

PETITION TO LIST THE  
SOUTHWEST WILLOW FLYCATCHER  
*Empidonax traillii extimus*  
AS A FEDERALLY ENDANGERED SPECIES

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Forest Guardians

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Mr. Manuel Lujan  
Secretary of the Interior  
Office of the Secretary  
Department of the Interior  
18th and "C" Street, N.W.  
Washington, D.C. 20240

Kieran Suckling, David Hogan, Robin Silver, the Biodiversity Legal Foundation, Friends of the Owls, and Forest Guardians hereby formally petition to list the Southwest Willow Flycatcher (*Empidonax traillii extimus*) as endangered pursuant to the Endangered Species Act, 16 U.S.C. 1531 et seq. (hereafter referred to as "ESA"). This petition is filed under 5 U.S.C. 553(e) and 50 CFR 424.14 (1990), which grants interested parties the right to petition for issue of a rule from the Assistant Secretary of the Interior.

Petitioners also request that Critical Habitat be designated for the Southwest Willow Flycatcher concurrent with the listing, pursuant to 50 CFR 424.12, and pursuant to the Administrative Procedures Act (5 U.S.C. 553).

Due to the fact that very few Southwest Willow Flycatchers remain, that the subspecies has suffered precipitous declines in recent years, and that habitat destruction with associated anthropogenic effects is ongoing and impending, we appeal for emergency listing and emergency critical habitat pursuant to ESA 4(b)7 and 50 CFR 424.20 in order to sustain the subspecies in the very immediate future.

Petitioners understand that this petition action sets in motion a specific process placing definite response requirements on the U.S. Fish and Wildlife Service and very specific time constraints upon those responses.

#### Petitioners

Kieran Suckling is a Doctoral Candidate, Mexican spotted owl (*Strix occidentalis lucida*) field researcher, and conservationist who has extensively studied the status and natural history of the Southwest Willow Flycatcher. He lives in the vicinity of one of the few remaining Southwest Willow Flycatcher breeding areas.

David Hogan is conservationist and coordinator of the San Diego Biodiversity Project. He is monitoring the destruction of southern California's riparian ecosystems and the resulting detrimental effects on numerous sensitive bird species. He lives in the vicinity of one of the few remaining Southwest Willow Flycatcher breeding areas.

Robin Silver, MD. is a conservationist with a long history of interest in the protection of southwestern birds and the dwindling habitats on which they depend.

The Biodiversity Legal Foundation is a non-profit public interest organization dedicated to the preservation of all native wild plants and animals, communities of species, and naturally functioning ecosystems in this country. Through visionary educational, administrative, and legal actions, the BLF endeavors to encourage improved public attitudes and policies for all living things.

Friends of the Owls is a non-profit conservation group dedicated to the study and preservation of Southwestern raptors and the canopied woodlands upon which they depend.

Forest Guardians is actively protecting the American Southwest's remaining forest ecosystems through education, Forest Service appeals, lawsuits, and other means.

## Executive Summary

The Southwest Willow Flycatcher is one of three allopatric Willow Flycatcher subspecies breeding in the American Southwest. Though all three have suffered population losses, the Southwest Willow Flycatcher has declined the most dramatically (Schlorff 1990b). It is in fact, the most endangered riparian obligate bird in the Southwest (Hunter 1988), more endangered even, than Least-bell's Vireo (*Vireo bellii pusillus*) and Bald eagle (*Haliaeetus leucocephalus*), both of which are already federally listed.

As far back as 1987, the Southwest Willow Flycatcher was known to be on extinction's very edge. Noted ornithologist, Phillip Unitt, declared:

"The available evidence indicates that the population of *extimus* has declined precipitously and that the subspecies is now rarer than many other birds formally designated as endangered...it has dwindled nearly to extinction as the habitat on which it depends has been degraded and decimated" (Unitt 1987).

Unitt estimated that only 500 pairs, scattered about 41<sup>1</sup> widely separated locations, existed at that time. Only four of those locations had recently supported more than 5 bird pairs. He estimated 87 known pairs in California, several dozen in Arizona and several hundred in New Mexico. He was able to determine no trend in the "past few years," but concluded that the subspecies population was "clearly much smaller now (1987) than 50 years ago."

Much has changed in the intervening 4 and a half years. Of the 41 sites he determined to be definite or possible breeding locations, 10 are now known to have been abandoned and another 8 are probably abandoned (see Section VII). One additional breeding site, and one abandoned breeding site have been discovered. The net total translates to a loss of between 25.6 and 41.9 percent of Unitt's 1987 estimate. Of the 4 sites he identified as supporting more than 5 pairs, one dropped from a high of 11 pairs in 1987 to only 2 separated pairs in 1991 (Brown 1991); one decreased 25% between 1990 and 1991, and is expected to decrease another 16 to 32 percent in 1992 (Laymon pers. comm.); and one has not recently been surveyed but is suspected of having declined by both the New Mexico Department of Game and Fish and a noted ornithologist from the Gila Valley area (Hubbard pers. comm., Zimmerman pers. comm.).

Though California has lost a number of breeding sites since 1987, it may have retained its 87 pairs due to an increase at one site. The Arizona estimate has dropped from several dozen to 10 or 12 (see Section VII). Where Hubbard (1987) previously estimated several hundred breeding pairs in New Mexico, he now suspects there are less than 100 (pers. comm.). Dale Zimmerman believes the number be more in the range of 50 to 75 (pers. comm.). In all, there are at most 150-170 known pairs of Southwest Willow Flycatchers<sup>2</sup> and probably no more than 300 pairs in existence.

Given current population declines, the Southwest Willow Flycatcher may well become extinct by 1995 or 2000 (Zimmerman pers. comm.).

Though Southwest Willow Flycatchers have been known to nest in tamarisk (*Tamarix chinensis*) thickets, their preferred nesting habitat is mature Fremont cottonwood (*Populus fremontii*)/Gooding willow (*Salix goodingii*) forests along still or slow moving watercourses. These forests have a well developed cottonwood overstory, a mixed midstory, and a thick willow understory. At one time lining the rivers and creeks of the Southwest like a green ribbon of life, these bosques are today North America's rarest forest type (Nature Conservancy 1987). Grazing, dams, vegetation clearing, agriculture and development have decimated the Southwest's riparian areas, and with them, riparian obligate species such as the Southwest Willow Flycatcher.

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<sup>1</sup>Unitt actually counted 43 localities, but we have combined two with other localities because of their nearness to one another.

<sup>2</sup>As this figure assumes all singing birds are paired males, while it is known that not all males are paired and that females sometimes sing, the actual number is certainly less.

The Southwest Willow Flycatcher is listed as Endangered by the California Department of Fish and Game (1990), the Arizona Game and Fish Department (1988) and the New Mexico Department of Game and Fish (group 2, 1988). The U.S. Forest Service classifies the Southwest Willow Flycatcher as "Sensitive" in Regions Three (1988) and Five (1984). It was made a candidate for federal listing under the Endangered Species Act with a category 2 classification in 1986 and was uplisted to a category 1 in 1991.

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## I. CLASSIFICATION AND NOMENCLATURE

**Scientific Name.** *Empidonax traillii extimus* (Phillips) was first recognized as a subspecies by Phillips (1948) and Aldrich (1951). Although Phillips held that there were four subspecies while Aldrich held that there were five, both recognized *extimus*. Every taxonomic study since has recognized the subspecific validity of *extimus*. Its exclusion from the AOU's 1957 Checklist of North American Birds was an "oversight" (Laymon per. comm.).

Study of intraspecific flycatcher variation was disrupted when Stein (1958, 1963) demonstrated that *E. traillii* was actually two sibling species, *E. alnorum* and *E. traillii*. Unitt (1987) recently reconfirmed the existence of *E. t. extimus* as a well defined subspecies using the '75% rule.' A more restrictive method than measuring the statistical significance of differences between population means used in other taxonomic studies, the 75% rule states that for population A to be considered a subspecies distinct from population B, 75% of the individuals of population A should overlap with no more than 3% of the individuals of population B. In addition to *extimus*, Unitt distinguished *brewsteri*, *traillii*, and *adastus* as subspecies.

All current Willow Flycatcher researchers acknowledge the subspecific validity of *E. t. extimus*. It is recognized by USFWS Museum Specialist, Ralph Browning (per. comm 1992); USFWS Endangered Species Ornithologist, James Lewis (Lewis 1989); authority on flycatcher taxonomy, Dr. Ned Johnson of the University of California at Berkley (Lewis, 1989); and Alan Phillips (Browning per. comm.). It is also recognized by Arizona Game and Fish, California Fish and Game, New Mexico Game and Fish and the U.S. Fish and Wildlife Service.

**Common Name.** Birds of the genus *Empidonax* (family *Tyrannidae*) are commonly called "Flycatchers". Prior to 1958, *Empidonax traillii* was known as "Traill's flycatcher". Following Stein (1958, 1963), *E. traillii* came to be known as the "Willow Flycatcher" or "Little flycatcher" and *E. alnorum* the "Alder flycatcher". The subspecies in question, *E. t. extimus*, may be referred to as the "Southwestern Willow Flycatcher" or the "Southwest Willow Flycatcher". Because of the difficulty of distinguishing subspecies in the field, observers frequently refer only to the species name, "Willow Flycatcher," and rarely, to the more archaic, "Traill's flycatcher".

## II. SUBSPECIES DESCRIPTION

**General Nontechnical Description.** Southwest Willow Flycatcher is a moderately large, broad-billed member of the genus *Empidonax* measuring about 5<sup>3/4</sup>" including the tail. It has conspicuous light colored wing bars and lacks the distinct eyering found in other Flycatcher species. Upperparts are brownish-olive to gray-green, throat whitish, breast pale olive, and abdomen yellowish. While perched, Southwest Willow Flycatcher flicks its tail slightly upward. It is most easily distinguished from related Flycatcher species by song- usually a burry "fitz-bew," and less often a rough "rrrip," large bill, and pale throat. The four subspecies of Willow Flycatchers, however, are nearly impossible to tell apart on the basis of casual observation. They are most commonly distinguished in the field by their breeding range.

**Technical Description.** The Southwest Willow Flycatcher is distinguished by color and wing structure (Aldrich 1951, Oberholser 1974, Phillips 1948, Snyder 1953, Wetmore 1972, Unitt 1987). Unitt (1987) and Hubbard (1987) provide concise reviews.

The dorsum of *extimus* and *traillii* is a pale grayish green (color 43) in comparison to *brewsteri* which is dark brownish olive (color 48) and *adastus* which is a dark grayish green (color 49). *Extimus* and *adastus* tend toward the pale and dull whereas *traillii* and *brewsteri* tend toward the dark and bright. The noticeable contrast between darker back and paler cap in *brewsteri* and *adastus* is quite subtle in *extimus* and *traillii*. The underparts of *extimus* and *traillii* are often paler than those of *brewsteri* and *adastus*. *Extimus* has a pale yellow abdomen where that of *traillii* is a lighter hue.

Comparing the relative lengths of the 10th and 5th primaries, Unitt (1987) was able to distinguish 93% of *extimus* and *traillii*, 88% of *adastus* and *traillii*, and 89% of *brewsteri* and *traillii*.

### III. DISTRIBUTION

The current range of the Southwest Willow Flycatcher is somewhat diminished from its known former range. Based on an exhaustive examination of skins, Unitt (1987) presented a picture of its current and historical range. It formerly bred from northern Baja California up through Inyo Co., California in the eastern part of its range and across northern New Mexico and southern-most Nevada and Utah in the north. There are no records from southern Colorado, but it may well have bred there also. The eastern edge of its range lies between the Rio Grande and the Pecos River. It may breed as far south of Big Bend National Park, though records from there are questionable. There are two records from northern Sonora.

The Southwest Willow Flycatcher has withdrawn from the edges of its historic range. Birds with a narrow range of habitat requirements tend to be even more selective at the edges of their range and so are more susceptible to habitat disturbances there. It has not been recorded in Nevada, Utah, Texas or Sonora since 1969 and may well be extirpated from Baja California as well. It no longer occurs in western Arizona, effectively fragmenting its range into an eastern and western portion. Populations in both northern and southern Arizona have been reduced to scattered pairs. It has disappeared from the southern, and is declining in the middle portion of the Rio Grande in New Mexico, but seems to have maintained its historic range elsewhere in the state.

The Southwest Willow Flycatcher winters in El Salvador (Rio San Miguel and Lake Olomega), Nicaragua (Greytown), Costa Rica (Bebedero), Panama (Bocas del Toro; San Felix, Chiriqui; Gatun, Canal Zone; Portobelo, Colon; and El Real, Darien) and rarely in Colombia (Turbaco, Choco, La Raya, Norosi, Pueblo Nuevo, Nazaret, Honda, and Magdalena River) (Phillips 1948; Gorski 1969, 1971; Wetmore 1972; Fitzpatrick 1980).



#### IV. Biology

**Migration.** Hunter (1991) suggests that Southwest Willow Flycatcher can be strongly differentiated into an integradated montane group, and a non-integradated, low elevation "core" group. The latter, he says, arrives at breeding sites in late April, significantly later than the former which do not arrive until late May or early June. He correlates the difference with leaf-out times.

I have only been able to find two records of April arrival: one on the lower Colorado River (April 28th), probably well below 1,000 feet (Grinnell 1914); and one at Weldon (April 30th), well above 2,000 feet, (McCaskie 1977). Phillips et al. (1964) found Southwest Willow Flycatchers arriving at lower elevation breeding sites in southern California and Arizona in the first week of May. But the subspecies has also been recorded arriving in the Gila Valley, (over 5,000 feet) in the first week of May (Unitt 1987), while it does not arrive in the Grand Canyon (2,625-2,800 feet) until mid-May (Unitt 1987). I have found no records of June arrival.

It does not appear then, that a strong differentiation can be made between low elevation and high elevation populations based on Spring arrival dates. It may be true, however, that arrival at very high elevations, such as Alpine and Greer, is delayed.

Autumn migration begins in late July, continuing into mid September. Adults may leave earlier than young because they delay molting until arrival on their wintering grounds whereas the young molt prior to migration.

**Reproduction.** Southwest Willow Flycatchers are open-cup nesters. Nests made of shredded bark, cattail tufts, and grasses lined with fine grasses and feathers, are usually built in the fork of a willow (Johnson 1989a). They can occasionally be found in the lower branches of large tree.

Buff eggs, dark on one end, are laid from early June through early July. Average clutch sizes of 4 eggs laid in 4 days have been reported for Willow Flycatchers in Washington state (Bent 1963, Walkinshaw 1966). Brown (1988) found 82% of Southwest Willow Flycatcher nests in the Grand Canyon, on the other hand, to contain 3 eggs, while Hubbard (1987) reports a mean clutch size of 2.25 in New Mexico. In coastal California clutches commonly have 3 to 4 eggs (Unitt 1987). Two or more clutches, with the number of eggs per clutch declining as a result, are often laid in response to Brown-headed Cowbird (*Molothrus ater*) parasitism.

