Banding and Genetic Sampling of Willow Flycatchers in Colorado - 1996 & 1997 Summary Report

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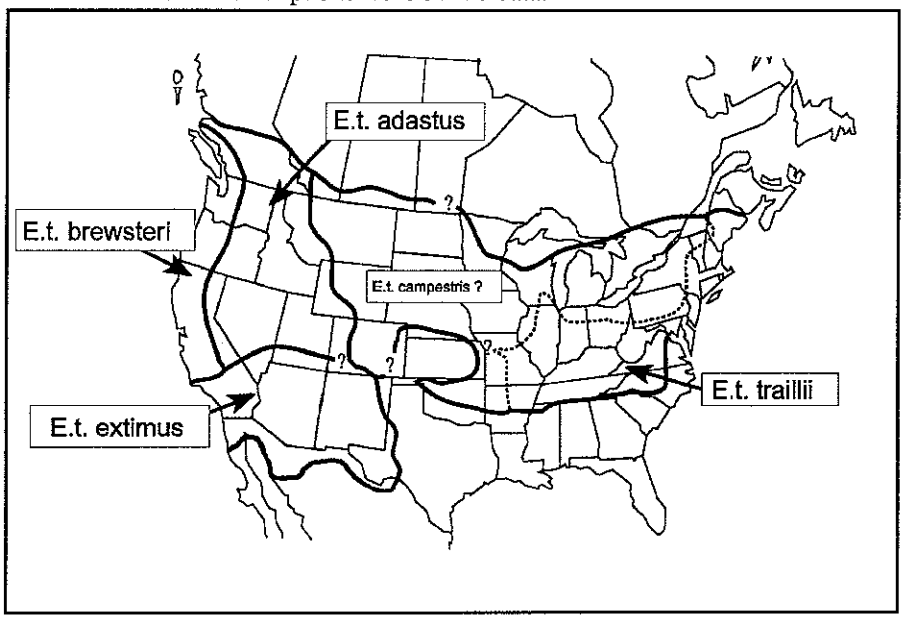
INTRODUCTION

Willow flycatcher taxonomy, status and distribution in Colorado

The willow flycatcher (*Empidonax traillii*) is a small passerine bird widely distributed across much of North America. A neotropical migrant, it spends only three to five months each year on its breeding grounds, with the remainder of the year spent in migration and on wintering areas in Central America and (possibly) northern South America (USFWS 1993). Willow flycatchers are relatively late spring migrants, with many individuals still migrating northward as late as early June. Southbound migrants may depart their breeding areas as early as late July. During these same periods, other individuals are already actively nesting and raising young on their breeding territories. Therefore, spring and fall migrants may be found in the same river systems, sometimes even the same habitat patches, as territorial breeders during all but a relatively short period of the summer (from roughly 15 June through 20 July; Unitt 1987). This potential co-occurrence and overlap of breeding and migrating flycatchers often confuses the local status of the species in many areas.

The southwestern willow flycatcher (*Empidonax traillii extimus*) is one of the four (Unitt 1987) or five (Phillips 1948, Browning 1993) recognized subspecies of the willow flycatcher (Figure 1). The subspecies taxonomy of the willow flycatcher is based on examination of subtle differences in morphology and coloration, primarily from museum specimens. The absence and/or limited number of available museum specimens from some regions, coupled with the difficulty in separating breeders from migrants and the subtle nature of the differences themselves, complicates efforts at characterizing the subspecies boundary ranges. However, the taxonomic validity of *E.t. extimus* is widely accepted and has been recently confirmed (Phillips 1948, Aldrich 1951, Unitt 1987, Browning 1993)

Figure 1. The breeding range distribution of the subspecies of the willow flycatcher (*Empidonax traillii*). Based on Unitt (1988) and Browning (1993), with modifications based on unpublished USFWS data.



Arizona, New Mexico, and California comprise the core of the southwestern willow flycatcher's historic and current range. The breeding range probably extends into western and southwestern Colorado, but the exact range limits are unclear. Henshaw (1875) collected seven specimens near Fort Garland (Costilla County) and one from Pagosa Springs (Archuleta County), but the nature and timing of these records make it impossible to determine if they were breeders or migrants. Phillips (1948) listed *E.t. adastus* specimens near Pueblo (Pueblo County) and Colorado Springs (El Paso County), but made no mention of flycatchers from the southwest portion of the state. Bailey and Niedrach (1965) describe two willow flycatchers collected in San Juan County, but these records are not confirmed as breeders. They conclude, based partially on some cooperative work with A.R. Phillips, that *extimus* probably enters some part of western Colorado and intergrades with *adastus* in the Rocky Mountains.

More recent work provides at best only limited clarification on the range limits of *extimus*. Unitt's (1987) review of flycatcher taxonomy and status did not include any confirmed *extimus* breeding specimens or localities in Colorado. Andrews and Righter (1992) describe the uncertain status of *extimus* in Colorado, but note that willow flycatchers such as those at Escalante State Wildlife Area (Delta County) may be of this race. Browning's (1993) review of willow flycatcher taxonomy discusses some of the difficulties in determining the subspecies' ranges in this region, but included portions of far southern and southwestern Colorado as possibly within *extimus* range (pending further clarification).

In short, the taxonomic status of willow flycatchers breeding in southern and western Colorado is still unclear. Furthermore, there have been few verified willow flycatcher breeding records in these areas. However, the U.S. Fish and Wildlife Service (1995) ruled that willow flycatchers breeding in southwestern Colorado are included among those protected as *extimus*. This has focused attention on the need to survey for suitable breeding habitat, document current breeding sites, and continue investigations of the subspecies range boundaries in Colorado.

Although other willow flycatcher subspecies will breed in drier bushy habitat (McCabe 1990), *extimus* is a riparian obligate, nesting only in dense, mesic riparian habitats. The southwestern willow flycatcher has suffered serious declines as suitably dense, wet riparian habitats have been lost or modified (USFWS 1993), and has been listed as a federal endangered species (USFWS 1995). Range-wide, *extimus* has an estimated breeding population of only 300-500 pairs, scattered among approximately 80 breeding areas (Sogge et al. 1997a). The vast majority of breeding sites include five or fewer breeding territories, and many sites are in small remnant patches of suitable riparian habitat (Sferra et al. 1997, Cooper 1997, USFWS unpublished data). Thus, the current southwestern willow flycatcher breeding population consists primarily of widely scattered, small breeding groups.

Management and conservation of the southwestern willow flycatcher must take into account the challenges posed by such small, potentially isolated breeding groups. Small breeding groups, particularly those in small habitat patches, face increased risk of extirpation by stochastic events (such as fire or flooding). Flycatchers breeding in small habitat patches may also be at greater risk to predation or cowbird parasitism (Robinson et al. 1995). Another significant concern is the nature and degree of genetic diversity and isolation within and between the breeding groups. Preservation of genetic variability is important, in that genetic diversity may be correlated with productivity, the frequency of detrimental alleles, and the ability to adapt to future environmental

changes (Nevo 1978, Weins et al. 1989, Seitz and Loeschcke 1991). Differences in genetic variability can also tell us whether the flycatchers at the different breeding sites are genetically isolated (and hence distinct subpopulations), or whether there is genetic mixing between the breeding sites.

Purpose of this report:

This report summarizes the willow flycatcher banding and site reconnaissance activities that we conducted during 1996 and 1997. Although genetics is an important component of this project, DNA analysis will not be completed until the summer of 1998 and will therefore be reported at that time. Given the management and conservation value of the information from the banding component of this study, we felt it worthwhile to summarize the banding information and make it available now.

Project Objectives:

This project began as a result of numerous meetings and workshops with researchers, resource and land managers, and regulatory biologists throughout the Southwest. It became clear that management actions were being evaluated and carried out despite having little or no detailed information on the local status, distribution, and ecology of the willow flycatcher. In Colorado, the number, location, and extent of willow flycatcher breeding sites in the southern and southwestern portions of the state were poorly known. Further, virtually nothing was known regarding the genetic characteristics of known or suspected breeding groups.

In 1996, the USGS Colorado Plateau Field Station (CPFS) at Northern Arizona University began preliminary flycatcher survey and research efforts in Colorado. In 1997, the U.S. Bureau of Reclamation in Salt Lake City provided funding that allowed full-scale banding and molecular genetic analysis of flycatchers at selected breeding sites in Colorado. The objectives of these efforts are listed below.

Banding component:

Capture and band willow flycatchers in order to:

(1) collect blood samples for genetic analysis (see below);

(2) look for physiological evidence of breeding condition (such as cloacal protuberances in males, and brood patches in females) that could provide verification of breeding at a site;

(3) allow, through repeated visits to a site, verification whether individual flycatchers are territorial and/or breeding residents at a site;

(4) use banded birds to better estimate flycatcher population size at each breeding site, and;

(5) provide for future follow-up at several sites in order to help determine site fidelity, movements, and survivorship.

