek	SAMECR	Calif.	2004	Kenwood, 2006
Santa Ana River—Mtn Home Village	SAMTNH	Calif.	2004	Kenwood, 2006
Santa Ana River—Rattlesnake Creek	SARTSN	Calif.	2004	Kenwood, 2005
Santa Ana River—San Timoteo Creek	SASNTI	Calif.	2006	Kenwood, 2007
Santa Ana River—SR 38 Bridge Crossing	SA38BC	Calif.	2005	Kenwood, 2007
Santa Ana River—Strawberry Creek	SASTCR	Calif.	2000	Kenwood, 2008
Santa Ana River—Van Dusen Canyon	SAVDCA	Calif.	2002	Kenwood, 2005
Santa Ana River—Waterman Creek	SAWACR	Calif.	2001	Kenwood, 2008
Santa Clara River—Arco/Four Corners	STARCO	Calif.	2005	Kenwood, 2006
Santa Clara River—Fillmore Fish Hatch	STFILL	Calif.	2002	Kenwood, 2005
Santa Clara River—San Francisquito Creek	STSFQR	Calif.	2001	Kenwood, 2006
Santa Clara River—Saticoy	STSATI	Calif.	2003	Kenwood, 2005
Santa Clara River—Soledad Canyon	STSOCA	Calif.	2004	Kenwood, 2005
Santa Clara River—Upper Piru Creek	STUPPI	Calif.	2006	Kenwood, 2007



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Site name	Site code	State	Year	Reference
Santa Cruz River—Cienega Creek	SZCICR	Ariz.	2006	Graber and others, 2007
Santa Margarita River—Fallbrook Creek	SMFALL	Calif.	2007	Kenwood, 2008
Santa Maria River, Lower	SNSMLO	Ariz.	2005	English and others, 2006
Santa Ynez River—Gibraltar	SYGIBR	Calif.	2002	Kenwood, 2005
Santa Ynez River—Lompoc	SYLOMP	Calif.	2003	Kenwood, 2005
Santa Ysabel Creek—Tim's Canyon	SDTICA	Calif.	2002	Kenwood, 2005
Sulphur Creek	PHSUCR	Calif.	2003	Kenwood, 2008
Sweetwater Reservoir	SWSWRE	Calif.	2006	Kenwood, 2007
Temecula Creek—Aguanga	TEAGUA	Calif.	2001	Kenwood, 2005
Verde River—Camp Verde	VECAVE	Ariz.	2007	Stump, written commun., Mar. 2008
Verde River—Davenport	VEDAWA	Ariz.	2006	Graber and others, 2007
Verde River—Tavasci Marsh	VETAVA	Ariz.	1999	Paradzick and others, 2000
Verde River—Tuzigoot Bridge	VETUZI	Ariz.	2006	Graber and others, 2007
Virgin River at St. George	VIGIOR	Utah	2007	Day, 2008

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