Incubation time for Willow Flycatchers in Washington averages 12 days and nestling time, 12.5 days (King 1955).

Current breeding populations in New Mexico rarely exceed 3 pairs, though populations of 10 or more have been reported (Hundartmark 1978). The Southwest Willow Flycatcher is a loosely colonial, territorial bird (Johnson 1989a, Hunter 1989, Zimmerman pers. comm.) and it is possible that breeding population sizes are affected by habitat availability. As suitable habitat is currently quite limited, it is difficult to ascertain "normal" breeding population sizes. Large amounts of suitable habitat on the Kern River has remained unoccupied (Laymon pers. comm.), and to a lesser extent, in the Grand Canyon as well (Brown 1991). Both populations have suffered tremendous declines recently, however, and the Grand Canyon offers less than ideal habitat, so it is again difficult to ascertain "normal" density and use levels.

**Mortality.** Nice (1957) reported a 46% egg-to-fledgling success rate in open-cup nesting birds. Among Willow Flycatchers in California (*brewsteri* subspecies), on the other hand, Sanders and Flett (1989) recorded a 19% egg-to-fledgling success rate. Stafford and Valentine (1985) also reported low *brewsteri* egg-to-fledgling success rates of 25% and 38% during two years of study. Whitfield (1991) and Laymon (pers. comm.) reported Southwest Willow Flycatcher nesting success rates of 25.8%, 18.3% and 16% on the Nature Conservancy Kern River Preserve in 1989, 1990 and 1991 respectively. The decline coincided increased depredation rates and with rising Brown-headed Cowbird parasitism rates of 50%, 55% and 75.6% in the same years (Laymon pers. comm.).

Assuming a "conservative" 50% mortality rate for young and adult Willow Flycatchers in the Sierra Nevada (*brewsteri* subspecies), Schlorff (1990b) estimated a net replacement rate of approximately .5%. Noting that replacement rates of less than 1 indicate a declining populations (Wilson and Bossert 1971), Schlorff concluded that the "low net replacement rate indicates the extreme vulnerability of the state's (California) remaining Willow Flycatcher populations to local extinction." As *extimus* replacement rates are lower than those of *brewsteri*, its susceptibility to local extinction is even greater.

Lower elevation breeding birds such as *extimus* are more heavily parasitized than high elevation birds such as *brewsteri* (Hunter 1991, Rosenberg et al. 1991).

**Foraging Techniques.** Willow Flycatchers are entirely insectivorous, either hawking prey in the air or gleaning prey from tree limbs (Verbeek 1975). Males tend to perch high, generally above 10 ft, while females perch and forage in lower, protected willow branches (Sanders and Flett 1989). Frakes and Johnson (1982) reported average *brewsteri* foraging flight distance from perches to be 13 ft, while Schlorff (1990b) observes that most hawking flights are less than three feet. Willow Flycatchers shift perches every few minutes and will occasionally forage from perches outside their territories (Sanders and Flett 1989).

Prey species are usually flies, gnats, mosquitoes and other terrestrial or aquatic insects (Schlorff 1990b).

**Territory/Colony Size.** Little is known about Southwest Willow Flycatcher territory sizes. They are a loosely colonial bird, however, probably preferring enough suitable nesting habitat for multiple territories. Brown (1991) found Southwest Willow Flycatchers to show a distinct preference for the relatively large patches of suitable habitat along an 86 mile stretch of the Colorado River. One nest was located in 3.1 ha patch and one in a 2.8 ha patch. Neither patch supported more than 1 pair. Smaller suitable habitat patches were unoccupied. Laymon (pers. comm.) estimated territory sizes of 1-2 acres on the Kern River.

*E.t. brewsteri* mating territory sizes in California range from 1.45 to 2.19 acres, averaging .84 acres (Sanders and Flett 1989). Nearby suitable habitat was undefended and unoccupied. Territories rarely overlap or share common borders. Stafford and Valentine (1985) found *E.t. brewsteri* territory sizes in the southern Sierra to range between .22 and .94 acres, averaging .48 acres. 73 Willow Flycatchers in Michigan had an average territory size of 1.74 acres.

Both male and female Willow Flycatchers of the *brewsteri* subspecies spend most of their time within their territories, but will forage in adjacent areas, especially when feeding young (Sanders and Flett 1989). Both males and females regularly use perches outside their defended territory throughout the breeding season. Average distance of perches from territories was 62 ft and ranged from 13 to 94 ft. While feeding nestlings and fledglings, *brewsteri* foraged as far as 330 ft from their territory (Sanders and Flett 1989).

## V. Habitat Requirements

**Elevation.** Formerly, Southwest Willow Flycatcher was known as a common breeding bird in middle and lower-elevation riparian woodlands, though it was found locally at higher elevations as well (Unitt 1987). In Arizona, it was found most often in the Sonoran Zone, and very locally, in the Transition Zone (Phillips et al. 1983). In southern California, it was common along the Pacific coast (Willet 1912, 1933) and along the lower Colorado River (Unitt 1987), with scattered pairs at higher elevations.

In recent years, it has become almost completely absent from low elevation riparian areas away from the Pacific coast. In New Mexico it is entirely extirpated from the lower Rio Grande Valley, no longer breeding there below 4,600 feet (Bernardo area). It is holding on, however, at elevations above 5,000 feet in the upper and middle Rio Grande, and in the mountains along the western border. In Arizona, there are only four recent breeding sites below 3,000 feet, all of them quite small. One of the sites (Grand Canyon) has declined nearly to the point of extinction since 1987. The other three sites (Fort Thomas, Dudleyville, and San Manuel) have not been surveyed since 1986. There are a number of recent reports of individual pairs breeding in the White Mountains from 7,000 to 8,000 feet. It no longer occurs along the lower Colorado River in California, but does breed along the Pacific coast and at one site at the southern tip of the Sierra Nevada (Kern River, 2,300-2,650 feet). The combination of a cooler climate and more intensive conservation efforts may be responsible for the continued occupation of low elevation sites in southwestern and southcentral California.

The extirpation of the Southwest Willow Flycatcher from what was apparently its favored elevation range, corresponds quite closely with the decimation of low elevation cottonwood/willow riparian forests. Grazing, dams and agricultural development have denuded low elevation waterways to point of no longer being riparian areas at all in many cases. The relation of predation, cowbird parasitism and tamarisk invasion to deforestation and elevation will be dealt with later.

**Vegetative Community.** In Arizona, Phillips et al. (1983) describe the Southwest Willow Flycatcher as a breeder of "dense willow associations and buttonbush swamps," while Johnson (1989a) remarked on its affinity for "dense willow-cottonwood thickets and woodlands along streams and rivers." In the Greer area, it breeds in willow thickets (pers. obser.).

At lower elevations in New Mexico, it is associated with an overstory of Fremont cottonwood and Rio Grande cottonwood (*P. wislizenii*), and an understory of Goodings willow, box-elder, tamarisk, Russian olive (*Eleagnus angustifolia*) and, locally, water birch (*Betula occidentalis*) (Hubbard 1987). At higher elevations, the preferred overstory is typically composed of Narrowleaf cottonwood (*P. angustifolia*) and the understory of willows, thinleaf alder (*Alnus tenuifolia*) and, locally, water birch (Hubbard 1987). Zimmerman (1970) reports a limited use of *Baccharis* thickets in the Gila Valley, but generally found the subspecies "very closely associated with the presence of willows, particularly *Salix gooddingii*."

In lowland California, it is "strikingly restricted to thickets of willows, whether along streams in broad valleys, in canyon bottoms, around mountainside seepages, or at the margins of ponds or lakes" (Grinnell and Miller 1944). It was apparently restricted to willow thickets along the lower Colorado River (Rosenberg et al. 1991)

Hubbard (1987) found 55% of 20 nests in New Mexico to be in tamarisk, 35.5% in willows, and one nest each in a Russian olive and a box-elder. Brown (1988, 1991) found 100% of 14 Grand Canyon nests in tamarisks. In the latter case, Southwest Willow Flycatcher seemed to prefer tamarisk over native willows.

These two cases have been widely discussed but are somewhat deceiving. The 55% reported by Hubbard were all from a single local, Elephant Butte Reservoir. It does not represent a widespread breeding preference in the state. No currently occupied or possibly occupied sites, in fact, are in tamarisk dominated areas (Trochet pers. comm., Zimmerman pers. comm., Hubbard pers. comm., Fritz pers. comm.). The subspecies no longer even occurs at Elephant Butte. When it did occur at the reservoir, it was not selecting for tamarisk- tamarisk was essentially the only riparian vegetation present due to constantly fluctuating water levels (Fritz pers. comm.). The same standing tamarisks continued to be used even after rising waters had killed them, and were not abandoned until they eventually fell, suggesting that the colony was displaying site fidelity rather than a significant vegetation preference.

The Grand Canyon is the only other definite case of nesting in tamarisk. While tamarisk was significantly selected over native willows as a nesting **tree** (Brown 1988), it was not significantly selected as nesting **habitat**- it is the dominant species in the Grand Canyon (Brown 1988). The two tamarisk patches where nests were found in 1991 were significantly larger than generally available riparian patches (Brown 1991) providing lower edge-to-patch size ratios. The available willow had much higher edge-to-patch size ratios (Linder pers. comm.). The most common willow in the Grand Canyon today, moreover, is coyote willow, a more disturbance tolerant, smaller subspecies than Gooding willow. The 7 to 9 year old coyote willow stand, 2.5 meters in height, present near the Cardenas Marsh nest site in 1991, could not rival the thermal protection provided by the 5 meter tall tamarisk in which the nest was found, nor could it provide as much safe interior nesting space. It appears then, that in the particular situation of the Grand Canyon (=few cottonwoods and short, small stands of coyote willow), tamarisk provides the best, though not necessarily ideal, protection against excessive heat and edge related predation and parasitism.

It should be noted that the Grand Canyon population has declined dramatically since 1987 and may be extirpated from the area altogether. The lower Rio Grande, and much of the middle Rio Grande, which are dominated by tamarisk (Hunter et al. 1988) no longer support breeding Southwest Willow Flycatchers- the subspecies does continue to occur, however, on the middle to upper stretches of the river where cottonwood/willow habitat persists.

The only other localities where Southwest Willow Flycatcher is suspected of nesting in tamarisk are on the San Pedro River and at Fort Thomas on the Gila River (Hunter 1991). Tamarisk is the dominant midstory or canopy species where territories and obvious nesting pairs were consistently present.

**Vegetative Structure.** In terms of avian abundance and diversity, mature cottonwood/willow forests are the among North America's richest habitats (Carothers et al. 1974, Rosenberg et al. 1991). They are favored by wintering birds looking for tall, thermally exposed perches, and by breeding birds looking for cavities and thermal protection. That deciduous cottonwood/willow stands offer the greatest thermal protection among low elevation riparian tree communities, is evident by the breeding schedule of its associated bird life. It is overwhelmingly preferred by late summer breeders such as Western Yellow-billed Cuckoo, Bell's Vireo, Yellow Warbler, Summer Tanager, and Southwest Willow Flycatcher. While avian diversity and abundance is correlated with stand size, maturity and density, "even sparse and isolated willow patches...are better habitats...than are pure tamarisk or sparse, stunted mesquite stands" (Rosenberg et al. 1991). Tamarisk has consistently been found to support fewer bird species than cottonwood/willow (Rosenberg et al. 1991, Hunter et al. 1987, Hink and Ohmart 1984).

Willows and cottonwood are generally the tallest trees in a low elevation riparian area, reaching heights of 60 to 80 feet. They are also vertically diverse with an the understory of grasses, small shrubs and willows; a midstory of young

cottonwoods, box elder (*Acer negundo*), ash (*Fraxinus spp.*) and willows; and a high cottonwood overstory sometimes reaching 90 feet above the ground.

Breeding in the mid-summer heat of low elevation riparian areas, Southwest Willow Flycatcher has become an "extreme habitat specialist" (Hunter 1991) in its need for thermal protection. With the recent demise of the mature cottonwood tree as an extensive member of the riparian community ("it has been virtually eliminated in natural stands"[Rosenberg et al. 1991]), Southwest Willow Flycatcher has disappeared from the lower elevations of the Southwest. Hubbard (1987) concluded from studies in New Mexico, that the subspecies will nest in marginal areas lacking dense or extensive vegetation, but must have an overstory and an understory.

## VI. CAUSES OF DECLINE

"The demise of the Southwest Willow Flycatcher can be explained primarily by the loss of willow-cottonwood riparian habitats....Of the many declining riparian birds, only the Southwest Willow Flycatcher has declined to very low population levels throughout its range...this subspecies is a very good indicator of the health and stability of native floodplain riparian habitats. These habitats are inching closer each year to complete disappearance in Arizona and throughout the Southwest" (Hunter 1989).

Habitat destruction and fragmentation currently pose the greatest threats to the continued existence of the Southwest Willow Flycatcher and are most responsible for its tremendous historic decline. Brood parasitism is an immediate threat, but from a systematic perspective, must be correlated with habitat loss and fragmentation. Tamarisk invasion as well is largely a function of habitat disturbance. Pesticides are a potential, and possibly an actual threat. Collecting does not appear to have been an important historical problem, but with current population levels, it could be in the future.

Urban development has been the cause of much habitat loss for the Southwest Willow Flycatcher, particularly in southern California and in the urban areas of New Mexico and Arizona. It will be a continual threat into the future. More habitat, however, has been lost to agricultural development. Overall, overgrazing by domestic livestock has been the principal agent of riparian destruction in the West (Phillips et al. 1983, Johnson 1989, Jacobs 1991). Floods and erratic water flows stemming from logging and dams also contribute to habitat loss.

The Southwest Willow Flycatcher's special habitat needs make it more vulnerable to threats which would not prove so disastrous were suitable habitat available in sufficiently large patches (Hunter 1989, Zimmerman pers. comm.).

**The Demise of Southwestern Riparian Forests.** According to the Nature Conservancy (1987) fewer than 20 occurrences of cottonwood/willow forests remain in Arizona. Only five of the 20 are extensive. "Covering less than .001 percent of Arizona's land area, cottonwood/willow forests are North America's rarest forest type" (Arizona Nature Conservancy 1987). These forests are home to over 100 state and federally listed threatened and endangered species in Arizona and New Mexico (Johnson 1989). As a general indicator of riparian health, consider that of Arizona's 32 native fishes, 5 are extinct or extirpated and 21 of the remaining 27 are either officially listed by state or federal agencies or under consideration for listing. Of 50 cienegas described by early Arizona explorers, only 15 exist today and only one of those is protected (Arizona Nature Conservancy 1987).