Genetics component:

Use DNA fingerprinting techniques to analyze the current genetic characteristics of the willow flycatcher, with emphasis on:

(1) estimating the degree of genetic variation within willow flycatcher breeding groups in Colorado, and comparing similarity/dissimilarity among different subpopulations, and

(2) evaluating conservation and management options with respect to preserving genetic diversity within the southwestern subspecies.

Study Areas:

A primary objective of our work was to capture, band, and sample as many willow flycatchers as possible at sites throughout southern and southwestern Colorado. The study sites selected are listed below (see also Figure 2), including areas where we detected flycatchers but did not take genetic samples (indicated by an asterisk).

Sites within potential *E.t. extimus* range:
Alamosa National Wildlife Refuge (Alamosa County)
McIntire Springs (Conejos County)
Beaver Creek - San Juan National Forest (Dolores County)
Clear Creek - San Juan National Forest (Dolores County)
Escalante State Wildlife Area (Delta County)
Fruit Growers Reservoir (Delta County)*
Confluence Park in Delta (Delta County)*
Vega Reservoir (Mesa County)
Plateau Creek (Mesa County)

Sites bordering potential *E.t. extimus* range
Gothic (Gunnison County)
Horse Ranch Park (Gunnison County)
Colorado River at Silt (Garfield County)

Sites outside potential *E.t. extimus* range
Lake Avery (Rio Blanco County)
Rio Blanco Lake (Rio Blanco County)
Buford (Rio Blanco County)
Homestake Creek (Eagle County)
Arapaho National Wildlife Refuge (Jackson County)

These sites spanned a broad geographic and elevational range, and included areas on both sides of the boundary line between the southwestern race (*E.t. extimus*) and the other two Colorado subspecies (*E.t. adastus* and *E.t. campestris*).

Willow Flycatcher Banding Project Sites - 1996 and 1997

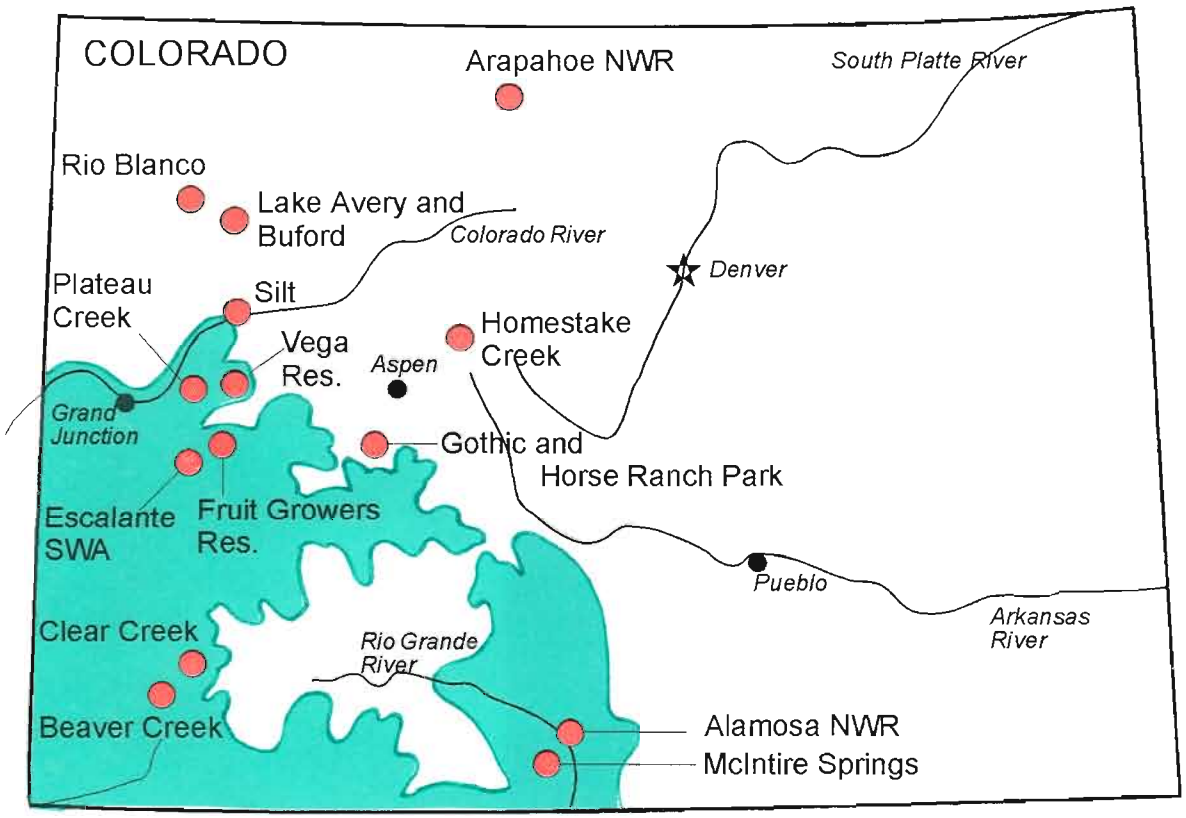


Figure 2. Location (orange dots) of willow flycatcher banding and genetics sampling sites in 1996 and 1997. The shaded green area approximates the region that the U.S. Fish and Wildlife Service is currently administering as potential *E.t. extimus* range, pending further research and clarification. For more detailed map of the administrative range boundaries, contact the USFWS Grand Junction office.

METHODS

Prior to our fieldwork in Colorado we spoke with representatives of state and federal agencies, Colorado breeding bird atlas staff, and private land owners to locate and obtain access permission to willow flycatcher breeding sites. We chose a suite of sites that included a range of diverse habitats across a large elevation gradient, geographically distributed areas across the western half of the state. Due to the large number of sites we spent as little as one morning in some areas. Our main objective was to try to catch at least five individuals in each area. Relatively few willow flycatcher surveys had been conducted in Colorado, so few breeding sites were known and there was often no information on the precise location of flycatcher territories within a site. Some areas only had historical records of breeding flycatchers. Prior to banding, we visited each site and tried to locate territorial flycatchers by using tape playback method (Sogge et al. 1997a). When we detected a flycatcher we would return later that day or the next morning to band. Banding was the critical aspect of our project, so we spent little or no time observing the birds and gaining demographic information at most sites. We tried at each site to confirm nesting for at least one of the pairs.

As noted in the introduction, except during a short period each summer, willow flycatchers detected at a site could be breeders, migrants, or both. Timing of sampling, physiological condition, and multiple visits to a site can assure that captured flycatchers were residents, rather than migrants. For example, from May to mid-June (when migrants may be present) we banded at sites with known breeding flycatchers. We also used return visits to verify breeding status of many individuals. From mid-June to July (the non-migrant period) we concentrated on areas that we could visit only once, but could be sure that all captured flycatchers were residents. Throughout the season, many captured flycatchers had cloacal protuberances or brood patches, which immediately verified their breeding status (see below).

Banding:

We captured and banded flycatchers in 1996 and 1997. All adult willow flycatchers were captured using mist nets. Once we found a flycatcher defending an area, we set up mist nets and lured the birds in by using willow flycatcher vocalizations broadcast from a tape or CD. Early in the season we also used an *Empidonax* flycatcher decoy mount to complement the tape playback. Each captured flycatcher was banded with a numbered USFWS aluminum band. Birds from select sites were additionally banded with a unique combination of plastic color bands on the other leg. The color bands consisted of two colors, with the lower color band a common color shared by all flycatchers from that site. This allows each individual to be identified if seen again. For each flycatcher, we measured wing chord, tail length, tarsal length, culmen (area tip of bill to the anterior end of nostril) length, bill width, weight, and fat level. Gender of adult flycatchers was determined by the presence of a cloacal protuberance (an external bulb in male passerines where they store sperm) or a brood patch (when the female's abdomen loses feathers to provide more skin contact for incubating eggs). Brood patches begin three-five days before egg laying and recede once the fledglings have left the nest.

Although only aluminum USFWS bands were used at most sites, we did use color-bands at Alamosa NWR, Beaver and Clear Creeks, Escalante SWA, and McIntire Springs. At these sites, land managers had expressed interest on continuing monitoring throughout the breeding season and possibly in future years. Seasonal and yearly monitoring of color-banded flycatchers can provide agencies and land managers with data on population size, survivorship and mortality, immigration, emigration, site fidelity, and movement between sites.

Genetics:

DNA was obtained from blood taken from living birds by clipping the tip of a toenail, when birds were captured and handled for banding. This technique works well for obtaining one to two drops of blood from small passerines, with no discernable negative effects (Super and van Riper 1995, Paxton and Sogge 1996). Blood was drawn from the toenail directly into a 0.5 ml microtube, then stabilized with buffer. Samples were placed in a cooler while in the field and then frozen in the lab until the DNA was extracted.

DNA was extracted from blood using standard DNA extraction protocols. The mitochondrial DNA cytochrome b gene amplified using the polymerase chain reaction (PCR: Hoelzel and Green 1992). Amplified DNA has been sent to the University of Arizona Biotechnology Lab for sequencing. We will compare sample DNA sequences to determine within-and between-subpopulation variation. Sequences will be edited and aligned using the DNASTAR computer program. Phylogenetic analyses will be carried out using PAUP (Phylogenetic Analysis Using Parsimony) version 3.1 (Swofford 1990). The reliability of phylogenetic branch points will be estimated using bootstrap analysis (Felsenstein 1985).

Purified nuclear DNA is currently being subjected to amplified fragment length polymorphism (AFLP) analysis (Vos et al. 1996), a newly-developed genetic procedure that characterizes the amount of genetic variability within individuals and populations, and evaluates the relatedness between breeding groups.

RESULTS

Overall summary

In 1996, the Colorado Plateau Field Station (CPFS) staff spent 10 days at eight different sites in Colorado banding 25 adults and one fledgling flycatcher. In 1997, banders spent 36 days at a total of 11 sites banding 65 adult flycatchers. We recaptured two willow flycatchers and resighted two others banded in 1996. One recaptured flycatcher had been previously color-banded and the other had only an aluminum band. The color-banded bird had a minor injury underneath the color bands, but still appeared to have full use of the leg. The other bird did not have any leg injuries.

During the field work associated with banding efforts, we located territorial willow flycatchers at nine sites within the geographic area that the USFWS is currently administering as potential *extimus* range (Table 1). Willow flycatchers were also found at three other sites (Silt, Horse Ranch Park and Gothic) near the boundary range, and five additional sites outside of the potential *extimus* boundary.

We conclusively verified breeding at 10 sites, including six within the administered *extimus* boundaries (Table 1). Although this was not a formal flycatcher survey project, and so did not include repeated standardized surveys (e.g., per the Sogge et al. 1997a protocol) at most sites, we recorded the actual number of individuals and pairs that we found at each site. This greatly clarified population size estimates at each sites. In total, we found 71 potential *extimus* territories, ranging from 1 - 29 per breeding area.

We collected blood samples at 15 sites, with blood taken from all 91 flycatchers banded in Colorado during 1996 and 1997. Our goal was to obtain at least five genetic samples from each area that we visited. We achieved this goal at seven of the 15 sites, but collected four or fewer blood samples at the remaining sites (Table 1). To date, we have succeeded in extracting DNA from all of the samples collected in 1996 and 1997. We will complete detailed analyses of the DNA samples during the winter and spring of 1998, and results will be presented in a separate report no later than July 1998.

In the remainder of the results section, we present specific information for each of the 15 study sites, in the order listed in Table 1. Each site description includes location, habitat, flycatcher abundance and breeding status information. Photographs of all sites (except Plateau Creek) are presented in Appendix 2. Also included is a notation on brown-headed cowbird (*Molothrus ater*) abundance using the following terms:

Abundant- at least one cowbird was seen at each territory;
Common- cowbirds were seen in the majority of territories;
Uncommon- rarely saw a cowbird; and
None- no cowbirds seen at site.

Table 1: Summary of the 1996 &1997 Colorado willow flycatcher banding project including site, estimated number of territories, total flycatchers detected at each site, number of days spent at each site, number of flycatchers banded, whether birds were confirmed residents, and whether any birds at the site were nesting. BP= brood patch, FL= caught fledgling, NEST= found nest, & NC= no nesting confirmed

SITE	# of Estimated Territories	# of Flycatchers Detected	Total Days at Site	# of Birds Banded	Confirmed Residency?	Confirmed Nesting?
Sites within potential *E.t. extimus* range						
Alamosa NWR - 1997	29	39	6	18	Y	BP
McIntire Spring - 1997	8	9	3	6	Y	BP
Beaver Creek - 1997	10	12	4	7	Y	BP
Clear Creek - 1997	9	15	4	11	Y	NEST, BP
Escalante State W.A. - 1997	8	12	11	14	Y	NEST, FL,
Fruit Growers Reservoir - 1997	1	2	4	0	Y	NC
Confluence Park - 1997	1	1	none	0	N	NC
Vega Reservoir - 1997	4	7	2	2	Y	NEST, BP
Plateau Creek - 1997	1	2	1	1	Y	NC
Sites bordering potential *E.t. extimus* range						
Gothic - 1996	2	3	2	2	Y	NC
Horse Ranch Park - 1996	4	6	1	4	Y	BP, FL
Silt - 1996	2	4	3	Y	BP	BP
Sites outside potential *E.t. extimus* range						
Lake Avery - 1997	1	2	1	N	N	NC
Rio Blanco Lake - 1997	12	22	2	10	Y	NEST, BP
White River at Buford - 1997	3	3	1	4	Y	NC
Homestake Creek - 1997	2	3	1	2	N	NC
Arapahoe NWR - 1997	6	10	2	6	Y	BP
TOTAL	103	152	46	91		

Descriptions of each Site

Alamosa National Wildlife Refuge (Alamosa County)
Elevation 2,290 m

The Alamosa NWR breeding site consists of a series of linear strips of willow along a two mile stretch of the upper Rio Grande River. A majority of the habitat is monotypic coyote (*Salix exigua*) and peach-leaf willow (*S. amygdaloides*) with little narrow-leaf cottonwood (*Populus angustifolia*) overstory. The willow stands range from 3-12 m in width and 15-100 m in length with the average height being 3 m. The willow flycatchers appear to be evenly distributed throughout the different sized willow strips. Within the interior there is little or no understory vegetation and the canopy is dense with approximately 80-90% canopy coverage. On 25 July 1996 we caught and banded (USFWS metal bands only) four of unknown sex and one female willow flycatcher. At least six additional flycatchers were heard singing further east along the river. In 1997 we spent five days banding 13 new birds and recaptured one from 1996. All 14 birds were color banded. Twenty-nine territories were detected with at least 10 of those having paired birds. Three captured females had brood patches (one in 1996 and two in 1997), confirming nesting for the site.

Brown-headed Cowbirds: Common

Alamosa National Wildlife Refuge

Table 2: Willow flycatchers banded at Alamosa NWR in 1996 and 1997, including the date banded or recaptured, year first banded, USFWS numerical band number, color band combination, age, sex, and whether a genetic sample was obtained.

DATE	YEAR FIRST BANDED	USFWS BAND NUMBER	COLOR BAND LEFT	COLOR BAND RIGHT	AGE	SEX	GENETIC SAMPLE TAKEN
25 -July- 96	1996	1740-91746		X	AHY	M	Y
25 -July- 96	1996	1740-91747	X		AHY	M	Y
25 -July- 96 recaptured 31-May-97	1996	1740-91748	K/P	X	AHY	U	Y
25 -July- 96	1996	1740-91749	X		AHY	U	Y
25 -July- 96	1996	1740-91750		X	AHY	F	Y
31 -May- 97	1997	1590-97406	G/P	X	AHY	M	Y
01-June- 97	1997	1590-97407	B/P	X	AHY	M	Y
01 -June- 97	1997	1590-97408	Y/P	X	AHY	U	Y
01 -June- 97	1997	1590-97409	W/P	X	AHY	U	Y
24 -June- 97	1997	1590-97435	O/P	X	AHY	M	Y
24 -June- 97	1997	1590-97436	P/P	X	AHY	U	Y
24 -June- 97	1997	1590-97437	D/P	X	AHY	F	Y
24 -June- 97	1997	1590-97438	KW/P	X	AHY	U	Y
25 -June- 97	1997	1590-97439	UW/P	X	AHY	U	Y
25 -June- 97	1997	1590-97440	WK/P	X	AHY	U	Y
25 -June- 97	1997	1590-97441	PD/P	X	AHY	M	Y
25 -June- 97	1997	1590-97442	WU/P	X	AHY	F	Y
25 -June- 97	1997	1590-97443	X	R/P	AHY	F	Y

Color bands are read from top/bottom and LEFT leg to RIGHT leg: R=red, K=black, D=dark blue, G=green, B=light blue, Y=yellow, W=white, O=orange, P = Pink KW=black/white split, RW=red/white split, DP=dark blue/dark pink split, UW = purple/white split, WK = white/black split, WR = white/ red split, WU= white/purple split, and X=USFWS numbered aluminum band. AHY =adult, M=male, F=female, and U=unknown sex

McIntire Springs (Conejos County)
Elevation: 2,300 m

McIntire Springs is a nature preserve managed by the Bureau of Land Management. In 1994 cattle grazing was discontinued in hope that the land would return to its natural state, a rich cottonwood-willow/riparian/wetland complex along the Conejos River. The area contains large open meadows surrounded by large monotypic willow stands of coyote willow, whiplash willow (*Salix caudata*), and crack willow (*S. fragilis*). The area also includes a series of irrigation channels and abundant beaver ponds. Between the willow and the river are large stands of narrow-leaf and lance-leaf cottonwood (*Populus acuminata*). The multiple willow stands are extensive, ranging from 2-60 m wide, 50-200 m long, and 2.5-5 m high. The flycatchers appeared to be spread out with at least 75 m between territories (with the exception of two territories within 10 m of each other). At four territories we caught one bird each and at one territory we caught a pair. The latter included a female with a full brood patch, confirming nesting for the site.