In the introduction to Birds of Arizona, Phillips et al. (1983) describe the near total destruction of that state's riparian woodlands:

"Except for the Salt River, the history of other Arizona marsh and water habitats can be summarized in one sad word: destruction. Their desiccation was accomplished in many ways: ditching, pumping, diversion of water, destruction of woody vegetation, and above all by the incessant over grazing of the entire drainage basins, permitting the rains to run off in short, disastrous floods that trenched the floors of the canyons, washes, and valleys. This of course caused long-stored waters to vanish down the river-beds. In some less-frequented areas, the marshes disappeared before any naturalist had visited them. such places included Marsh Pass near Kayenta, and the extensive marshes of the Little Colorado River and the San Simon Valley. The bordering fringes of cottonwoods and willows (and, in the south, mesquites) have been decimated by cutting, clearing, and the lowering of the water table. Areas of once-abundant artesian water like the San Pedro and Sulphur Springs Valleys must now pump water for farming purposes from far underground."

Sadly, the riparian forests of southern California, New Mexico, Nevada, Utah and Texas have suffered much the same abuse. These essential waterways are without question the most heavily impacted areas in the entire Southwest (Arizona Game and Fish Department 1988, New Mexico Department of Game and Fish 1985). Between 1780 and 1980, California lost 91% of its wetlands, Arizona lost 36% and New Mexico lost 33%. In the same time period, Nevada lost 52% of its wetlands, Utah lost 30% and Texas lost 52% (Dahl 1990). The toll on riparian forests was even worse- in the last century, 90% of New Mexico and Arizona riparian areas have been destroyed (Arizona State Parks 1988).

While the Southwest Willow Flycatcher has been driven to the edge of extinction by massive and general riparian destruction, it is necessary to look at both the local and range-wide effects in more detail to understand the actual processes of extinction at work.

**Habitat Fragmentation.** The very small size of current Southwest Willow Flycatcher populations makes them very susceptible to local extinction. Stochastic processes such as floods, fires, summer snow storms, or diseases could easily decimate any of the existing populations and immediately extirpate any of the scattered breeding pairs. Anthropogenic problems such as brood parasitism and tamarisk invasion are also extinction threats to small populations. Were populations larger, a proportionally larger number of birds would be expected to survive stochastic and systematic threats, and be able to re-establish the population.

More threatening in the long-term, however, are the highly deterministic processes of extinction which are complementary to, but independent of stochastic processes. Patterson (1978) has noted that the non-random process of extinction inevitably leads to the extirpation of rare and local species from **small** habitat "islands." Small habitat patches, even in great numbers, do not serve the biological needs met by larger patches. Species in small habitat fragments go extinct in a very predictable sequence (Cutler 1991, Patterson 1978)- a sequence which starts with the rarest species such as the Southwest Willow Flycatcher. While Patterson is concerned with the sequence rather than the causes of extinction, it is clear that small populations have a very limited genetic pool from which to draw upon in the face of changing environmental conditions. They are also more likely to be wiped out in a single stroke, leaving no regenerative base.

The isolation of populations from one another also increases the risk of local extinction. Were the separate populations near to or connected to one another by strings of suitable habitat, local extinction due to stochastic and more systematic processes could be overcome by recolonization from unaffected sites. Isolated populations are also **genetically** separated, narrowing the genetic variance necessary to enable dynamic responsiveness to environmental changes. Inbreeding problems may also develop in such populations.

Habitat fragmentation on the local and range level poses a grave threat, exacerbating problems which otherwise would not threaten the existence of the species. Grazing, brood parasitism and tamarisk invasion are all exacerbated by habitat fragmentation.

As habitat patch sizes decrease, not only is habitat lost, but the edge to patch size ratio increases, exposing interior dwelling species to threats which are excluded from, or lessened in the interior. As large, continuous areas of suitable habitat are converted to a greater number of small areas, the threshold size needed for successful breeding is no longer met (Forman et al. 1976, Galli et al. 1976, Whitcomb et al. 1976, Whitcomb 1977, MacArthur and Wilson 1967, Willson and Carothers 1979). As edge-to-patch size ratios increase, interior dwelling birds such as Southwest Willow Flycatcher are less able to hide their nests safely away from the exposed habitat edge. Cowbird parasitism rates, for example, have been positively correlated with increased edge-to-patch size ratios (Rothstein et al. 1980, Brittingham and Temple 1983, Airola 1986) as has depredation (Whitfield 1990). Because riparian forests have a naturally high edge-to-patch size ratio, species dependent upon interior nesting spaces are particularly sensitive to any further fragmentation.

Brown (1991) noticed a distinct Southwest Willow Flycatcher preference for larger stands of habitat along the Grand Canyon. Zimmerman (pers. comm.) likewise noticed that Southwest Willow Flycatchers in the Gila Valley selected for larger expanses of riparian woodland and decreased in numbers as the habitat became increasingly fragmented. The only nests found along an 86 mile stretch of the Grand Canyon were in patches of larger than average size. There was one each in patches of 2.8 and 3.1 ha (Brown 1991). It should be kept in mind, however, that this particular population is in the midst of a dramatic decline, possibly to the point of extirpation in the very near future. These patches may not be indicative of sizes needed to support healthy populations.

Just as fragmentation of local habitats is a well documented cause of extirpation, habitat fragmentation at the landscape level promotes extinction. Scattered populations are unable to interact genetically, recolonize extirpated sites, or expand their range into new areas (Schlorff 1990a, Sanders and Flett 1989). This is a grave threat given that the California and New Mexico populations are now separated by the vast space of Arizona from which the Southwest Willow Flycatcher is virtually extirpated.

**Overgrazing.** Grazing of domestic cattle is probably the single greatest direct and indirect threat to Southwest Willow Flycatcher habitat.

*E.t. extimus*, like *E.t. brewsteri*, the other subspecies breeding in the southwest, nests in willows which are highly susceptible to trampling by cattle. Forty percent of 20 *brewsteri* nests observed in the Shaver Lake area were destroyed by cattle congregating in riparian areas (Stafford and Valentine 1985, Valentine 1987).

Overgrazing prevents the establishment of new willows and cottonwoods, the trampling of established plants, and "notching" or "highlining". The vast majority of grazed western riparian areas are deficient in willow understory and are nearly devoid of overstory cottonwoods. When the larger trees die, there are few, if any, younger trees to replace them. Overgrazing has also been closely correlated with erosion and excessive flooding, which uproot larger plants and prevent the establishment of younger plants.

When notched or highlined, willows become top heavy with live branches above and few below. Serena (1982) noted this condition in otherwise suitable habitat in the Sierra Nevada from which *brewsteri* was conspicuously absent.

Willow Flycatchers are found in high numbers on the Malheur National Wildlife Refuge only in areas which are ungrazed or rarely grazed (Taylor and Littlefield 1986). Seven years of transects revealed a negative correlation between grazing intensity and Willow Flycatcher numbers, and a positive correlation between numbers of Willow Flycatchers and numbers of healthy willows. AUMs on a test plot were steadily lowered from 1973 to 1982 and Willow Flycatchers, which were at first absent, began to appear in 1978- AUMs had dropped by this time to 50%. By 1982, when AUMs had declined by a factor of four, 30 Southwest Willow Flycatchers were present. During the nine years in which grazing decreased and willow cutting and spraying was eliminated, banks which were previously devoid of shrubby vegetation came to support thick belts of willows.

Brown-headed Cowbirds, formerly associated with bison, are now followers of cattle. Cowbirds like to forage in the grass stubble left in the wake of the West's most omnipresent and voracious ungulate. As cattle prefer to congregate in riparian areas, they create an anthropogenic food source in the vicinity of densely populated breeding habitat, bringing the Cowbird's foraging and nesting areas together. Finally, cattle have a deadly effect on continuous strips of riparian vegetation. The more they fragment the habitat, the more habitat edges become available to cowbird parasitism.

Harris et al. (1987) noticed that Southwest Willow Flycatcher numbers increased from 26 to 39 singing birds during a 5 year period in which the California Nature Conservancy acquired a property and reduced the intensity of cattle grazing. Southwest Willow Flycatchers appeared on the Brock Canyon allotment on the Gila National Forest the second year after cows were removed (Steve McDonald pers. comm.). Many of the locations where Southwest Willow Flycatchers still occur, in fact, are areas from which cattle have been excluded or drastically diminished: the Glenwood State Fish Hatchery, the New Mexico Game and Fish Wildlife Enclosure, Rio Grande Conservancy land in the Albuquerque area, Black Rock Reservoir, Grand Canyon National Park, Kern River Preserve, and Camp Pendleton.

**Tamarisk Invasion.** In the late sixties, Zimmerman (1969) warned that "the prospect of widespread elimination of indigenous woody vegetation along our waterways is staggering in the magnitude of the destruction to bird life that it would entail." He was particularly concerned about the invasion of noxious tamarisk, an exotic plant introduced in the early nineteen hundreds as an ornamental and erosion break. A little over a decade later, one researcher concluded:

"The demise of the Southwest Willow Flycatcher can be explained primarily by the loss of willow-cottonwood riparian habitats. Along most major river systems, exotic tamarisk has replaced willows and cottonwoods as the dominant riparian tree" (Hunter 1980).

Southwest Willow Flycatcher never nests in tamarisk at low elevations (Hunter 1991), rarely at middle elevations, and never at high elevations. The replacement of its preferred, native willow-cottonwood breeding sites with tamarisk generally means extirpation.

Tamarisk invasion is a secondary threat in that it does not displace native phreatophytes under undisturbed conditions- willows and cottonwoods must first be cleared out. Firewood cutting, riparian vegetation removal (for the purposes of reducing water use), flooding and grazing are all associated with tamarisk invasion (Hunter et al. 1988, Rosenberg et al. 1991, Behle and Higgins 1959, Ohmart 1977, Hink and Ohmart 1984). Tamarisk invaded the Pecos River Basin in 1912 and spread to 31,200 ha by 1967. Even after 21,850 ha were cleared by 1971, by 1980 there were 11,295 ha. The lower Colorado had 14,353 ha in 1980 and the lower Rio Grande had 5,600 ha. Cottonwood-willow vegetation in the same areas is now minimal: 834 ha on the Pecos, 3,354 ha on the Colorado and 60 ha on the Rio Grande (Hunter et al. 1988). Southwest Willow Flycatcher does not breed at any of these sites today.

We quote at length from Rosenberg et al. (1991) on the tragic mechanics of tamarisk invasion on lower Colorado River:

"An exotic species of tree, saltcedar (tamarisk) spread into the valley from the Gila River (around 1920). Saltcedar, which has little value to native wildlife, found ecological conditions optimal for its spread and eventual dominance. In 1894, Mearns (1907) estimated that about 160,000-180,000 ha of alluvial bottomland between Fort Mohave and Fort Yuma were covered by riparian vegetation. As of 1986, total riparian vegetation comprised only about 40,000 ha, approximately 25% of the available bottomland estimated by Mearns (Anderson and Ohmar 1984; Younker and Andersen 1986). Roughly 40% of the area remaining in 1986 was covered by pure saltcedar; an additional 43% consisted of native plants mixed with saltcedar; 16.3% was covered by honey mesquite and/or native shrubs; and only 0.7% (307 ha) could be considered mature cottonwood or willow habitat (Ohmart et al. 1988).

The successful spread of saltcedar is an example of how an introduced species can optimally exploit an environment disturbed by man, to the detriment of native vegetation. Initially, it became established in areas where

native vegetation had been cleared and the land left fallow (Ohmart et al. 1977). Saltcedar has a high rate of seed production, with as many as 600,000 seeds per plant produced from April through October (Robinson 1965). This long period of seed production allows it to germinate well into fall, when most native trees are no longer producing viable seeds. Saltcedar has become dominant along the lower Colorado River by also being salt-, fire-, and flood-tolerant.

Where channelization and river-flow management have resulted in very little native plant regeneration, senescent stands of mesquite or willow have been replaced by saltcedar. In addition, soil and water salinity levels have risen dramatically in association with irrigation practices and evaporation from reservoirs. Native plants, except saltbush and quail bush, exhibit a low tolerance to saline soils. In contrast, saltcedar thrives under highly saline conditions.

Saltcedar is deciduous and, without floods, large amounts of leaf litter accumulate. Therefore, after 10 or more years fires almost become a certainty, especially during the hot and dry summer months. After a fire, saltcedar and arrowweed quickly regenerate, whereas cottonwood and quail bush usually fail to return. Thus, saltcedar will be the first to regenerate in stands of mixed vegetation, and through successive fires this species eventually displaces most native species...

To summarize...a floodplain that was once filled from end to end with expansive and impenetrable forests of cottonwood, willow, and mesquite has been converted, in little more than a century, to a largely treeless valley...The relatively little remaining riparian vegetation exists in fragmented strips, most being saltcedar. Sadly and ironically, some of the worst destruction, including the virtual elimination of cottonwood-willow habitats from the entire valley, came only in the last decade, a period during which our nation's commitment to conservation and research should have been strongest. The information was at hand, the consequences were obvious, but admonitions went unheeded."

Cattle do not browse tamarisk leaves as they do willow and cottonwood, creating a situation where tamarisks which survive trampling eventually displace more heavily abused native species. Once established, tamarisk grows rapidly, spreading by both seed and cuttings. It is a much heavier water user than native phreatophytes and sinks deeper roots, eventually lowering water tables and outcompeting natives. Tamarisk especially thrives in preferred Southwest Willow Flycatcher sites along ditches, reservoirs, ponds, marshes and backflows.

**Water Impoundment.** Southwest Willow Flycatcher habitat is degraded by dams both on the upstream and downstream sides. Down-river, dams prevent the seasonal water level flux which annually produce backwater areas and silt flats supporting riparian thickets. They also trap sediments necessary to replenish eroding beaches. Upstream, riparian areas are submerged, killing vegetation along the river bottom, and leaving (in some instances) vegetation at the impoundment edge which is highly vulnerable to fluctuating water levels. Rising reservoir levels at Elephant Butte Lake, for example, drowned riparian thickets, extirpating the Southwest Willow Flycatcher population which formerly bred there in relatively high numbers. Elephant Butte, like Caballo Reservoir and Blue Lake Reservoir (all former breeding sites), drove out the native willow-cottonwood vegetation, replacing it with tamarisk.

Glen Canyon Dam is another tragic example. Eight years of research on the environmental effects of the dam have shown that water release fluctuations designed to maximize electricity production have devastated the riparian ecology below the dam, eroding beaches and uprooting wildlife habitat. Southwest Willow Flycatchers were once common in Glen Canyon (Behle and Higgins 1959) but have been extirpated above the dam due to flooding and are all but extirpated below it as well.