Brown-headed Cowbirds: Common

Table 3: Willow flycatchers banded at the McIntire Springs, including the date banded, year first banded, USFWS numerical band number, color band combination, age, sex, and whether a genetic sample was obtained.

DATE	YEAR FIRST BANDED	USFWS BAND NUMBER	COLOR BAND LEFT	COLOR BAND RIGHT		SEX	GENETIC SAMPLE TAKEN?
27 -June- 97	1997	1590-97444	X	K/P	AHY	M	Y
27 -June- 97	1997	1590-97445	X	D/P	AHY	U	Y
27 -June- 97	1997	1590-97446	X	G/P	AHY	U	Y
27 -June- 97	1997	1590-97447	X	Y/P	AHY	U	Y
27 -June- 97	1997	1590-97461	X	W/P	AHY	M	Y
27 -June- 97	1997	1590-97462	X	O/P	AHY	F	Y

Color bands are read from top/bottom and LEFT leg to RIGHT leg: K=black, D=dark blue, G=green, Y=yellow, W=white, O=orange, P = Pink, and X=USFWS numbered aluminum band.
AHY =adult, M=male, F=female, and U=unknown sex

Beaver Creek (Dolores County)
Elevation: 2,440 m

The Beaver Creek breeding site is an immense stand of dense monotypic peach-leaf willow at least 3200 m long, 480 m wide, and reaching 3 m in height with no overstory. Other vegetation types are coyote willow and hawthorne (*Crataegus rivularis*). Beaver Creek itself is perennial, and approximately 90% of the 1997 territories were within 10 m of standing water. The valley's surrounding habitat consists of Ponderosa Pine (*Ponderosa pinus*), Gambel's Oak (*Quercus gambellii*), and Aspen (*Populus tremuloides*). Beaver Creek is located in the Dolores Ranger District of the San Juan National Forest. We caught nine willow flycatchers, including a female with a brood patch, confirming nesting for the site.

Brown-headed Cowbirds: None in 1997 (although 4 males and 1 female seen on 3 July 1995).

Table 4: Willow flycatchers banded at Beaver Creek, including the date banded or recaptured, year first banded, USFWS numerical band number, color band combination, age, sex, and whether a genetic sample was obtained.

DATE	YEAR FIRST BANDED	USFWS BAND NUMBER	COLOR BAND LEFT	COLOR BAND RIGHT	AGE	SEX	GENETIC SAMPLE TAKEN
26 -July- 96	1996	1740-91640	X		AHY	M	Y
03 -June- 97	1997	1590-97412	X	P/B	AHY	M	Y
29 -June- 97	1997	1590-97452	X	D/B	AHY	U	Y
29 -June- 97	1997	1590-97453	X	KW/B	AHY	U	Y
29 -June- 97	1997	1590-97454	X	RW/B	AHY	F	Y
30 -June- 97	1997	1590-97455	X	DP/B	AHY	U	Y
30 -June- 97	1997	1590-97456	X	UW/B	AHY	U	Y

Color bands are read from top/bottom and LEFT leg to RIGHT leg: D=dark blue, B = light blue, P = Pink, KW=black/white split, RW=red/white split, DP=dark blue/dark pink split, UW = purple/white split, WK = white/black split, WR = white/ red split, WU= white/purple split, and X=USFWS numbered aluminum band. AHY =adult, M=male, F=female, and U=unknown sex

Clear Creek (Dolores County)
Elevation: 2,900 m

The Clear Creek breeding site is in the Dolores Ranger District of the San Juan National Forest. The flycatcher habitat is located along Clear Creek as well as several other small drainages that have minimal running water. The drainage where 90% of the birds were captured was comprised of a series of beaver ponds with the water being at least 1-2 m deep in some places. The vegetation is dominated by peach-leaf willow patchily distributed in strips and clumps around the open water and beaver dams. Most individual strips were only 2 m by 10 m, but flycatcher territories included multiple clumps and strips. The surrounding habitat is dominated by large aspen stands intermixed with mixed conifer. We caught two females with brood patches and found one active nest. All of the territories were located directly over standing or running water.

Brown-headed Cowbirds: None

Table 5: Willow flycatchers banded at Clear Creek, including the date banded, year first banded, USFWS numerical band number, color band combination, age, sex, and whether a genetic sample was obtained.

DATE	YEAR FIRST BANDED	USFWS BAND NUMBER	COLOR BAND LEFT	COLOR BAND RIGHT	AGE	SEX	GENETIC SAMPLE TAKEN
25 -July- 96	1996	1740-91638	X		AHY	M	Y
25 -July- 96	1996	1740-91639		X	AHY	M	Y
02 -June- 97	1997	1590-97410	X	R/B	AHY	M	Y
02 -June- 97	1997	1590-97411	X	K/B	AHY	U	Y
28 -June- 97	1997	1590-97448	X	Y/B	AHY	U	Y
28 -June- 97	1997	1590-97449	X	W/B	AHY	U	Y
28 -June- 97	1997	1590-97451	X	O/B	AHY	F	Y
01 -July- 97	1997	1590-97457	X	B/B	AHY	U	Y
01 -July- 97	1997	1590-97458	X	WK/B	AHY	F	Y
01 -July- 97	1997	1590-97459	X	WR/B	AHY	U	Y
01 -July- 97	1997	1590-97460	X	PD/B	AHY	U	Y

Color bands are read from top/bottom and LEFT leg to RIGHT leg: R=red, K=black, B=light blue, Y=yellow, W=white, O=orange, WK = white/black split, WR = white/ red split, PD=pink/dark blue split and X=USFWS numbered aluminum band. AHY =adult, M=male, F=female, and U=unknown sex

Escalante State Wildlife Area (Delta County)
Lat-Long: 38° 45.377' N 108° 09.389"W Elevation: 1,700 m

The flycatcher habitat at Escalante SWA is adjacent to the Gunnison River west of Delta. The breeding area consists of linear strips of coyote willow with tamarisk (*Tamarix ramosissima*) and Fremont cottonwood (*Populus fremontii*) intermixed along a small water channel. The water levels fluctuate due to irrigation and rainfall. Singing willow flycatchers had been noted here each year since 1994 (Sogge, unpublished data). During 1996 we estimated at least 10 territories along the 500 m stretch of willow with more suspected within the small strips of tamarisk. One nest was located in a lone tamarisk. The younger Fremont cottonwoods were often used as song perches.

On March 9, 1997 the habitat at Escalante changed drastically when a local farmer's brush fire got out of control (Terry Ireland, *pers. comm.*) and burned 95% of the known breeding area at the wildlife area. In 1997, the first two flycatchers were detected in mid-May. One was within the historical breeding area in a small unburned patch of willow. The second flycatcher was in an unburned area on the bank of the Gunnison River in willow/tamarisk habitat, where no flycatchers had been detected in previous years (suggesting movement from the burned area). After a series of visits we found a total of six territories within the historical breeding area and two territories in unburned habitat along the Gunnison River. In the burned area three of the six territories included from 50-80% live coyote willow, with the interior having approximately 60% canopy coverage. All three territories had pairs and two of these attempted nesting. The outcome of the nests is unknown although when last seen they each contained three willow flycatcher eggs. The other three territories were in completely burned habitat, with two of the three territories having only unmated males. We found no evidence of nesting for the flycatchers within the burned area.

The prospects for eventual recovery of the burned breeding habitat at Escalante SWA seem promising. During the breeding season much of the willow and tamarisk resprouted and had reached approximately 1.5 m in height by the last week in July. However, it may be several years before the recovering vegetation is tall and dense enough to support successful nesting. The burnt cottonwoods appear completely dead and may not recover from the burn. The impact of the loss of these cottonwoods is uncertain, as they may be providing an important component of habitat at this site. However, the flycatchers still used the burnt trees for song perches, and do not typically nest in cottonwoods even when they are present.

Brown-headed Cowbirds: Abundant

Escalante State Wildlife Area

Table 6: Willow flycatchers banded at Escalante State Wildlife Area, including the date banded or recaptured, year first banded, USFWS numerical band number, color band combination, age, sex, whether it was in a completely, partially, or unburned area, and whether a genetic sample was obtained.

DATE	YEAR FIRST BANDED	USFWS BAND NUMBER	COLOR BAND LEFT	COLOR BAND RIGHT	AGE	SEX	EXTENT OF BURN IN 1997	GENETIC SAMPLE TAKEN?	RETURN IN 1997
27 -July- 96	1996	1740-91641	D/G	X	AHY	M	80%	Y	Y
28 -July- 96	1996	1740-91642	Y/R	X	AHY	M	NA	Y	N
28 -July- 96	1996	1740-91643	G/R	X	AHY	M	NA	Y	N
28 -July- 96	1996	1740-91644	B/R	X	AHY	U	NA	Y	N
28 -July- 96	1996	1740-91645	R	X	HY	F	NA	Y	N
28 -July- 96	1996	1740-91646	W/R	X	AHY	M	30%	Y	Y
28 -July- 96	1996	1740-91647	K/R	X	AHY	F	NA	Y	N
24- May- 97	1997	1590-97403	K/G	X	AHY	M	60%	Y	NA
24- May- 97	1997	1590-97404	G/G	X	AHY	U	100%	Y	NA
29 -May- 97	1997	1740-91675	R/G	X	AHY	M	100%	Y	NA
29 -May- 97	1997	1590-97405	O/G	X	AHY	U	0%	Y	NA
11 -June- 97	1997	1590-97413	Y/G	X	AHY	U	60%	Y	NA
11 -June- 97	1997	1590-97414	W/G	X	AHY	U	100%	Y	NA
11 -June- 97	1997	1590-97415	P/G	X	AHY	U	0%	Y	NA

Color bands are read from top/bottom and LEFT leg to RIGHT leg: R=red, K=black, D=dark blue, G=green, B=light blue, Y=yellow, W=white, O=orange, P = Pink and X=USFWS numbered aluminum band. AHY =adult, M=male, F=female, and U=unknown sex

Fruit Growers Reservoir (Delta County)
Elevation: 1,830 m

Fruit Growers Reservoir is a large man-made lake approximately 14 km northeast of Delta. On the east side of the lake is a riparian strip approximately 300 m by 150 m, dominated by saltcedar, coyote willow, and narrow-leaf cottonwood along the water edge. The reservoir levels fluctuate greatly depending on rainfall and time of year such that up to a third of the patch may be inundated. On 24 May 1996 we detected three singing flycatchers at the north end of the patch. On 30 July 1996 we found one willow flycatcher on the south end of patch on the water's edge, but this bird was not found the following day. Given the timing of the detections in 1996 and the fact that we did not locate any nests, we could not certain that these flycatchers were local breeders, as opposed to migrants. On 29 May 1997, we found a pair on the north side of the patch in mixed willow and tamarisk. We went back on 17 June and 14 July and both times found a willow flycatcher in the same spot. The number and timing of the 1997 detections confirms that flycatchers were present and territorial throughout the breeding season, although we did not document nesting. We did not capture any flycatchers at this site.

Brown-headed Cowbirds: Common

Confluence Park, Delta (Delta County)
Elevation: 1,500 m

On 15 July 1997 we detected a willow flycatcher singing at the confluence of the Gunnison and Uncompahgre Rivers, within the city of Delta. This detection was made during a non-work period, as the banding crew was jogging through the park at 1030 hrs. The habitat was mainly Russian olive (*Elaeagnus angustifolia*), coyote willow, and tamarisk. Unfortunately, the crew had completed their field work that day and were returning to Arizona, and no follow-up visits were possible. The detection occurred during what is typically considered the non-migrant period, so this flycatcher may have been a territorial resident or a post-breeding individual moving through the area. Given that we could not conduct any field work at the site, we did not determine if there were more flycatchers in the area.

Brown-headed Cowbirds: Not recorded due to nature of detection.

Vega Reservoir (Mesa County)
Elevation: 2,500 m

The breeding site at Vega Reservoir consists of a series of linear strips of peach-leaf willow at the Plateau Creek inflow at the reservoir. The willow stands vary in size, density, and height. The canopy coverage ranges from 40-80% in the interior. We found four territories (three pairs and one unmated male) along a 200 m stretch of willow. We also located a nest with four 3-day old nestlings, placed about 1 m high in a large peach-leaf willow 0.5 m off the bank of Plateau Creek.

Brown-headed Cowbirds: None

Table 7: Willow flycatchers banded at Vega Reservoir, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
12 -July- 97	1590-97463		X	AHY	U	Y
13 -July- 97	1590-97464		X	AHY	F	Y

X=USFWS numerical aluminum band: AHY, F=female, and U=unknown sex

Plateau Creek (Mesa County)
Elevation: 1,600 m

We found willow flycatchers at the "lower Ute site" along Plateau Creek, approximately 12 km due east of its confluence with the Colorado River. The habitat consists of a small (approximately 5 m by 15 m) strip of coyote willow with a narrow-leaf cottonwood overstory, adjacent to a creek in a riparian/wetland/meadow complex. We found one pair and banded one individual (unknown gender), but saw no direct evidence of breeding.

Brown-headed Cowbirds: Abundant (note that a Yellow Warbler was observed feeding a fledged cowbird chick)

Table 8: Willow flycatchers banded at Plateau Creek, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
30 -July- 96	1740-91673		X	AHY	U	Y

X=USFWS numerical aluminum band, AHY, and U=unknown se

East River at Gothic (Gunnison County)
Elevation: 2,830 m

The willow flycatcher site was located on private land near the East River. The site is a large monotypic willow patch surrounded primarily by quaking aspen which the flycatchers used as song perches. The patch width ranged between 50-200 m wide, with willows ranging from 1-2 m high. Although the nearest water source (the East River) was 150 m away, stand was located in very wet, muddy substrate.

Brown-headed Cowbirds: None observed.

Table 9: Willow flycatchers banded at the East River at Gothic, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
28 -July- 96	1740-91761		X	AHY	M	Y
29 -July- 96	1740-91762	X		AHY	F	Y

X=USFWS numerical aluminum band, AHY, M= Male, F=female, and U=unknown sex

Horse Ranch Park (Gunnison County)
Elevation: 2,680 m

The habitat at Horse Ranch Park is comprised of a linear strip of dense willow shrubs along Anthracite Creek. The riparian area parallels a road, and includes a small parking area frequently used as a trailhead. On 31 July 1996, we captured and banded three adult willow flycatchers, as well as one fledgling (verifying breeding at this site). A total of six flycatchers were noted at Horse Ranch Park.

Brown-headed Cowbirds: None observed.

Table 10: Willow flycatchers banded at Horse Ranch Park, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
31 -July- 96	1740-91763	X		AHY	M	Y
31 -July- 96	1740-91764		X	HY	M	Y
31 -July- 96	1740-91765	X		AHY	F	Y
31 -July- 96	1740-91776	X		AHY	F	Y

X=USFWS numerical aluminum band, AHY, F=female, and M= Male

Colorado River at Silt
Lat-Long: 39° 32.496' N 107° 41.812"W Elevation: 1,650 m

The breeding site is located on private land on the edge of a 0.8 ha pond located 20 m from the bank of the Colorado River, approximately 5 km due west from Silt. The habitat consists mainly of willow, Russian olive, narrow-leaf cottonwood, and sagebrush (*Artemisia spp.*). We found the flycatchers in a very small (approximately 5 m by 5 m) willow patch within this habitat, where the willows about 2 m tall. The flycatchers' territory included other vegetation within the patch, and the flycatchers repeatedly flew back and forth from the willow patch to the Russian olive. Two territories were detected with at least one breeding pair. Nesting was confirmed by capturing a female with a brood patch.

Brown-headed Cowbirds: Data not reported

Table 11: Willow flycatchers banded at Silt, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
29 -July- 96	1740-91648		X	AHY	M	Y
29 -July- 96	1740-91649		X	AHY	M	Y
29 -July- 96	1740-91650		X	AHY	F	Y

X=USFWS numerical aluminum band, AHY, F=female, and M= Male

Lake Avery (Rio Blanco County)
Elevation: 2,290 m

Lake Avery is located in a small alpine valley that appears heavily grazed by sheep. The breeding site consists of a large monotypic stand of peach-leaf willow at the inflow of Big Beaver Creek. The willow patches ranged from 4-20 m wide, 80-100 m long, and 3-5 m high. There is no overstory and the interior has little understory with approximately 80% canopy coverage. We found one pair at the site, but no direct evidence of nesting.