In addition to direct effects, dams have been shown to promote tamarisk invasion (Rosenberg 1991, Behle and Higgins 1959) and stream bank erosion (Williams 1991). Behle and Higgins (1959) noted that Brown-headed Cowbirds were rare in Glen Canyon prior to the filling of the dam.

**Logging.** Although there is little or no commercial logging in Southwest Willow Flycatcher habitat, the bird is continually threatened by flood waters which begin with run-off from logged forest areas. Deforested logging sites collect more snow and have quicker snow melt than unlogged areas. This, combined with erosion due to heavily disturbed ground vegetation and soils, causes snowmelt and rain water to release quickly in series of damaging flood bursts, rather than as a slow, annually fluctuating water source.

**Neotropical Deforestation.** Little is known about the winter ecology of *E. t. extimus*. Available evidence suggests that Willow Flycatchers utilize habitats on their winter range which are similar to preferred habitat in their breeding range (Terborgh 1980). It is likely, however, that winter habitat selection is a bit broader.

"The massive and near universal scale of deforestation" (Terborgh 1980) in the neotropics is certainly a threat to the Southwest Willow Flycatcher. Over 50% of the neotropical forest cover has already been lost (Myers 1980) and much of the existing forest has been heavily disturbed. Because bird concentrations are much higher on wintering grounds than on defended breeding territories, the "clearing of 1 ha of forest in Mexico is equivalent to expanding urban sprawl by perhaps 5-8 ha" in the



the U.S. (Terborgh 1980). Using deforestation figures from the Food and Agricultural Organization, Terborgh estimates that even a conservative forecast must conclude that unless the situation in Central America and the Greater Antilles changes dramatically, "suitable habitat will no longer be available for many migrant species by the end of the century."

It should be noted deforestation by and for cattle production is the major cause of forest habitat loss in the neotropics.

**Pesticides.** Being insectivores, Southwest Willow Flycatchers are vulnerable to agricultural insecticide programs. As their preference is for open flood plain areas such as the Imperial Valley, CA and the Gila Valley, NM, they often nest very near to, or in heavily used agricultural land.

**Cowbird Parasitism.** Brown-headed Cowbird brood parasitism is a well documented cause of population decline in open-cup nesters (Brittingham and Temple 1983), in Willow Flycatchers generally (Serena 1982; Schlorff 1990a, 1990b), and in Southwest Willow Flycatchers in particular (Hanna 1928, Rowley 1930, Friedman 1963, Unitt 1984, 1987; Harris 1991; Brown 1991). The decline of the Southwest Willow Flycatcher in central and coastal California has been positively correlated with the expansion of the Brown-headed Cowbird in the 1920s and 30s (Gaines 1974, Garrett and Dunn 1981, Laymon 1987). Unitt, in 1984, declared that "the exploding population of Brown-headed Cowbirds undoubtedly has been the principle cause of the decline of Southwest Willow Flycatchers," and that "widespread destruction of riparian woodlands has probably had an impact as well."

Of 16 Southwest Willow Flycatcher nests with eggs found in New Mexico, 25% were parasitized by Brown-headed Cowbirds (Hubbard 1987). In three cases, the nests contained one egg of each subspecies, the fourth had three Flycatcher and one Cowbird egg. Hubbard considered this a low rate of parasitism.

Fifty percent of eight nest found by Brown (1988) in the Grand Canyon had been parasitized. Three contained one Cowbird egg and 1 contained 2. Southwest Willow Flycatchers abandoned two of the nests, removed the parasitic eggs from one, and having covered the parasitized clutch of another, re-nested. The latter nest was again parasitized by Cowbirds.

Parasitism rates on the Kern River jumped from 50% to 80% between 1989 and 1991, while nesting success dropped from 25.8% to 16% (Laymon pers. comm). The total population declined by 25% in 1991 and is expected to continue declining if a Cowbird trapping program is not instituted. Depredation rates have also been high, and in 1990 at least, may have been more of a factor in declining nesting success than parasitism (Whitfield 1990).

On the positive side, Camp Pendleton has instituted a successful Cowbird trapping program which has reduced parasitism rates to 0%, allowing Least-bell's Vireos and Southwest Willow Flycatchers to increase their numbers in recent years. This is the only location in which the latter has experienced a population increase. Two other current Southwest Willow Flycatcher sites in California (Prado Basin and Anza-Borrego) have Cowbird trapping programs.

The Southwest Willow Flycatcher is in immanent danger of extinction due to Brown-headed Cowbird brood parasitism. Two of only four breeding sites which have supported more than five pairs in recent years are on the decline, partly in response to high parasitism rates. Care must be taken, however, not to confuse the symptom with the ailment. Rosenberg et al. (1991) point out that only 2 of 34 nests collected on the lower Colorado River in the early 1900s were parasitized, despite the fact that Brown-headed Cowbirds were already common. While brood parasitism has been a fact of life for Southwest Willow Flycatchers for nearly a century, it has only become a devastating problem in recent years. Unitt's 1987 reassessment of the plight of the Southwest Willow Flycatcher is more to the point- habitat destruction, he explains, is not a parallel phenomena, it is the **means** whereby brood parasitism is able to increase and become effective to the point of threatening the very existence of the Southwest Willow Flycatcher. The spread of Brown-headed Cowbirds and their increasing effectiveness are results of habitat disturbance (Gaines 1974, Garrett and Dunn 1981, Airola 1986, Laymon 1987, Unitt 1987, Hunter 1991, Harris 1991, Rosenberg et al. 1991). Analyzing a number of declining bird species associated with willows and cottonwoods on the lower Colorado River, Rosenberg et al. (1991) conclude that Brown-headed Cowbirds probably only hasten the demise of birds which are more fundamentally threatened by habitat loss.

Ready access to human related food sources is an important determinant of numbers and distribution of Brown-headed Cowbirds in the Sierra Nevada (Airola 1986; Rothstein et al. 1980, 1984; Verner and Ritter 1983). These authors found that cowbirds typically feed in residential areas, campgrounds, agricultural areas and where livestock are found, and from there travel (up to 4 miles) to more diverse, less disturbed areas in search of egg hosts. Such areas offer a greater density of possible hosts. Riparian forests, therefore, which offer high concentrations of human development, cattle and egg hosts (Beedy and Granholm 1985) are favored Cowbird targets.

The attraction to disturbed (i.e. humanized) and densely occupied breeding areas, however, is more complex. Grazing and agriculture not only provide food, they fragment riparian forests into small, isolated, rare stands. Birds such as the Southwest Willow Flycatcher, therefore, which have very precise habitat needs, seek out these stands and nest in them in high concentrations (Hunter 1991, Harris 1991, Laymon 1987, Mayfield 1977, Brittingham and Temple 1983, Rothstein et al. 1980).

The availability of Southwest Willow Flycatchers as hosts, is not simply a matter of sheer density (i.e. more nests to choose from), but of unnaturally high densities combined with unnaturally small cottonwood-willow stands forcing a greater number of nests out to the stand perimeter. These nests are more readily accessible to parasitism, predation and thermal radiation

than are nests hidden away within the interior of a stand. Harris (1991) found the average distance of 19 nests from the outer perimeter of the willow clump containing the nest was 7.03 m. As this declining population is highly parasitized and depredated, larger patches may be needed to support stable populations. In any event, the rarity today of willow-cottonwood stands larger than 14 meters in diameter, means that even breeding groups as small as one or two pair of Southwest Willow Flycatchers are likely to encounter unfavorably high edge-to-patch size ratios.

**Depredation.** While habitat destruction, cattle grazing and Brown-headed Cowbird parasitism have been universally identified as the main causes of Southwest Willow Flycatcher declines, predation is not to be discounted. Whitfield (1990) found that nesting success rate declines on the Kern River between 1989 and 1990 were more closely related to increasing depredation rates than to parasitism. While the rate of nest parasitism did indeed increase, the percentage of eggs lost to parasitism decreased. Depredation, which was responsible for most actual egg losses in both years, was responsible for a greater percentage of lost eggs in 1990 (57.1%) than in 1989 (50.7%).

The apparent positive relationship between depredation rates and increased edge-to-patch size ratios has long been an issue of concern to biologists studying interior dwelling species. Of 14 habitat parameters correlated with depredated and non-depredated Southwest Willow Flycatcher nests, Whitfield (1990) found the most significant difference to be in the distance of nests from the forest edge. The mean depredated nest distance was 5.85 m. and the mean non-depredated nest distance was 10.80 m.. Interiority, is more commonly measured in kilometers than meters, indeed, commonly discussed interior dwelling birds such as the Mexican spotted owl (*Strix occidentalis lucida*) and the Northern Goshawk (*Accipiter gentilis*) have ranges measured in the thousands of acres. But just as the Old Growth controversy is as much a riparian issue as it is a "forest" issue, interiority needs on a smaller scale are as important as they are on a large scale- more important perhaps given the tremendous number of endangered riparian species.

With the current very small sizes of mature, or even dense, willow-cottonwood patches a difference of 5 m. can be very important.

## VII. Current Status

### The Southwest Willow Flycatcher West of The Colorado River

"The Southwest Willow Flycatcher is seriously endangered in a significant portion of its range in California due primarily to habitat loss and degradation as a result of various human activities including livestock grazing and nest parasitism by Brown-headed Cowbirds...Without protective measures, the trend of habitat loss, nest parasitism by Brown-headed Cowbirds, and the failure of scattered populations to replace themselves will result in the further decline of Southwest Willow Flycatcher populations and may lead to their extirpation as a breeding species in California" (Schlorff 1990a).

The Southwest Willow Flycatcher was formerly widespread in the riparian woodlands of coastal southern California (Willet 1912, 1933) and along the lower Colorado River (Unitt 1987). Prior to 1940, 67 eggs were collected in the Los Angeles basin, 34 in the San Bernadino/Riverside area and 42 in San Diego Co. At what was probably the only substantial colony in southeast California, Hubert Brown collected 37 nests along the lower Colorado River near Yuma in 1902 (Unitt 1987). It was also present locally at higher elevations (Unitt 1987).

The current situation is dire: the Southwest Willow Flycatcher is "virtually extirpated" from California (Garrett and Dunn 1981), probably extirpated from Nevada and Baja California (Hunter 1988), and completely extirpated from the lower Colorado River. It simply no longer occurs at 80% of known former sites west of the Colorado River. Given the very small size of current and recently occupied sites, the decline in actual numbers of birds is probably more on the order of 90%. The areas in which it was formerly most abundant- the Los Angeles basin, the Santa Ana River near Riverside and San Bernadino, and the lower Colorado River- have all been abandoned. Of the eight sites where it still may persist, 3 are extremely tenuous (1-2 pairs) and may well already be extirpated, 3 others are very marginal (4-5 pairs), and only 2 support more than 25 breeding pairs. As all eight are low elevation sites, they are particularly vulnerable to Brown-headed Cowbird parasitism (Hanna 1928, Rowley 1930, Gaines 1974). Indeed, Kern River, the largest site has been declining in recent years partly due to nest parasitism.

The possibility of the Southwest Willow Flycatcher being completely extirpated west of the Colorado River in the near future is very real. Given the even worse condition of Southwest Willow Flycatchers in Arizona, there would be no possibility of recolonization.

1. South Fork of the Kern River, Kern Co. (California Nature Conservancy's Kern River Preserve and the adjacent South Fork Wildlife Area, recently turn over to the Sequoia National Forest). There is enough suitable habitat on the South Fork to support 100 pairs of Southwest Willow Flycatchers (Laymon pers. comm.). Since the Nature Conservancy bought the Kern River Preserve and cattle were removed from the Wildlife Area in 1982, dense willow thickets have established themselves and become home to obligate riparian species such as the Least-bell's Vireo, the Western Yellow-billed Cuckoo and the Southwest Willow Flycatcher. The Southwest Willow Flycatcher population peaked at 43 in 1989, the largest population in existence.

This crucial population has declined dramatically in recent years. Between 1989 and 1991, Brown-headed Cowbird parasitism rates jumped from 50 to 80 percent while the nesting success rate dropped from 25.8 to 16 percent. The total number of birds fell 25% (from 41 to 31) in 1991 and is expected to decrease again next year by 5-10 pairs (Laymon pers. comm.). The population will at that point have dropped below 25 pairs, the absolute minimum necessary to be exempt from stochastic extinction (Laymon and Halterman 1986). A proposal has been submitted to begin trapping cow birds, but has as yet not been accepted (Laymon pers. comm.)

Stochastic processes are not the only threat, however, "the South Fork Wildlife Area is threatened by periodic inundation and possible livestock grazing" (Schlorff 1990a). The Army Corps of Engineers recently transferred the property to the Sequoia N.F., largely in response to complaints that they were unduly limiting access to the area (Laymon pers. comm.). Though not at the level of grazing and flooding, light recreation use, especially camping, can have a significant impact on riparian obligate birds (Blakesley and Reese 1988). As the forest service commonly allows grazing in "wildlife" areas, their ownership can not be expected to guarantee protection in perpetuity.

2. Santa Margarita River at Camp Pendleton U.S.M.C. and adjacent private lands, San Diego Co. Southwest Willow Flycatcher numbers have jumped from 5 in 1980 to 29 in 1991 in direct response to a Brown-headed Cowbird trapping program initiated in 1983 to protect resident Least-bell's Vireos (the site is home to 45% of all known Least-bell's Vireos) (Buck pers. comm.). By 1991, 0% of Vireo nests were being parasitized (Griffith pers. comm.).

There is limited sheep grazing in the area and small patches of tamarisk, the invasion of giant reed (*Arundo donax*), however, appears to be a real threat (Buck pers. comm.). The Camp entered into a cooperative agreement with the town of

Fallbrook in the early eighties to build two dams on the Santa Margarita inside Camp Pendleton. The plan met with much opposition and was eventually dropped but could conceivably be raised again.

3. Upper San Luis Rey River, San Diego Co. (Cleveland National Forest and private). A 10 km stretch between Lake Henshaw and the La Jolla Indian Reservation supported 12 territorial Southwest Willow Flycatchers in 1984 and 6 in 1986 (Unitt 1987). Birds were still present as of 1991 (Unitt pers. comm.)

4. Prado Flood Control Basin, Riverside Co. (Army Corps of Engineers and Riverside Regional Parks). In the first reported siting in over 30 years from what used to be a major population center, L. R. Hays (in McCaskie 1986) found four pairs on the Santa Ana River in Prado Basin, Riverside Co. Four pairs were also present in 1991 (Zimble pers. comm.). Prado Basin is the largest continuous canopy riparian forest in Southern California. Cowbird trapping has been continuing in the basin for a number of years (Griffith pers. comm.)

Giant reed invasion is again a problem.

5. San Timoteo Creek, San Bernadino Co.. Five pairs were seen in 1987, but the site has not been surveyed since.

The occasion of the 1987 survey was a planned Army Corp of Engineers flood control project. If it goes through, and it looks as if it will, the project will prohibit the expansion of this population (Zimble pers. comm.). As a five pair bird "population" is extremely susceptible to stochastic extinction, the expansion of this population is paramount to its continued existence.

6. Anza-Borrego Desert State Park, San Diego Co. (State of California). Lower Willows in Coyote Gulch, a strong Least-bell's Vireo site, had one singing male in 1989 (Griffith pers. com. 1992). The Park has a Cowbird trapping program.

A single bird on a single year, obviously does not constitute a viable population. Anza-Borrego is far enough from the other sites to make colonization a problem.

7. Sweetwater Reservoir, San Diego Co. The only recent reports are from 1984, two singing males, and 1986, one singing male (Unitt 1987). Whether or not Southwest Willow Flycatchers have been present since is unknown.

8. Rio Santo Tomas, Baja California, Mexico. Despite finding 21 Bell's Vireos on the river in 1986, Phillip Unitt (1987) was able to locate only one Southwest Willow Flycatcher. This was the first reported sighting since 1928. There have been no reports since.

The riparian forests of Southern California, Baja California and the lower Colorado river have been intensively surveyed since 1981 because of concern for the Least-bell's Vireo and the Western Yellow-billed Cuckoo. Unitt, in 1987, estimated a total of 87 remaining Southwest Willow Flycatcher pairs based on high counts at ten sites. Three of those sites (Big Morongo Wildlife Preserve, Lake Cuyamaca and Lower San Luis Rey River) have since been abandoned while one new one (Anza-Boreggo) has been discovered. The Camp Pendleton population has meanwhile increased as the Kern River population has declined. Eighty-seven is probably still an accurate figure.

Steady bird numbers, however, do not make up for losses in breeding sites and distribution. Nevada, California, Baja California and the Lower Colorado River constitute a western Southwest Willow Flycatcher "range." The next nearest group is two birds in Grand Canyon National Park and a scattering of individual birds in eastern Arizona. The loss of breeding sites and good distribution in this "range" exhibits extinction dynamics described by Cutler (1991), Patterson (1978), Forman et al.(1976), Galli et al.(1976), Whitcomb et al. (1976), Whitcomb (1977), MacArthur and Wilson (1967), Willson and Carothers (1979).

In a first extinction wave, Southwest Willow Flycatchers withdrew from the edges of the "range": on the north, Independence (1917), Wild Rose Canyon (1917), Corn Creek (1962), Indian Springs (1936), Oro Grande (1920) and Seven Oaks (1905); on the south, San Pedro Martir (1925), San Telmo (1923), Cerro Prieto (1928), Campo (1908) and Doane Valle (1945); on the east, Nevada State Tip (1953), Bill Williams Delta (pre 1970), Ehrenberg (pre 1970), Mohave Wash (pre 1970), Yuma (1902-1945) and Salton Sea (1953); on the west, San Fernando Valley (1903), West Los Angeles (1898), El Monte (1903), Long Beach (1913), Pico Rivera (1920), Los Cerritos (1928), National City (1913) and Sunnyside (1917). Exceptions to the pattern were Palm Canyon (1908), Riverside (1892), Colton (1918) and Cuyamaca Creek (1895)- all interior sites from which the Southwest Willow Flycatcher was extirpated prior to 1966.

In a second, post-1966, wave of extinction, the shrunken range edges again were abandoned: Big Morongo (1981) in the north; Cuyamaca Lake (1986), Jamul Creek (1987) and Tijuana River (1984) in the south; Capistrano Beach (1966) and Lower San Luis Rey River (1987) in the West. Three sites at the edge of the current "range" are likely to be abandoned in a third wave in the near future if they are not already: Rio Santo Tomas and Sweetwater Reservoir in the south and Anza-Boreggo in the east. Each of these sites has but one singing male, possibly a pair, left. The declining Kern River population is the exception- it has until recently maintained a fairly stable population though isolated in the north.

## The Southwest Willow Flycatcher in Sonora, Eastern Arizona and Western New Mexico

The Southwest Willow Flycatcher is probably extirpated from Sonora (Hunter 1989) where it is only known from three locations (Unitt 1987). It "has been extirpated from much of...southern Arizona," with only one or two pairs occurring at three locations (Unitt 1987). There are 4-5 sites in the White Mountains which have each supported 1-2 pairs in recent years and four sites across the border on the upper Gila River in New Mexico. The Southwest Willow Flycatcher has been extirpated from 50% of known historic sites in Sonora, Eastern Arizona and Western New Mexico. The remaining sites are isolated from populations in California and along the upper Rio Grande drainage by a large zone of regional extinction. They are also separated from one another: 2 are on the upper San Pedro River, 1 is on the lower Gila River, 3-4 are in the White Mountains, 4 are on the upper Gila River, and 2 are on the Zuni Indian Reservation.

There is only one site in all of Sonora, eastern Arizona and western New Mexico which is even possibly minimally viable. The Southwest Willow Flycatcher has been extirpated from the southern portion of the region, from the west side all the way across Arizona into south central California, from all of northern Arizona (excepting two widely spaced pairs in the Grand Canyon) and southern Utah, and from the lower Rio Grande on the east. Only 2 of the 13 sites have had more than 5 pairs present in the last decade. The entire region is susceptible to systematic and stochastic extinction.

1. Black Rock Reservoir, McKinley Co., NM. Zuni Indian Reservation. One to two pair have been present yearly since 1981 in a willow thicket on the east side of Black Rock Reservoir. This site supported a pair of Western Yellow-billed Cuckoos from 1979 to 1982 or 1983, but has not since (Trochet pers. comm.). There is enough habitat on Black Rock to support 2 to 3 Southwest Willow Flycatcher pairs at most. Grazing is not permitted in the area, but cows do occasionally trespass (Cleary pers. comm.).

2. Rio Nutria, McKinley Co., NM. Zuni Indian Reservation. Southwest Willow Flycatchers (1-4) were present below the Rio Nutria Diversion Reservoir from 1988-1990 but were not present in 1991. This site may have been abandoned- a pair present in the nearby Village of Upper Rio Nutria in about 1987 has not been present since (Trochet pers. comm.).

3. Greer, Apache Co., AZ. Private and Apache-Sitgreaves National Forest. One to two birds have been recorded at two or three sights in and around Greer and Benny Creek in recent years. There has been talk of retiring or resting the Mount Baldy Wilderness grazing allotment, but nothing has happened as of yet.

4. Alpine, Apache Co., AZ. Private, adjacent to Apache-Sitgreaves National Forest. The only record is of one bird in 1991. The area is probably grazed.

5. Blue River, Greenlee Co., AZ. Checker-board private/Apache-Sitgreaves National Forest ownership along much of the upper Blue river bottom. The only record is of one bird in 1989. Although there have been localized grazing reductions along the Blue in recent years, it is still heavily grazed. Riparian vegetation on the Sand Rock allotment along the lower Blue has regenerated after a five year rest but is currently under review for restocking. The Apache Sitgreaves National Forest has proposed building a dam on Pigeon Creek, a tributary to the lower Blue, which would further degraded riparian habitat there. The project is currently in the Biological Assessment phase.

6. Brock Canyon Allotment, Grant Co., NM. Gila National Forest. Southwest Willow Flycatchers (4) were recorded in this area in 1969 and again in 1990 (2). The Gila National Forest bulldozed suitable habitat adjacent to a known nest site in 1991, possibly fragmenting the site beyond viability. The Brock Canyon allotment has not had cows for several years but can be put back into rotation.

7. Buckhorn, Grant Co., NM. The only record is of 2-3 pairs in 1987.

8. Cliff, Grant Co., NM. Private. Fifty and 53 birds were heard in 1981 and 1983 respectively, some of which may have been migrants. John Hubbard, New Mexico Game and Fish, believes this population, the only population east of the Colorado River even minimally viable, has probably since declined (pers. comm.).

9. Redrock, Grant Co., NM. Private, BLM and State land. This is one of only two sites in the entire region that has had more than five pairs in recent years. It supported 28 singing males in 1981 and 19 in 1983. The New Mexico Game and Fish Game Farm Inclosure, an important component of this site, is continually threatened by water losses- its water rights were previously transferred to Snow Lake (a recreational reservoir), and it has held water since only because of a large flood in the early eighties (Fischer pers. comm.).

10. Dudleyville, Pinal Co., AZ. Southwest Willow Flycatchers were recorded at Dudleyville, in 1985 (4) and in 1986. It is possible that the area has since been abandoned- Cook's Lake, five miles to the south, a high density site (25-30 pairs) in the 1940s, dwindled over the years and was abandoned by 1986. The 1983 flood channelized the San Pedro, dropping the water level below the reach of long established cottonwoods (Corman pers. comm.). These mature trees are now dying off.

11. San Manuel, Pinal Co., AZ. Three birds were recorded in 1985 and several more in 1986. Historic locations on the San Pedro River immediately above and below San Manuel are no longer occupied.

12. Fort Thomas, Graham Co., AZ. This is the only site on the Gila River in Arizona which is still possibly occupied. Three birds were seen in 1985 and several in 1986. 1983 flood waters are largely responsible for the existence of suitable habitat on the Gila River at Fort Thomas (Corman pers. comm.).



### The Southwest Willow Flycatcher in the Rio Grande Drainage

The area between the Rio Grande and the Pecos river, from northern New Mexico down to northern Texas, forms the eastern edge of the Southwest Willow Flycatcher's historic range. In recent times, however, it has been extirpated from Texas, the lower Rio Grande in New Mexico, and east of the Rio Grande. It probably no longer occurs at at least 61% of known historic sites in this portion of its range. Of the 7 sites occupied at least once in the last decade and not known to be extirpated, 5 have not been seen in 8 years. Given the very small size of current populations (one has 4-5 pairs, the other 5 have 1-3 pairs), it probable that the actual loss of bird pairs is much higher.

The Rio Grande drainage population is experiencing range shrinkage and fragmentation indicative of extinction processes (see figure ???) The one late eighties record is from the historic center of the range. It is surrounded most immediately by sites last known to be occupied in the early eighties. Sites last known to be occupied in the sixties and seventies surround those, and sites known only prior to 1970 lay farthest from the historic center. The Rio Grande drainage population has disappeared from the southern and eastern edges of its range. Much of the northern edge has been abandoned as well. The six sites which might still be occupied are separated from one another by miles of unsuitable habitat. Each site, and the entire Rio Grande drainage population, is extremely susceptible to stochastic extinction in the immediate future.

In relation to the status of the entire subspecies, the loss of the Rio Grande "population" would be cataclysmic. The extirpation of the eastern edge of its already fragmented range could well mean extinction for the subspecies.

Hubbard (1987) concluded his status review of Southwest Willow Flycatchers in New Mexico saying that it:

"is virtually inescapable that a decrease has occurred in the population of breeding Southwest Willow Flycatchers in New Mexico over historic time. This is based on the fact that wooded sloughs and similar habitats have been widely eliminated along streams in New Mexico, largely as a result of the activities of man in the area. Particularly detrimental to Southwest Willow Flycatcher habitat have been the diversion of water, draining of wetlands, channelization and leveeing of streambeds, construction of canals, drains, and impoundments, and the cutting of woodlands. These activities have reduced or altered the extent of these habitats rather widely in New Mexico."

Though new habitats have been created by water impoundment, the result are usually temporary at best- the habitat tends to be inundated by rising water, desiccated by lowered water, or both alternately. This has been particularly true for sites along the lower Rio Grande.

Heavily fluctuating water levels at Elephant Butte Reservoir, a Bureau of Reclamation hydro-electric dam, flooded out the largest Southwest Willow Flycatcher population in the Rio Grande drainage in 1975. It has not been recorded in 5 subsequent survey seasons (Hundertmark 1978, Hubbard 1987). During the 1970's, water levels at Elephant Butte varied from two million acre feet to almost empty. It has not been full to capacity in recent years and releases have been lowered, but is expected resume "normal" operation soon (Rucker pers. comm.). Caballo Lake, another Bureau of Reclamation project below Elephant Butte, also suffers dramatic water level fluctuations. The Southwest Willow Flycatcher has not been recorded there in recent years either. The vegetation at both reservoirs is dominated by tamarisk and both are grazed by BLM permittees (Rucker pers. comm.). The La Joya State Game Refuge was dredged by the local water conservancy authority in the mid-eighties destroying Southwest Willow Flycatcher habitat (Unitt 1987). The birds have not since been present in the refuge.

1. Rio Chama at los Ojos/Parkview, Rio Arriba Co., privately owned. If this site is still populated it may be the largest in the Rio Grande drainage system. The last, and largest record is of 4-5 singing males in about 1983 (Trochet pers. comm.)

2. Canjilon, Rio Arriba Co., Carson National Forest. One singing male has been recorded at this site in 1973, 1982 and 1983.

3. Oxbow Marsh, Bernalillo Co., Sierra Club Foundation, Albuquerque Public Schools and Ray Graham. This site was drained in the summer of 1975 by the Rio Grande Water Conservation Project and left dry for five months until public opposition prevailed. Most of the Gooding's willows died at that time and were replaced by coyote willow, a smaller, and presumably less attractive habitat to Southwest Willow Flycatchers. Water diversion is a constant threat to Oxbow marsh, as is the loss of cottonwoods due to beavers. There are few "recruits" to replace mature trees (Funk pers. comm.).

4. Rio Bravo Bridge, Bernalillo Co., Rio Grande Valley State Park. Only one bird has been seen here- in 1988 (Hoffman pers. comm.) The park is owned by the state and operated by the city. No grazing is allowed. This site is also home to a Western Yellow-billed Cuckoo and a Common black hawk.

5. Isleta, Bernalillo Co., Isleta Pueblo. Two to three singing males were heard in 1981 and 1982.

6. Bernardo, Socorro Co., state land. The last record is of two singing males, three miles north of Bernardo in 1983. There is little suitable habitat left; this population is quite possibly extirpated (Hubbard pers. comm.)



7. Bosque del Apache National Wildlife Refuge, Sierra Co. Southwest Willow Flycatchers have very likely been extirpated from the Bosque. There is only one record of one singing male heard in 1982. The area is dominated by tamarisk and the sites both upstream and downstream have been long abandoned.



### The Southwest Willow Flycatcher in the Upper Colorado River Drainage

The Southwest Willow Flycatcher is all but extirpated from the northern edge of its range. It no longer occurs at 88.3% of known historic sites along the Colorado River in northern Arizona and southern Utah, and along the San Juan River in southern Utah and northern New Mexico. There are no records of Southwest Willow Flycatchers breeding in southern Colorado, though it is possible they did, at least historically.