Brown-headed Cowbirds: None

Table 12: Willow flycatchers banded at Lake Avery, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
12 -June- 97	1590-97416		X	AHY	U	Y

X=USFWS numerical aluminum band
AHY =adult, U= unknown

White River at Buford (Rio Blanco County)
Elevation: 2,135 m

The breeding site is located at a public fishing area on a series of small ponds adjacent to the White River, along the edge of a dense mixed conifer forest. Surrounding the ponds are dense clumps of coyote and peach-leaf willow averaging 3 m tall. There is no overstory and the interior is dense with 90% canopy coverage. The average distance of territories from water is about 5 m. We surveyed a small section of the suitable habitat and found three territories containing a total of five birds. We found no direct evidence of nesting, although paired flycatchers were observed interacting.

Brown-headed Cowbirds: None

Table 13: Willow flycatchers banded at the fishing ponds in Buford, including the date banded or recaptured, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
12 -June- 97	1590-97417		X	AHY	U	Y
12 -June- 97	1590-97418		X	AHY	U	Y
12 -June- 97	1590-97419		X	AHY	U	Y
12 -June- 97	1590-97421		X	AHY	U	Y

X=USFWS numerical aluminum band
AHY =adult, U= unknown

Rio Blanco Lake (Rio Blanco County)
Elevation: 1,830 m

The breeding site at Rio Blanco Lake consists of a series of willow patches located between the lake and White River, where the surrounding landscape is rolling hills with predominately sagebrush-type habitat. Within the breeding area the major plant types are coyote willow, peach-leaf willow, wild rose (*Rosa spp.*), snowberry (*Symphoricarpos spp.*) and narrow-leaf cottonwood. The habitat structure varies greatly in size, density, and extent of overstory. Along a one mile stretch we found 12 territories and 10 pairs, and banded 10 individuals. We confirmed nesting at the site by capturing females with full brood patches and locating a female on a nest in a wild rose about 0.5 m off the ground. We could feel and see bulges from eggs in the lower reproductive tract in several other females, indicating they would be laying eggs shortly.

Brown-headed Cowbirds: Uncommon

Table 14: Willow flycatchers banded at Rio Blanco Reservoir, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
13 -June- 97	1590-97420		X	AHY	U	Y
13 -June- 97	1590-97422		X	AHY	F	Y
13 -June- 97	1590-97423		X	AHY	F	Y
13 -June- 97	1590-97424		X	AHY	U	Y
13 -June- 97	1590-97425		X	AHY	U	Y
13 -June- 97	1590-97426		X	AHY	U	Y
13 -June- 97	1590-97427		X	AHY	F	Y
16 -June- 97	1590-97432		X	AHY	M	Y
16 -June- 97	1590-97433		X	AHY	F	Y
16 -June- 97	1590-97434		X	AHY	M	Y

X=USFWS numerical aluminum band. AHY=adult, M=male, F=female, and U=unknown sex

Homestake Creek (Eagle County)
Elevation: 2,750 m

Homestake creek originates from Homestake Reservoir in the Sawatch mountains and flows into the Eagle River. Along a five mile stretch of the creek are widely scattered clumps of peach-leaf and coyote willow, with little or no overstory. The clumps are sparse with 40-60% canopy cover. The surrounding habitat is dominated by aspen and mixed conifer. During a quick survey we detected only two territories, one with a mated pair and one with an unmated male. We found no direct evidence of nesting.

Brown-headed Cowbirds: None

Table 15: Willow flycatchers banded at Homestake Creek, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
14 -June- 97	1590-97430		X	AHY	U	Y
14 -June- 97	1590-97531		X	AHY	M	Y

X=USFWS numerical aluminum band. AHY=adult, M=male, and U=unknown sex

Arapahoe National Wildlife Refuge (Jackson County)
Elevation: 2,470 m

Arapahoe NWR is located about 10 km south of Walden, in north-central Colorado. Here the Illinois River meanders through a wide, long floodplain dominated by clumps of coyote, plain-leaf and other willows interspersed in a common timothy (*Phleum pratense*), reedgrass (*Calamagrostis canadensis*) and sedge (*Carex spp.*) herbaceous matrix. We captured and banded willow flycatchers along the river channels and ponds just downstream of the refuge maintenance yard. The willow clumps here vary greatly in width and length, but are all generally linear, tall (3-5 m) and quite dense. Surface water, including many beaver pond areas, was present at all capture sites. Willow flycatchers were already known to breed at this site (e.g., Sedgwick and Knopf 1988). We captured a female with a brood patch, which verified continued breeding in 1997.

Brown-headed Cowbirds: Abundant

Table 16: Willow flycatchers banded at Arapahoe National Wildlife Refuge, including the date banded, USFWS numerical band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	LEFT LEG	RIGHT LEG	AGE	SEX	GENETIC SAMPLE TAKEN
17 -July- 97	1590-97465		X	AHY	M	Y
17 -July- 97	1590-97466		X	AHY	F	Y
17 -July- 97	1590-97467		X	AHY	M	Y
18 -July- 97	1590-97468		X	AHY	M	Y
18 -July- 97	1590-97469		X	AHY	M	Y
18 -July- 97	2070-55366*		X	AHY	U	Y

X=USFWS numerical aluminum band, AHY, F=female, and U=unknown sex
*Bird from which we took a genetic sample was banded by the MAPS station at the refuge.

DISCUSSION

Banding Success

Our overall sampling success was high, with a total of 91 individuals captured and banded, distributed among 15 sites where we attempted banding. This represents 61% of the individuals that we detected at the banding sites. We did not meet our specific goal of at least five individuals at each site, but this occurred only at sites with seven or fewer territories (where the capture of five individuals is unlikely and/or extremely time consuming).

Timing and capture techniques are important considerations for the successful banding of willow flycatchers. Flycatchers were captured using mist nets and the aide of a tape or CD recording of a willow flycatcher vocalization, and in some cases, an *Empidonax* decoy. A typical setup consisted of a mist net set up within a territory, and a tape recorder and/or decoy placed near the net to attract the birds. A decoy appeared to help in the beginning of the season when the birds were more territorial, with both male and female flycatchers making low passes toward the decoy into the nets.

We found that the early stages of the breeding chronology to be the best time to band. During initial territory establishment, pair formation, and early nest stage, the flycatchers are much more responsive to a tape playback and decoy. They are also more vocal, making them easier to detect. As the breeding season progressed, the flycatchers become less vocal and territorial, and it became more difficult to lure them into the mist nets.

Genetic Sampling

We succeeded in getting blood samples (via toe-nail clip) from all 91 willow flycatchers that we banded. To date, nuclear DNA has been successfully extracted and amplified from these blood samples, and awaits further analysis. AFLP work has begun, and the technique works well for the willow flycatcher nuclear DNA. Unexpectedly, universal primers commercially available for amplification and sequencing of bird mitochondrial d-loop DNA did not work on our willow flycatcher samples. We therefore developed our own mitochondrial DNA d-loop primers specific to the willow flycatcher. These primers have been successfully tested, and mitochondrial DNA amplification and sequencing will be carried out during the winter and spring of 1998.

The number of samples collected, as well as the geographic locations from which they were obtained, will allow calculation and comparison of genetic variation and similarity within and among the breeding groups. In those few cases where less than five samples were collected, we will pool samples from nearby small populations for comparative purposes.

It is important to note that the genetic component of this study will not specifically answer the question of subspecies taxonomy or distribution in Colorado. Our analysis will provide statistics on the degree of relatedness between different breeding groups, which is needed in order to understand whether breeding groups display significant levels of genetic differentiation. However, a full-scale subspecies taxonomic study would need comparative DNA/blood samples from willow flycatcher breeding groups throughout North America (such sampling has not yet

been funded or conducted). Fortunately, the DNA samples gathered over the course of this project can be used to compare with other samples rangewide, once a rangewide project is funded.

Current Distribution and Status of the Willow Flycatcher

This project has done much to clarify the breeding status of the willow flycatcher in western Colorado, particularly in the southwest portion of the state. We were fortunate to build upon preliminary work by a variety of dedicated agency and non-governmental biologists who have recently surveyed for potential southwestern willow flycatcher breeding sites. The following discussion focuses on the twelve sites within and bordering potential *E.t. extimus* breeding range.

As recently as 1995, there were only a few known or suspected willow flycatchers breeding areas in southwestern Colorado; Escalante SWA (breeding confirmed in 1982; Andrews and Righter 1992), Beaver Creek, and Clear Creek. Early in the breeding season of 1996, biologists suspected a few flycatchers bred at Fruit Growers Reservoir, Alamosa NWR, and the Plateau Creek/Vega Reservoir area, but were not able to confirm this. During our visits to these sites in 1996 and 1997, we conclusively verified territoriality and/or breeding at all of these sites except Plateau Creek.

Although this project did not include a formal flycatcher survey program and our field work did not include extensive surveys of each site, we were generally able to make a rough estimate of the population size for the general area in which we were working (Table 1). In most cases, that included all or most of the potential breeding habitat in the area. At sites being monitored by other biologists (e.g., McIntire Springs, Beaver Creek and Clear Creek), we included their information in our estimates. Based on these estimates, the willow flycatcher breeding groups in western and southwestern Colorado are generally small (10 or fewer territories), as is the case elsewhere in the Southwest (Sferra et al. 1997, Cooper 1997, USFWS unpublished data).