Completely inundating riparian areas upstream, and alternately flooding and desiccating habitat downstream, Glen Canyon Dam has desimated the native flora and fauna of the Colorado and San Juan Rivers. In addition to direct destruction, it is also responsible for the increased domination of tamarisk (Behle and Higgins 1959) and Brown-headed Cowbirds throughout the diminished ecosystem.

There are only two sites in this portion of the Southwest Willow Flycatcher's range where it may still breed. The population at both these sites declined precipitously between 1987 and 1991 to a single pair at each and may well now "be inadequate for the long-term maintenance of a viable population" (Brown 1991). The nearest known occupied breeding site to these pairs is about 200 miles away.

Southwest Willow Flycatcher were common in the extensive Gooding willow, sand bar willow (*Salix exigua*), tamarisk, baccharis and arrowweed (*Pluchea sericea*) thickets of Glen Canyon in the 1950s (Behle and Higgins 1959). The filling of Lake Powell was predicted to stimulate growth of tamarisk thickets along shores of embayments and on the deltas at the mouths of incoming streams, while the fluctuating water levels were expected to decrease the extent of willow-cottonwood thickets (Behle and Higgins 1959). To the ill fortune of the Southwest Willow Flycatcher, both of these predictions proved true. Where it used to be quite common, the subspecies is now entirely absent from Glen Canyon above the Glen Canyon Dam, and occurs at only two sites along 86 miles of river below the dam.

Hoover Dam is likely to have caused the same level of destruction farther down on the Colorado river, an area from which the Southwest Willow Flycatcher is now entirely absent. A historic site (1972) on the San Juan River at Kirtland, which has also supported Western Yellow-billed Cuckoos, is currently threatened by the proposed Animas-La Plata project which would impound 200,000 acre feet of water for industrial and agricultural releases.

1. Saddle-Kwagunt, Coconino Co., AZ. Grand Canyon National Park, between River Miles 47 and 54, 24 km upstream from the confluence of the Colorado and Little Colorado Rivers. Nine pairs of Southwest Willow Flycatchers were present here in 1986 (Brown 1988). This section of the river comprises the "largest (100-150 ha) and best developed tract of riparian habitat between Lees Ferry and Phantom Ranch...a distance of 150 km by river" (Brown 1988). During 1991 surveys, Brown found only 1 singing male at Saddle-Kwagunt (Brown 1991).

2. Cardenas Marsh, Coconino Co., AZ. Grand Canyon National Park, river mile 71. This isolated 2 ha marsh supported two pairs of Southwest Willow Flycatchers in 1986. It is surrounded by well-developed riparian vegetation (Brown 1988). During 1991 surveys, Brown found only 1 singing male at Saddle-Kwagunt (Brown 1991).

During six years of study along a 86 mile stretch of the Grand Canyon, Brown found no other Southwest Willow Flycatchers.



## VIII. Inadequacy of Existing Regulatory Mechanisms

**United States Forest Service.** Although the Southwest Willow Flycatcher was put on Regional Forester's Sensitive Species List for Arizona and New Mexico as far back as 1988, no National Forest in Region 3 has as yet developed a management plan for the species. No Forest in the Region uses it as a riparian indicator species. No Forest in the Region has implemented Southwest Willow Flycatcher inventories. No Forest in the Region mentions the subspecies either in its Forest Plan or Forest Plan Environmental Impact Statement. No Forest even lists the Southwest Willow Flycatcher as a species of concern on grazing allotments where it currently and historically has occurred.

This neglect has been less than benign. Systematic overgrazing, water impoundment, and floods associated with overgrazing and logging have made the riparian cottonwood-willow association the most endangered habitat in North America. Surveying birdlife along 21 miles of the Gila River and Mogollon Creek within the Gila National Forest, Dale Zimmerman (1970) noted that "isolated trees and small to fairly large patches remain, but no truly mature cottonwood forest of any size now exists...In many stands, the cottonwoods appear only in the upper stratum; there are few young examples of any size. This is in most instances a reflection of browsing pressure by cattle." Native grasses, young willows and young sycamores were almost completely absent. He did find, however, *Argemone*, an indicator of excessive cattle grazing (Kearney and Peeble, 1951) and *Verbascum*, *Tribulus* and *Salsola*, indicators of disturbed soil and ground cover. He also found that Juniper had replaced the riparian trees in many areas: "their appearance probably...coincided with increased cattle grazing and elimination of normal ground cover."

Noting that previously lush riparian areas had "been largely denuded," Zimmerman concluded:

"The riparian woodlands and shrublands are receiving a disproportionate amount of use by domestic stock and decided misuse by certain elements of the visiting public who use the valley for recreation. It is apparent that to date 'wildlife values' have been given rather little consideration compared to 'cattle values'...the present wildlife of the Gila Valley remains largely if not entirely by accident. It gets along the best it can under generally worsening conditions. For some species this clearly is not sufficient for survival...At present, mature trees are disappearing at a rate far greater than that for reproduction of the same species. Significant reduction of grazing by domestic animals in the river valley would be a major step toward improvement of habitat."

The Gila National Forest knowingly destroyed willow habitat adjacent to a Southwest Willow Flycatcher nest site on the Brock Canyon allotment in 1991 in order to get tractor access to a ditch (McDonald pers. comm.).

Some of the best potential Southwest Willow Flycatcher habitat in the Gila Valley exists in the Gila National Forest Bird Habitat Area. Cattle have been excluded from the area for 2-3 years. The Forest, however, has just reached an agreement with the Pacific Western Cattle Company which will allow them to use the Habitat Area as a temporary cattle holding pen. A similar situation exists on the SXS allotment which contains some of the only potential habitat on the Forest at this time. It had been cattle free for six years, but was grazed in 1990 during a particularly dry spell. The allotment is coming up for review and possible restocking.

Though the Gila and Apache-Sitgreaves National Forests both have 10 year riparian recovery plans, neither has made any significant progress in implementing them though the 10 year period is half over. Both Forests are currently considering building dams on important tributaries to the San Francisco and Blue Rivers. Tularosa Creek and Pigeon Creek are among the very few tributaries in the region which have a consistent water supply.

The Carson National Forest has channelized the Chama River in the vicinity of the Willow Flycatchers breeding there despite public opposition (Hitt pers. comm.). The vegetation along the riverbank was decimated impacted by the heavy machinery involved.

The Sequoia National Forest has recently acquired the South Fork Wildlife Area from the Army Corps of Engineers. This area is adjacent to the Kern River Preserve, and with it forms a crucial Southwest Willow Flycatcher breeding site. The transfer, however, was made in part because the Army was perceived as being too restrictive concerning recreational use (Laymon pers. comm.). The Forest will soon open the area up to greater recreation. Recreation, particularly in riparian areas, is known to increase Brown-headed Cowbird brood parasitism, decrease understory vegetation, and decrease insect populations. As this site is already declining in response to high parasitism rates, it can not afford any increase in Cowbirds. The Kern River Preserve is currently considering trapping Cowbirds but having a recreation area nearby would probably undercut any Cowbird population control measures taken on the Preserve.

**Bureau of Land Management.** BLM grazing allotments are in as bad, or worse shape than Forest Service allotments. Though the BLM manages grazing on Elephant Butte Lake and Caballo Reservoir, it has developed no Southwest Willow Flycatcher conservation program.

**National Park Service.** Despite evidence that Southwest Willow Flycatcher populations respond positively to Brown-headed Cowbird trapping programs, despite recommendations to do so by a noted flycatcher authority (Brown 1991), and despite precipitous declines in what has been Arizona's only even marginally stable population, the Grand Canyon National Park has resisted instituting a trapping program, in part because it would be "inappropriate" and "impractical" within a National Park (Davis 1991). Without such a program, the Southwest Willow Flycatcher will almost certainly be extirpated from the Park in the very near future, perhaps as early as 1992.

**Bureau of Reclamation.** Bureau of Reclamation dams at Elephant Butte Lake and Caballo Reservoir have been responsible for the flooding of native cottonwood-willow habitat and the invasion of tamarisk. There are currently no regulations governing the fluctuation of reservoir or run off water levels that would adequately protect the Southwest Willow Flycatcher. Several breeding sites recently located on the Rio Grande and the Gila Rivers were the result of studies instituted by the Bureau in conjunction with plans for future water developments (Hink and Ohmart 1983, Montgomery et al. 1985).

The detrimental effects of Glen Canyon Dam on the Grand Canyon have been well studied. On August 1, 1991, interim regulations signed by Secretary Lujan cut water fluctuations on the Colorado River by three-quarters and the river's high water line by one-third. The regulations are to remain in effect until 1993 when the Glen Canyon Dam environmental impact statement is due. The Western Area Power Administration (WAPA), which operates the dam, had previously changed the water level below the dam as much as 13 feet per day, alternately submerging and dehydrating those plants which managed to survive on the flood-eroded beaches. The Bonytailed chub and the Colorado River squawfish have been extirpated, the Humpback chub and the Razorback sucker are declining. The Southwest Willow Flycatcher has been extirpated above the dam and survives at the only two healthy riparian areas along a 360 km stretch of river below Glen Canyon Dam. These two areas, one 2 ha and the other 100-150 ha, are under constant threat of destruction. It has been estimated that between 35 and 40% of Southwest Willow Flycatcher habitat below the dam was destroyed by water release caused floods between 1980 and 1985 (Pucherelli 1987).

The WAPA is lobbying to have the interim regulations scaled back to allow continued heavily fluctuating water releases (Williams 1991). Three weeks after the interim regulations took effect, Secretary Lujan issued draft "exception criteria" allowing the WAPA to violate the new regulations 3 percent of the time and in "emergency" situations. This exception is more than enough to insure the continued destruction of Southwest Willow Flycatcher habitat below the dam.

**National Wildlife Refuges.** Though National Wildlife Refuges (Bosque del Apache and Big Morongo) have been important breeding sites for the Southwest Willow Flycatcher, there have been no measures taken to protect the bird on any of the Refuges where it has been known to occur. Bosque del Apache, for example, has been allowed to degrade to the point of being taken over by tamarisk.

**Indian Nations.** No Indian Nations have regulations regarding the conservation of Southwest Willow Flycatchers. The Bureau of Indian Affairs briefly drained Black Rock Reservoir on the Zuni Indian Reservation in 1990 or '91 as part of a safety inspection (Cleary pers. comm.).

**State Agencies.** The Arizona Game and Fish Department listed the Southwestern Southwest Willow Flycatcher as Endangered in 1988, in 1989 they advised that, "the most urgent need is protection of existing willow-cottonwood thickets, and restoration where such habitats have already been destroyed, along rivers and streams at middle and lower elevations. An intensive statewide survey of known and possible breeding habitats is needed, and the relationship of cowbirds to Southwest Willow Flycatcher breeding success must be studied" (Johnson 1989a). These recommendations have not gone very far, however- one area on the lower Gila River is being restored and there are plans to survey Tonto Creek in the future. The State has instituted no measures to protect known or recent breeding sites.

The State of New Mexico has done even less. The La Joya State Game Refuge, for example, a recently occupied site, is over-run with tamarisk. Dredging of the actual breeding site may have been responsible for the subspecies' extirpation from La Joya in 1986 (Unitt 1987). The State Fish Hatchery in Glenwood, once a large breeding site, used to be excellent marsh habitat but has been allowed to degrade. The State Game Farm Enclosure, a current site, also used to be excellent marsh habitat until its water rights were transferred to Snow Lake, a recreational reservoir.

California is the only state in which broad riparian recovery and protection plans have been implemented, not on a scale large enough to prevent the loss of a number of breeding sites since 1987, however. In 1990 the Southwest Willow Flycatcher was listed as a state Endangered Species. At State Fish and Game department suggested that "the more likely means of recovery for the species is by habitat restoration," and "control of Brown-headed Cowbird populations" (Schlorff 1990a). Successful habitat restoration and parasite control have been largely carried out by the Nature Conservancy on the South Fork of the Kern River and the U.S. Marine Corps on the Santa Margarita River at Camp Pendleton.

"No state or federal laws explicitly protect California's riparian woodland and montane meadows, habitats which provide essential resources for the state's remaining populations of Willow Flycatchers. The only Willow

Flycatcher population in the state whose habitat is protected in perpetuity is that on the Nature Conservancy's Kern River Preserve" (Schlorff 1990a).

The recent extirpation of Southwest Willow Flycatchers from the San Luis Rey River Valley was due to a water diversion plan which dehydrated its habitat (Unitt pers. comm.).

### IX. Critical Habitat Designation Recommended

Petitioners strongly recommend the designation of critical for the Southwest Willow Flycatcher coincident with its listing. Its demise is clearly and overwhelmingly related to the fragmentation, degradation and outright destruction of riparian habitat, especially willow-cottonwood habitat. Critical habitat should be designated in all areas where it is currently located and in key unoccupied areas where restoration is necessary for the conservation of the subspecies.

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Dated this    day of January, 1992



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<sup>3</sup>Most of the documents referenced in this petition were gathered from the U.S. Fish and Wildlife office in Phoenix which has an extensive Southwest Willow Flycatcher file thanks to the efforts of Kathleen Linder. Documents not originally in the FWS file but referenced in this petition (excepting book length manuscripts), have been supplied to the Phoenix office.

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## Appendix B: Views of Scientific Authorities

**John Hubbard**, Endangered Species Program Director, New Mexico Department of Game and Fish:

"(T)he conclusion is virtually inescapable that a decrease has occurred in the population of breeding Southwest Willow Flycatchers in New Mexico over historic time. This is based on the fact that wooded sloughs and similar habitats have been widely eliminated along streams in New Mexico, largely as a result of the activities of man in the area. Particularly detrimental to Southwest Willow Flycatcher habitat have been the diversion of water, draining of wetlands, channelization and leveeing of streambeds, construction of canals, drains, and impoundments, and the cutting of woodlands. These activities have reduced or altered the extent of these habitats rather widely in New Mexico...If *E. t. extimus* proves to be a valid subspecies and the total breeding population is estimated at fewer than 1000 pairs, it should be considered for listing as a threatened/endangered species by the U. S. Fish and Wildlife Service under the Endangered Species Act" (Hubbard 1987)

**Chuck Hunter**, U.S. Fish and Wildlife Service:

"...various field investigations...have documented extreme declines throughout much of its historical range" (Hunter 1988).

"Only 25 pairs are thought to remain in Arizona, which makes this subspecies as rare as the Federally endangered Bald Eagle (*Haliaeetus leucocephalus*), a species that receives a tremendous amount of attention from management agencies...(it) is very close to total extirpation in this state...Arizona has witnessed the steepest (population) declines...The demise of the Southwest Willow Flycatcher can be explained primarily by the loss of willow-cottonwood riparian habitat. Along most major rivers systems, exotic saltcedar has replaced willows and cottonwoods as the dominant riparian tree...These habitats are inching closer each year to complete disappearance...in Arizona and throughout the Southwest...Of the many declining riparian birds, only the Southwest Willow Flycatcher has declined to very population levels throughout its range...I can think of no other bird species, or subspecies, that deserves Federal protection more immediately than the Southwest Willow Flycatcher" (Hunter 1989).