Several sites deserve specific discussion. At Alamosa NWR, we located 29 territories distributed in the willow thickets that grow linearly along the banks of the Rio Grande. We saw additional similar habitat in areas where we did not band or survey, so there may be additional flycatcher territories within and adjacent to the refuge. McIntire Springs also appears to have sufficient high-quality habitat to support more flycatchers than are currently present, and may develop into a larger site in the near future. At several other locations in the San Luis Valley, we observed from a distance what appeared to be potential breeding habitat. These sites were located on private land, and so were not accessed or surveyed. However, given the appearance of the habitat, it is quite possible that willow flycatchers may be breeding on privately owned sites throughout the valley. If this is the case, the San Luis Valley could have an overall breeding population several times larger than we are currently aware of.

Beaver Creek and Clear Creek may also have more sizable populations than we noted, especially given that the majority of the extensive Beaver Creek site is on unsurveyed private lands. The habitat on these private lands appears to be almost identical to the Forest Service lands where the flycatchers have been located, so the likelihood of additional flycatchers here is high.

The Escalante SWA site has the longest documented history of known or suspected breeding in southwest Colorado. Flycatchers were noted there from 1981-86, and confirmed breeding in 1982 (Andrews and Righter 1992). More recently, six to eight singing willow flycatchers were detected there each May during interagency willow flycatcher survey training sessions from 1994 - 1996 (Sogge, unpublished data). As the largest known breeding population in that region of the state, there was cause for concern when the breeding habitat was severely burned in early 1997. Fire has destroyed occupied flycatcher breeding habitat at several other sites throughout the Southwest, with impacts including destruction of active nests and nest trees, and abandonment of breeding territories (Paxton et al. 1996, Langridge and Sogge 1997a). Fire is clearly a significant threat in many (and possibly most) of the riparian areas where southwestern willow flycatchers are found.

Our observations at Escalante suggest that even though some flycatchers returned to the burned area, subsequent productivity was negatively affected (based on a lack of nesting activity in more than half of the flycatcher territories). Continued monitoring is needed to determine how rapidly the habitat recovers, and how long before the flycatchers are able to successfully breed. If recovery is slow, the Escalante flycatchers may die out or disperse to other sites before recovery is complete.

At Fruit Growers Reservoir, we were able to confirm at least one territorial willow flycatcher. Given the extent and density of the habitat at the site, it appears to have potential for more territorial flycatchers than we detected in 1997. Additional intensive surveys should be conducted to better determine the number and distribution of flycatchers at the reservoir, and to verify nesting status.

Characteristics of Breeding Habitat

Overall, willow flycatchers were found across a wide elevational range, from 1,600 m at Plateau Creek to 2,900 m at Clear Creek and Gothic. Most sites were above 2,000 m, and four sites were at greater than 2,600 m. In southwestern Colorado, the highest were at Beaver Creek (2,450 m) and Clear Creek (2,900 m). Clear Creek is approximately 500 m higher than the highest currently occupied flycatcher sites in Arizona and New Mexico (Sferra et al. 1997, Cooper 1997).

The habitat at most willow flycatcher breeding sites in Colorado was comprised totally or primarily of willow. Monotypic willow stands varied from narrow, relatively linear strips to extensive tracts over 100 m wide and more than a km long. Occupied habitat always included patches or strips of willows above 2 m high (though portions of the habitat may have been shorter). The nature and structure of these willow habitats matches Colorado breeding habitat descriptions given by Bailey and Niedrach (1965) and Andrews and Righter (1992). It is also similar to willow-dominated flycatcher habitats in Arizona (Sferra et al. 1997, Langridge and Sogge 1997b), New Mexico (Cooper 1997, Langridge and Sogge 1997a) and northeastern Utah (Behle 1981).

Although most sites were dominated by willow, there were a few exceptions. Escalante SWA and Fruit Growers Reservoir included significant amounts of saltcedar/tamarisk. At Escalante,

several of the 1996 willow flycatcher territories were located in saltcedar-dominated portions of the site and at least one nest was placed in saltcedar. Similarly, at least part of the willow flycatcher's territory at Fruit Growers in 1997 included a stringer of tall, dense saltcedar. Willow flycatchers were breeding in Russian olive-dominated habitat at Silt, and the singing flycatcher detected at Confluence Park in Delta was singing from within similar habitat. Such use of exotic vegetation and habitats occurs in Arizona (Sferra et al. 1997, Sogge et al. 1997b), Nevada (R. McKernan, unpublished data), New Mexico (Cooper 1997) and Utah (R. McKernan and USFWS, unpublished data), but has not been well described for Colorado.

Surface water was present at all Colorado sites, usually in the form of a river, stream, lake, beaver ponds, or spring runoff. The Gothic site was 150 m distant from this type of surface water (the East River), but the dense willow habitat was maintained by very wet, saturated soil. Water has been identified as an important component of willow flycatcher habitat in the Southwest (USFWS 1993, Cooper 1997, Sferra et a.1997, Sogge et al. 1997a), although the species will breed in drier, shrubby sites in other portions of its range (McCabe 1990)

Cowbirds

We detected cowbirds at seven sites. Of the sites within potential *E.t. extimus* range, cowbirds were abundant to common at four. Given the limited amount of time we spent at many areas, cowbirds should not be considered completely absent simply because we did not detect them on our visit, so they are likely present at more than just seven sites.

Only the willow flycatcher breeding population at Arapaho NWR has been studied with regard to cowbird parasitism (Sedgwick and Knopf 1988), so the nature and extent of cowbird impacts at other sites in unknown. However, cowbird abundance is often considered an indicator of cowbird parasitism pressure (Robinson et al. 1995). If so, then the willow flycatcher populations at Alamosa NWR, McIntire Springs, and Escalante are potentially at risk. Cowbirds have been shown to significantly decrease flycatcher nest success and productivity elsewhere in Colorado (Sedgwick and Knopf 1988) and the Southwest (Whitfield and Enos 1996, Sogge et al. 1997b), and may be doing so at sites in southwestern and southern Colorado. Cowbird trapping and euthanasia have successfully reduced cowbird parasitism and its effects on willow flycatchers in other areas (Whitfield 1990, Whitfield and Enos 1996), and would likely do so at Colorado sites.

MANAGEMENT RECOMMENDATIONS

We are not yet certain which, if any, of the willow flycatcher populations in southern and southwestern Colorado are of the endangered *extimus* subspecies. Until subspecies status boundary ranges are clarified, the USFWS will treat as *extimus* all willow flycatchers found breeding within a large portion of this region (refer to Figure 2). Currently, the known populations in this region are few, generally small, and widely separated. As such, they may deserve management interest and protection even if they are not of the endangered southwestern race. With these considerations in mind, we offer the following management recommendations.

Continued and expanded surveys

Only a portion of the region's riparian areas have been thoroughly surveyed for breeding populations and potential flycatcher habitat. Our observations suggest that willow flycatchers may use smaller, shorter and more fragmented habitat patches in Colorado than is seen in Arizona, New Mexico, or southern California. Thus, there is certainly potential breeding habitat that has not been surveyed even near the sites where we have worked (e.g., the San Luis Valley and/or the Gunnison River near Delta). Because effective management and conservation requires a thorough understanding of the abundance and distribution of flycatchers and their habitat, we recommend continued and expanded willow flycatcher surveys in the region's riparian areas.

These surveys should be conducted per the established protocol (Sogge et al. 1997a), with careful attention to using trained and qualified staff, and the required timing and number of survey visits. Where possible, more than the minimum number of surveys should be conducted, as willow flycatchers at high elevations seem to vocalize less predictably, and are therefore harder to detect, later in the season. Survey efforts should be coordinated among agencies and surveyors, and the results reported to a single agency or individual. This individual or agency should consolidate the information and prepare an annual statewide report, as is done for Arizona (e.g., Sferra et al. 1997) and New Mexico (e.g., Cooper 1997). Coordinated efforts, analysis and reporting are needed to minimize duplication of effort, maximize functional and financial efficiency, and assure the landscape level understanding needed for this species.

Continued monitoring of selected sites

Although we now know the location and extent of a number of willow flycatcher breeding sites in southern and southwestern Colorado, we know virtually nothing about their productivity, stability, or persistence. We do not even know whether any of these breeding groups are increasing or decreasing. Such information is critical to effective management, both locally and regionwide. In 1996 and 1997, we began color-banding flycatchers at several of the breeding sites, principally in areas where local agencies had expressed an interest and potential capability to continue monitoring the populations. This could provide information on population trends, site fidelity, and movements.