"The status of willow flycatcher in the Southwest is quite clear. There has been substantial decline throughout the Southwest and remnant populations are mostly small, widely scattered, and apparently in decline...the bottom line for the southwest willow flycatcher is the loss of cottonwood-willow habitats on almost all lower-elevation riparian systems. Cottonwood-willow regeneration is limited as a direct result of water management policies" (Hunter 1991).

**Terry Johnson**, Non-Game Branch Supervisor, Arizona Game and Fish Department:

"We are very much concerned (about) the Southwest Willow Flycatcher ...The *extimus* race is endangered not just in Arizona!...I am very much afraid the Southwest Willow Flycatcher might be dismissed as 'just another *Empidonax*,' and the southwestern race as reflecting a local problem... Neither is true...The Southwest willow flycatcher must "get the attention it needs now" (Johnson 1989b, emphasis original).

"The most urgent need is protection of existing willow-cottonwood thickets, and restoration where such habitat has already been destroyed, along rivers and streams at middle and lower elevation" (Johnson 1989a).

**Gale Monson**, ornithologist:

"In short, it would appear both birds (the Cactus ferruginous pygy-owl and the Southwest Willow Flycatcher) are deserving of ENDANGERED status" (Monson 1991, emphasis original).

**Ronald W. Schlorff**, Associate Wildlife Biologist, California Department of Fish and Game:

"The loss of lowland riparian woodlands is probably the principal reason for the reduction of California's Willow Flycatcher population and the contraction of their range...Public lands occupied by Willow Flycatchers should be managed to protect riparian vegetation rather than for livestock grazing or other incompatible uses. One of the most important elements in protecting riparian habitats that support Willow Flycatcher is to eliminate or reduce grazing or to fence riparian areas to exclude livestock from willow clumps where nests are located...Brown-headed Cowbird numbers must be reduced...development of campgrounds, feedlots, corrals, dairies, horse stables, garbage dumps, and housing should be discouraged in areas adjacent to habitats supporting Willow Flycatchers...These measures will help to preserve existing populations...but may not contribute significantly to the recovery of the species. To increase Willow Flycatcher numbers in California, these management guidelines must be applied to areas that are potentially suitable for, but currently unoccupied by this species" (Schlorff 1990a).

**Phillip Unitt**, ornithologist:

"(*E*)*xtimus* has dwindled nearly to extinction as the habitat on which it depends has been degraded and decimated...The available evidence indicates that the population of *extimus* has declined precipitously and that the subspecies is now rarer than

may other birds formally listed as endangered. The subspecies is now absent from many areas where it was once common, and most of the remaining population is restricted to a few colonies...Riparian habitat destruction is probably most responsible for the decline of *extimus*...Protection and restoration of riparian woodlands is clearly the flycatchers' primary need..." (Unitt 1987).

**Mary Whitfield**, ornithologist:

"MANAGEMENT RECOMMENDATIONS...1. Preserve and protect as much riparian habitat as possible. Especially areas that currently have resident Willow Flycatchers or have had them in the past. 2. Eliminate or decrease cattle grazing in and near areas that Willow Flycatchers occupy...3. Improve riparian habitat through restoration...4. In areas where Cowbird parasitism is high and the Willow Flycatcher population is declining, trap Brown-headed Cowbirds...It should be realized that this is only a short-term solution and efforts to restore habitat and/or remove or reduce cattle grazing are more important long-term solutions" (Whitfield 1990).

**Dale Zimmerman**, ornithologist:

"The Southwest Willow Flycatcher may become extinct by the year 1995 or 2000 if it is not given federal protection...There are probably only 50-75 pairs remaining in New Mexico" (pers. comm.).



## Appendix C: Recent and Historical Sites West of the Colorado River.

Locality	Date	# Singing Males or Pairs	Land Ownership
<b>South Fork Kern River, Kern Co., CA</b>			
Weldon, Kern Co.	1911	1 (Unitt 1987)	Nature Conservancy Sequoia National Forest
18 km east of Onyx Ranch	1982	27 (Serena 1982)	
Kern River Preserve	1982	1	
Near Weldon	1984	23 (McCaskie 1984)	
Near Weldon	1986	39 (Harris et. al. 1987)	
	1989	43 (Laymon pers. comm.)	
	1990	41 (Laymon pers. comm.)	
	1991	31 (Laymon pers. comm.)	
<b>Santa Margarita River, San Diego Co., CA</b>			
2 mi. NE of Fallbrook	1980	5 (Unitt 1984)	U.S.M.C. Camp Pendleton Private
Camp Pendleton	1981	5 (Unitt 1987)	
Camp Pendleton	1982	10 (Unitt 1987)	
Camp Pendleton	1983	10 (Unitt 1987)	
Camp Pendleton	1984	16 (Unitt 1987)	
2 mi. NE of Fallbrook	1984	0	
Camp Pendleton	1985	15 (Unitt 1987)	
Camp Pendleton	1986	17 (Unitt 1987)	
Santa Margarita, C.P.	1987	?	
Pilgrim Creek, C.P.	2	(Griffin pers. comm.)	
Pilgrim Creek	2	(Griffin pers. comm.)	
Santa Margarita River (Fallbrook Public Utility District)	1	(Griffin pers. comm.)	
Santa Margarita River, C.P.	1988	16 (Griffin pers. comm.)	
Pilgrim Creek, C.P.	2		
Pilgrim Creek	2		
Santa Margarita River, C.P.	1989	20 (Griffin pers. comm.)	
Pilgrim Creek, C.P.	2		
Pilgrim Creek	2		
Santa Margarita River, C.P.	1990	26 (Griffin pers. comm.)	
Pilgrim Creek, C.P.	3		
Pilgrim Creek	1		
Duluz Creek, C.P.	2		
Las Floras Creek, C.P.	1		
Santa Margarita, C.P.	1991	29 (Griffin pers. comm.)	
Pilgrim Creek, C.P.	24		
Pilgrim Creek	3		
Pilgrim Creek	1		
French Creek, C.P.	1		
<b>Upper San Luis Rey River, San Diego Co., CA</b>			
Lake Henshaw to La Jolla Reservation	1984	13 (Unitt 1987)	Cleveland N.F. State
3.6 km northwest of Lake Henshaw Dam	12		
Lake Henshaw to La Jolla Reservation	1986	6 (Unitt 1986)	
(Birds still present as of 1991)		(Unitt pers. comm.)	

**San Timoteo Creek**, San Bernadino Co., CA 1987 5 (Zimble pers. comm.)

**Prado Flood Control Basin**, Riverside Co., CA Army Corp of Engineers  
 Santa Ana River 1986 4 (McCaskie 1986) Riverside Regional Parks  
 Santa Ana River 1991 4 (Zimble pers. comm.)

**Anza-Borrego Desert State Park**, San Diego Co., CA State  
 Lower Willows, Coyote Canyon 1989 1 (Griffith pers. comm.)

**Sweetwater River**, San Diego Co., CA  
 National City 1913 1 (Unitt 1987)  
 Sunnyside, Sweetwater River 1917 1 (Unitt 1987)  
 Sweetwater Reservoir 1920 2 (Unitt 1987)  
 Sweetwater Reservoir 1921 2 (Unitt 1987)  
 Sweetwater Reservoir, upper end 1984 2 (Unitt 1987)  
 Sweetwater Reservoir, upper end 1986 1 (Unitt 1987)

**Rio Santo Tomas**, Baja California,  
 5 km northwest of Santo Tomas 1986 1 (Unitt 1987)

**Big Morongo Wildlife Preserve**, San Bernadino Co., CA **EXTIRPATED**  
 1977-1980 0 (Unitt 1987)  
 1981 1 (Unitt 1987)  
 1982-1983 0 (Unitt 1987)  
 1991 0 (Trochet pers. comm.)

**Oro Grande**, San Bernadino Co., CA 1920 1 (Unitt 1987) **EXTIRPATED**

**Colton**, San Bernadino Co., CA **EXTIRPATED**  
 Santa Ana River near Colton 1908 1 (Unitt 1987)  
 1918 1 (Unitt 1987)

**Seven Oaks**, San Bernadino Co., CA **EXTIRPATED**  
 1905 1 (Unitt 1987)

**Cuyamaca Peak**, San Diego Co., CA **EXTIRPATED**  
 Base of Cuyamaca Peak 1895 1 (Unitt 1987) Cleveland N.F.

**Lake Cuyamaca**, San Diego Co., CA **EXTIRPATED**  
 South end of Lake Cuyamaca 1920 8 (Unitt 1987) Cleveland N.F.  
 South end of Lake Cuyamaca 1921 8 (Unitt 1987) State  
 South end of Lake Cuyamaca 1984 4 (Unitt 1987)  
 South end of Lake Cuyamaca 1986 0 (Unitt 1987)  
 (No sightings in recent years despite repeated surveys) (Unitt pers. comm.)

**Lower San Luis Rey River**, San Diego Co., CA **EXTIRPATED**  
 Gird Road 1978 1 (Unitt 1984)  
 3 km NE of Bonsall 1978 1 (Unitt 1987)  
 3 km NE of Bonsall 1984 0 (Unitt 1987)

**Doane Valley**, San Diego Co., CA **EXTIRPATED**  
 Doane Valley, Palomar Mountain 1945 1 (Unitt 1987)

**Jamul Creek**, San Diego Co. **EXTIRPATED** by reservoir  
 At entrance to Lower Otay Lake 1975 1 (Unitt 1987) flooding

At entrance to Lower Otay Lake	1987	0		
<b>Tijuana River, San Diego Co., CA</b>				<b>EXTIRPATED</b>
East of Dairy Mart Road	1981	1	(Unitt 1987)	
East of Dairy Mart Road	1982	2	(Unitt 1987)	
East of Dairy Mart Road	1984	5	(Unitt 1987)	
East of Dairy Mart Road	1986	0	(Unitt 1987)	
(No recent sightings, water has been diverted)			(Unitt pers. comm.)	
<b>Campo, San Diego Co., CA</b>	1908	1	(Unitt 1987)	<b>Extirpated</b>
<b>San Fernando Valley, Los Angeles Co., CA</b>				<b>EXTIRPATED</b>
San Fernando	1899	1	(Unitt 1987)	
	1903	1	(Unitt 1987)	
<b>West Los Angeles, Los Angeles Co., CA</b>				<b>EXTIRPATED</b>
Cienaga (= W. Los Angeles)	1889	1	(Unitt 1987)	
<b>El Monte, Los Angeles Co., CA</b>	1897	1	(Unitt 1987)	<b>EXTIRPATED</b>
	1903	3	(Unitt 1987)	
<b>Long Beach, Los Angeles Co., CA</b>	1913	1	(Unitt 1987)	<b>EXTIRPATED</b>
<b>Pico Rivera, Los Angeles Co., CA</b>	1920	1	(Unitt 1987)	<b>EXTIRPATED</b>
<b>Los Cerritos, Los Angeles Co., CA</b>	1908	2	(Unitt 1987)	<b>EXTIRPATED</b>
<b>Capistrano Beach, Orange Co., CA</b>	1966	2	(Unitt 1987)	<b>EXTIRPATED</b>
<b>Riverside, Riverside Co., CA</b>	1892	2	(Unitt 1987)	<b>EXTIRPATED</b>
<b>Palm Canyon, Riverside Co., CA</b>				<b>EXTIRPATED</b>
Palm Canyon, San Jacinto Mts.	1908	1	(Unitt 1987)	
<b>Salton Sea, Imperial Co., CA</b>	1934	1	(Unitt 1987)	<b>EXTIRPATED</b>
3 miles west of Niland	1952	1	(Unitt 1987)	
3 miles west of Niland	1953	5	(Unitt 1987)	
<b>Lower Colorado River, Imperial Co., CA</b>				<b>EXTIRPATED</b>
Near Yuma	1902	37	(Unitt 1987)	
5 miles northeast of Yuma	1910	1	(Unitt 1987)	
2 miles north of Bard	1925	1	(Unitt 1987)	
	1930	5	(Unitt 1987)	
3 miles north of Bard	1			
Potholes (= Laguna Dam)	4			
Potholes (= Laguna Dam),	1938	1	(Unitt 1987)	
Bard	1945	1	(Unitt 1987)	
<b>Wild Rose Canyon, Inyo Co., CA</b>				<b>EXTIRPATED</b>
Wild Rose Canyon, Panamint Mts.	1917	1	(Unitt 1987)	
<b>Independence, Inyo Co., CA</b>				<b>EXTIRPATED</b>
2 mi. north of Independence	1917	1	(Unitt 1987)	
<b>Rio San Telmo, Baja California</b>				<b>EXTIRPATED</b>
Las Cabras	1923	1	(Unitt 1987)	

<b>San Pedro Martir</b> , Baja California				<b>EXTIRPATED</b>
La Grulla	1925	1	(Unitt 1987)	
<b>Cerro Prieto</b> , Baja California				<b>EXTIRPATED</b>
7 miles east of Cerro Prieto	1928	4	(Unitt 1987)	
<b>Indian Springs</b> , Clark Co., NV				<b>EXTIRPATED</b>
Indian Springs	1932	3	(Unitt 1987)	
Indian Springs	1936	2	(Unitt 1987)	
<b>Corn Creek</b> , Clark Co., NV	1962	1	(Unitt 1987)	<b>EXTIRPATED</b>
<b>State Tip</b> , Clark Co., NV				<b>EXTIRPATED</b>
Colorado River, southern tip of state	1953	1	(Unitt 1987)	
<b>Bill Williams Delta</b> , La Paz Co., AZ				<b>EXTIRPATED</b>
	1990	0	(Trochet pers. comm.)	
<b>Near Eherenberg</b> , La Paz Co., AZ	pre-1970	1	(Unitt 1987)	<b>EXTIRPATED</b>
<b>La Paz</b> , La Paz Co., AZ				<b>EXTIRPATED</b>
	pre-1970	1	(Unitt 1987)	
<b>Yuma</b> , Yuma Co., AZ				<b>EXTIRPATED</b>
	pre-1970	1	(Unitt 1987)	

## Appendix D: Recent and Historic Sites in the Rio Grande

<u>Location</u>	<u>Singing Males</u>		
	<u>Date</u>	<u>or Pairs</u>	
<b>Rio Chama</b> , Rio Arriba Co., NM			Private
Rio Chama		(Hubbard 1987)	
Los Ojos/Parkview	1925	2 (Hubbard 1987)	
Los Ojos/Parkview	about 1983	4-5 (Trochet pers. comm.)	
<b>Canjilon</b> , Rio Arriba Co., NM			Carson National Forest
near Canjilon	1973	1 (Hubbard 1987)	
near Canjilon	1982	1 (Hubbard 1987)	
near Canjilon	1983	1 (Hubbard 1987)	
<b>Red River</b> , Taos Co., NM			
Red River area	1975	1 (Hubbard 1987)	
<b>Dixon</b> , Taos Co., NM			
Rio Grande	1976	(Hubbard 1987)	
<b>Rio Penasco</b> , Taos Co., NM			
east of Penasco	1970	1 (Hubbard 1987)	
east of Penasco	1972	1 (Hubbard 1987)	
east of Penasco	1981	1 (Hubbard 1987)	
<b>Philmont Scout Ranch</b> , Colfax Co., NM	1970's	1 (Hubbard 1987)	Private
<b>Jemez Mountains</b> , Sandoval County, NM	1968	1 (Hubbard 1987)	
<b>Alameda</b> , Bernalillo Co., NM			Private
Rio Grande at Alameda,	1974	1-3 (Hubbard 1987)	
<b>Albuquerque</b> , Bernalillo Co., NM			Sierra Club Foundation, Albuquerque
Rio Grande at Albuquerque	1981	1 (Unitt 1987)	Public Schools and Ray Graham
Oxbow Marsh, Albuquerque	1985	2 (Unitt 1987)	
Oxbow Marsh, Albuquerque	1986	1 (Unitt 1987)	
<b>Rio Bravo Bridge</b> , Bernalillo Co., NM			Rio Grande Valley State Park
3 mi. south of Rio Bravo Bridge	1988	1 (Steve Hoffman pers. comm.)	State and City
<b>Isleta</b> , Bernalillo Co., NM			Isleta Pueblo
Rio Grande at Isleta	1981	2-3 (Hubbard 1987)	
Rio Grande at Isleta	1982	2-3 (Hubbard 1987)	
<b>Los Lunas</b> , Valencia Co., NM			
Rio Grande at Los Lunas	1981	1 (Hubbard 1987)	
<b>Bernardo</b> , Socorro Co., NM			State
Bernardo		(Unitt 1987)	
3 miles north of Bernardo	1983	2 (Hubbard 1987)	
<b>La Joya</b> , Socorro Co., NM			State Game Refuge
Rio Grande at La Joya SGR	1982	4 (Unitt 1987)	<b>EXTIRPATED</b> by local water
Rio Grande at La Joya SGR	1986	0 (Unitt 1987)	conservancy dredging

**Escondida**, Socorro Co., NM

1 mi. east, 1 mi. north Escondida 1964 1 (Unitt 1987)

**Bosque del Apache NWR**, Socorro Co., NM

Bosque del Apache NWR 1982 1 (Unitt 1987)

National Wildlife Refuge

**Elephant Butte Marsh**, Sierra Co., NM

Elephant Butte Marsh 1972 1 (Hubbard 1987)  
 Elephant Butte Marsh 1974 10 (Hundertmark 1978)  
 Elephant Butte Marsh 1975 2 (Hundertmark 1978)  
 Elephant Butte Marsh 1976 0 (Hundertmark 1978)  
 1978-1981 0 (Hubbard 1987)

Bureau of Reclamation  
**EXTIRPATED** by flooding

**Caballo Lake**, Sierra Co., NM

Caballo Lake (Unitt 1987)

Bureau of Reclamation

**Radium Springs**, Dona Ana Co., NM

8 miles north of Radium Springs 1939 2 (Hubbard 1987)  
 Radium Springs 1939 2 (Hubbard 1987)  
 Radium Springs 1948 1 (Hubbard 1987)

**Las Cruces**, Dona Ana Co., NM

Las Cruces 1920 2 (Hubbard 1987)

**Anthony**, Dona Ana Co., NM

near El Paso Country Club 1944 1 (Hubbard 1987)  
 near el Paso Country Club 1946 1 (Ligon 1961)  
 Anthony 1946 1 (Ligon 1961)

**Lower Penasco**, Chaves Co., NM

(Hubbard 1987)

**Fort Hancock**, TX

Rio Grande River at Fort Hancock

(Unitt 1987)

**Guadalupe Mountains**

Guadalupe Mountains

(Unitt 1987)

**Glenn Springs**, Brewster Co., TX

9 miles southeast of Glenn Springs

(Unitt 1987)

**Alpine**, Brewster Co., TX

15 miles northwest of Alpine

(Unitt 1987)

Appendix E: Recent and Historic Sites in  
Sonora, Eastern Arizona and Western New Mexico

Locality	Singing Males or Date	Breeding Pairs	Status
<b>Cottonwood Gulch</b> , McKinley Co., NM			<b>EXTIRPATED</b>
Cottonwood Gulch	1959	1 (Hubbard 1987)	Cottonwood Gulch Ass.
<b>Bluewater Lake</b> , McKinley Co., NM			<b>EXTIRPATED</b>
Bluewater Lake	1979-1980	0 (Trochet pers. comm.)	Private
Zuni Reservation	1981	1 (Trochet pers. comm.)	
Zuni Reservation	1982-1985	0 (Trochet pers. comm.)	
Zuni Reservation	1986	1 (Trochet pers. comm.)	
Bluewater Lake	1987-1988	0 (Trochet pers. comm.)	
<b>Blackrock Reservoir</b> , McKinley Co., NM			Zuni Indian Reservation
East side of reservoir	1981-1991	1-2 (Cleary pers. comm.)	
<b>Rio Nutria</b> , McKinley Co., NM			Zuni Indian Reservation
Below Nutria Diversion	1986-1990	1-4 (Trochet pers. comm.)	
Reservoir			
Village of Upper Rio Nutria	about 1987	1 (Trochet pers. comm.)	<b>EXTIRPATED</b>
Village of Upper Rio Nutria	1988-1991	0 (Trochet pers. comm.)	
<b>Springerville</b> , Apache Co., AZ			
Little Colorado River		(Unitt 1987)	
<b>Greer</b> , Apache Co., AZ			Apache-Sitgreaves National Forest
Confl. of Little Colorado and South (=East) Fork of the Little Colorado	prior to 1981	1 (Monson and Phillips 1981)	Private
Greer	1988	1-2 (Witzeman 1988)	
Greer	1991	1 (Corman 1991)	
Benny Creek	1991	1 (Corman 1991)	
West Fork of the Little Colorado	1991	1 (Corman 1991)	
<b>Alpine</b> , Apache Co., AZ			
200 yds. S. of U.S. 180, .5 mi. E. of U.S. 666	1991	1 (Bradley 1991)	
<b>Blue River</b> , Greenlee Co., AZ			
.5 mi. N. of old Blue Post Office	1989	1 (Bradley 1991)	
<b>Black River</b> , Apache Co., AZ			(Unitt 1987)
<b>Fort Apache</b> , Apache Co., AZ			White Mountain Apache Indian Reservation
.5 miles east of Fort Apache	1972	1 (Unitt 1987)	
<b>Apache Creek</b> , Catron Co., NM			
Apache Creek	1971	1 (Hubbard 1987)	Gila National Forest
<b>Tularosa Creek</b> , Catron Co., NM			Gila National Forest
Tularosa Creek	1976	1 (Hubbard 1987)	

<b>Reserve</b> , Catron Co., NM					
Reserve	1927	1	(Hubbard 1987)		Private
<b>Frisco Box</b> , Catron Co., NM			(Hubbard 1987)		Gila National Forest
between Frisco Box and hot springs					
<b>Glenwood</b> , Catron Co., NM					State Fish Hatchery
Glenwood State Fish Hatcher	1972	1	(Unitt 1987)		
<b>Pleasanton</b> , Catron Co., NM					
Pleasanton	1968	1	(Hubbard 1987)		
<b>Mogollon/Gila</b> , Grant Co., NM					Gila National Forest
Gila River from Turkey Creek to Mogollon Creek	1969	6	(Zimmerman 1970)		
Mogollon Creek from Rough Canyon to Gila River, Gila River down to the N.F. boundary	1969	4	(Zimmerman 1970)		
Brock Canyon Allotment	1990	2	(McDonald pers. comm.)		
<b>Mangus Springs</b> , Grant Co., NM					
Marsh near Mangus Springs the past"	"several pairs in		(Fischer pers. comm.)		<b>EXTIRPATED</b>
<b>Buckhorn</b> , Grant Co., NM					
Duck Creek a	2-3		(Hubbard 1987)		
<b>Cliff</b> , Grant Co., NM					Private
Gila River near Cliff	1981	50	(Egbert 1981)		
Gila River near Cliff	1983	53	(Montgomery et al. 1985)		
(records may include some migrants)					
<b>Bird Habitat Area</b> , Grant Co., NM					Gila National Forest
			(Zimmerman pers. comm.)		
<b>Redrock</b> , Grant Co., NM					New Mexico Game and Fish
Gila River	1937	2	(Hubbard 1987)		Game Inclosure, BLM and
Gila River	1959	common	(Hubbard 1987)		Private
Gila River	1968	1	(Hubbard 1987)		
Gila River, 1 mile north Red Rock	1975	1	(Hubbard 1987)		
Gila River, near Redrock	1981	28	(Hubbard 1987)		
Gila River, near Redrock	1983	19	(Montgomery et al. 1985)		
<b>Dudleyville</b> , Pinal Co., AZ					
San Pedro River	1985	4			
San Pedro River	1986		(Hunter pers. comm.)		
<b>Cook's Lake</b> , Pinal Co., AZ					<b>Extirpated</b>
5 miles south of Dudleyville	1940	25-30	(Gatz 1991)		
5 miles south of Dudleyville	1940	7	(Gatz 1991)		
5 miles south of Dudleyville	1976	1	(Gatz 1991)		
5 miles south of Dudleyville	1978	1	(Gatz 1991)		
5 miles south of Dudleyville	1979	1	(Gatz 1991)		
5 miles south of Dudleyville	1986	0	(Hunter pers. comm.)		
<b>San Manuel</b> , Pinal Co., AZ					
San Pedro River	1985	3			
San Pedro River	1986		(Hunter pers. comm.)		



<b>South of Mammoth</b> , Pinal Co.				
San Pedro River	1933		(Unitt 1977)	<b>EXTIRPATED</b>
<b>Charleston</b> , Cochise Co., AZ				<b>EXTIRPATED</b>
San Pedro River	~1975		(Kreuper, 1991)	BLM San Pedro Riparian National
San Pedro River	1986-1991	0		Conservation Area
<b>Fort Thomas</b> , Graham Co., AZ				
Gila River at Fort Thomas	1985	3	(Hunter pers. comm.)	
Gila River at Fort Thomas	1986	"several"	(Hunter pers. comm.)	
<b>Feldman</b> , Pinal Co., AZ				<b>EXTIRPATED</b>
	1940	1	(Monson and Phillips 1981)	
<b>Camp Verde</b> , Yavapai Co., AZ				<b>EXTIRPATED</b>
Verde River	pre 1970		(Unitt 1987)	
<b>Tucson</b> , Pima Co., AZ				<b>EXTIRPATED</b>
Santa Cruz River at Tucson	1884	1	(Unitt 1987)	
near Tucson	1940	1		
<b>Nogales</b> , Santa Cruz Co., AZ				<b>EXTIRPATED</b>
Santa Cruz River, Nogales	1885	1	(Unitt 1987)	
Santa Cruz River, Nogales	1893	1	(Unitt 1987)	
<b>Mexican Border</b> , Santa Cruz Co., AZ				
Santa Cruz River	1893	2	(Unitt 1987)	
<b>Sonora</b> , Mexico				
2 km south-southwest of La Casita	1955	1	(Unitt 1987)	
37 km south of Nogales	1952	1	(Unitt 1987)	
Agua Caliente, 48 km south of Nogales				

Appendix F: Recent and Historical Sites  
on the Upper Colorado Drainage

<b>St. George</b> , Iron Co., UT	(Behle 1958)	
Virgin River		
<b>Springdale</b> , Iron Co., UT	(Behle 1958)	
Virgin River, Springdale		
<b>Kanab</b> , Kane Co., UT		
3 miles south of Kanab	1958 1 (Behle 1985)	
<b>Havasus Creek</b> , Coconino Co., AZ	probable occurrence (Carothers and Johnson 1975)	Grand Canyon National Park <b>EXTIRPATED</b>
<b>Deer Creek</b> , Coconino Co., AZ	probable occurrence (Carothers and Johnson 1975)	Grand Canyon National Park <b>EXTIRPATED</b>
<b>Saddle Kwagunt</b> , Coconino Co., AZ		Grand Canyon National Park
	1982 1 (Brown 1991)	
	1983 4 (Brown 1991)	
	1984 3 (Brown 1991)	
	1985 7 (Brown 1991)	
	1986 9 (Brown 1991)	
	1987 4 (Brown 1991)	
	1991 1 (Brown 1991)	
<b>Little Colorado</b> , Coconino Co., AZ		Grand Canyon National Park
mouth of Little Colorado	1953 1 (Monson 1953)	<b>EXTIRPATED</b>
<b>Cardenas Marsh</b> , Coconino Co., AZ		Grand Canyon National Park
Cardenas Marsh	1971 1 (Carothers and Sharber 1976)	
Cardenas Creek	1982 1 (Brown 1991)	
Cardenas Creek	1983 0 (Brown 1991)	
Cardenas Creek	1984 1 (Brown 1991)	
Cardenas Creek	1985 1 (Brown 1991)	
Cardenas Creek	1986 2 (Brown 1991)	
Cardenas Creek	1987 3 (Brown 1991)	
Cardenas Creek	1991 1 (Brown 1991)	
<b>Lees Ferry</b> , Coconino Co., AZ		Grand Canyon National Park
2 mi. below Lees Ferry	1933 1 (Woodbury and Russell 1945)	<b>Extirpated</b>
near Lees Ferry	1936 2 (Woodbury and Russell 1945)	
.5 mi. below Lees Ferry	1938 9 (Behle and Higgins 1959)	
Lees Ferry	1953 1 (Monson 1953)	
Immediately above Lees Ferry	1959 common (Behle and Higgins 1959)	
<b>Glen Canyon</b> , Kane Co., UT		Glen Canyon National Recreation Area
25 mi. above Lees Ferry	1938 8 (Behle and Higgins 1959)	<b>EXTIRPATED</b>
41 mi. above Lees Ferry	1938 8 (Behle and Higgins 1959)	
63 mi. above Lees Ferry	1938 2 (Behle and Higgins 1959)	
50 mi. above Lees Ferry	1938 3 (Behle and Higgins 1959)	
75 mi. above Lees Ferry	1938 1 (Behle and Higgins 1959)	
<b>Kane Creek</b> , Kane Co., UT		Glen Canyon National Recreation Area
Junction of Kane Creek and	1958 1 (Behle and Higgins 1959)	<b>EXTIRPATED</b>