We recommend a program of continued monitoring at Beaver Creek, Clear Creek, Escalante SWA, Alamosa NWR and McIntire Springs. Other sites could be included, but do not currently have color-banded birds. At a minimum, monitoring should include continued surveys, detection

and recording of birds banded in 1996 and 1997, and careful behavioral observations to detect evidence of breeding and nesting. Given funding, permits, qualified staff and an appropriate research plan, monitoring could also include additional banding, nest checks and nest monitoring in order to determine productivity, nest success and cowbird impacts. All of this information is of great use in developing and carrying out management and conservation actions.

Cowbird control

Cowbirds are clearly having negative effects on willow flycatcher populations throughout the Southwest, with impacts that include nest failure, reduced productivity, and lowered nest success (Whitfield 1990, Whitfield and Enos 1996, Cooper 1997, Sferra et al. 1997, Sogge et al. 1997a and 1997b). Although we do not know the extent of such impacts in Colorado, the prevalence of cowbirds at several sites we studied suggests that similar impacts are likely. Cowbird control, via trapping and euthanasia, has been proven effective at reducing cowbird population and impacts at several sites in California and Arizona (Whitfield and Enos 1996, USFWS and Arizona Game and Fish Department unpublished data). We recommend that local land management agencies consider implementing cowbird control at willow flycatcher breeding sites and/or cowbird concentration areas. Potential areas to focus initial efforts include Escalante SWA, Alamosa NWR, and McIntire Springs. Such control programs require state and federal permits, and must be carefully planned (including discussions with agencies and individuals experienced with cowbird control) and executed.

Habitat protection

Until the species is recovered, or until the USFWS dictates that protection is not needed, it is important to protect currently known willow flycatcher breeding habitats. The nature and degree of threats vary between sites, so protection measures must be developed and implemented on a site-by-site basis. In some cases, such as McIntire Springs and Beaver Creek, protection may be achieved simply by continuing current management practices that favor development and maintenance of suitable habitat. In others, managers may wish to consider changes to grazing practices, recreation, or other land uses that are inconsistent with maintaining dense riparian habitats. The willow flycatcher nests that we found in Colorado were placed low (below 2 m) in willows or saltcedar shrubs that were susceptible to being trampled, as has been documented in similar habitat in California (Valentine et al. 1988). Therefore, we recommend excluding cattle and potentially damaging recreation activities from within occupied flycatcher breeding habitat from at least early June through mid-August, the period when flycatcher nests may be active.

At all sites, we recommend that land managers evaluate the risk of fire and develop fire management plans for sites with significant risk. Such plans should include communication and coordination with the local fire suppression entities so they know the location of the site and give protection priority to flycatcher breeding areas.

ACKNOWLEDGMENTS

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APPENDIX 1

Table of banding information for all willow flycatchers banded in Colorado, in sequential band order number.Color bands are read from top/bottom and LEFT leg to RIGHT leg: R=red, K=black, D=dark blue, G=green, B=light blue, Y=yellow, W=white, O=orange, P = Pink KW=black/white split, RW=red/white split, DP=dark blue/dark pink split, UW = purple/white split, WK = white/black split, WR = white/ red split, WU= white/purple split, PD = pink/dark blue split, and X=USFWS numbered aluminum band. AHY =adult, M=male, F=female, and U=unknown sex

Section 1: Willow flycatchers banded in 1996							
DATE	SITE	USFWS BAND NUMBER		AGE	SEX	COLOR BAND COMBINATION	RESIGHTED OR RECAPTURED IN 1997
25-Jul-96	Clear Creek	1740	91638	AHY	M		MAYBE*
25-Jul-96	Clear Creek	1740	91639	AHY	M		N
26-Jul-96	Beaver Creek	1740	91640	AHY	M		N
27-Jul-96	Escalante SWA	1740	91641	AHY	M	D/REX	Y
28-Jul-96	Escalante SWA	1740	91642	AHY	M	Y/REX	N
28-Jul-96	Escalante SWA	1740	91643	AHY	M	G/REX	N
28-Jul-96	Escalante SWA	1740	91644	AHY	U	B/REX	N
28-Jul-96	Escalante SWA	1740	91645	HY	F	REX	N
28-Jul-96	Escalante SWA	1740	91646	AHY	M	W/REX	Y
28-Jul-96	Escalante SWA	1740	91647	AHY	F	K/REX	N
29-Jul-96	Silt	1740	91648	AHY	M		N
29-Jul-96	Silt	1740	91649	AHY	M		N
29-Jul-96	Silt	1740	91650	AHY	F		N
30-Jul-96	Plateau Creek	1740	91673	AHY	U		N
25-Jul-96	Alamosa NWR	1740	91746	AHY	M		N
25-Jul-96	Alamosa NWR	1740	91747	AHY	M		N
25-Jul-96	Alamosa NWR	1740	91748	AHY	U	K/PAX	Y
25-Jul-96	Alamosa NWR	1740	91749	AHY	U		N
25-Jul-96	Alamosa NWR	1740	91750	AHY	F		N
28-Jul-96	Gothic	1740	91761	AHY	M		N
29-Jul-96	Gothic	1740	91762	AHY	F		N
31-Jul-96	Horse Ranch Park	1740	91763	AHY	M		N
31-Jul-96	Horse Ranch Park	1740	91764	U	M		N
31-Jul-96	Horse Ranch Park	1740	91765	AHY	F		N
31-Jul-96	Horse Ranch Park	1740	91776	AHY	F		N
*In 1997 a flycatcher was resighted with an aluminum band in the same territory as 1996.							

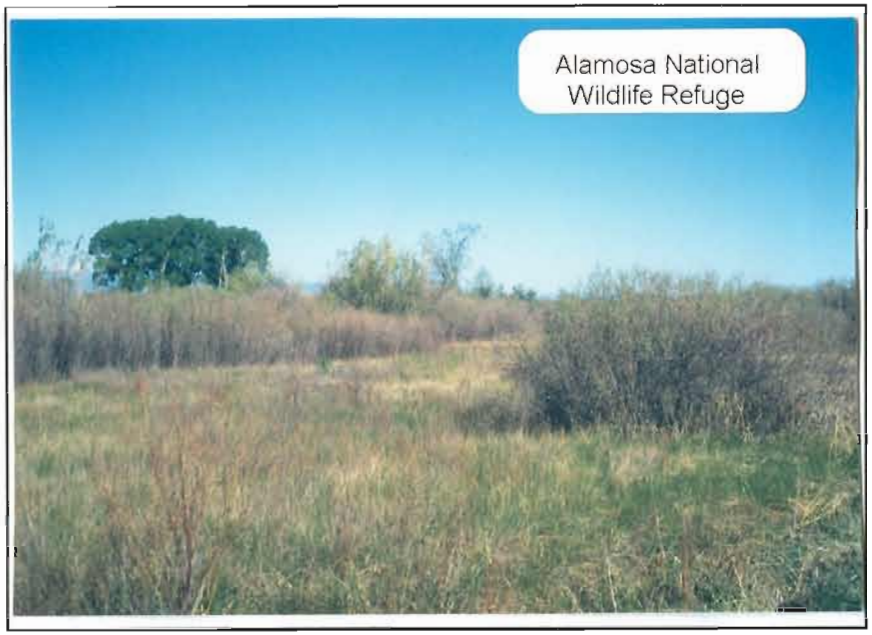
Section 2: Willow flycatchers captured in 1997						
DATE	SITE	USFWS BAND NUMBER		AGE	SEX	COLOR BAND COMBINATION
5/24/97	Escalante SWA	1590	97403	AHY	M	K/G:X
05/24/97	Escalante SWA	1590	97404	AHY	U	G/G:X
05/29/97	Escalante SWA	1590	97405	AHY	U	O/G:X
05/30/97	Alamosa NWR	1590	97406	AHY	M	G/P:X
06/01/97	Alamosa NWR	1590	97407	AHY	M	B/P:X
06/01/97	Alamosa NWR	1590	97408	AHY	U	Y/P:X
06/01/97	Alamosa NWR	1590	97409	AHY	M	W/PX
06/02/97	Clear Creek	1590	97410	AHY	M	A:R/X
06/02/97	Clear Creek	1590	97411	AHY	U	A:K/X
06/03/97	Beaver Creek	1590	97412	AHY	M	A:P/X
06/11/97	Escalante SWA	1590	97413	AHY	U	Y/G:X
06/11/97	Escalante SWA	1590	97414	AHY	U	W/G:X
06/11/97	Escalante SWA	1590	97415	AHY	U	P/G:X
06/12/97	Lake Avery	1590	97416	AHY	U	
06/12/97	White River at Buford	1590	97417	AHY	U	
06/12/97	White River at Buford	1590	97418	AHY	U	
06/12/97	White River at Buford	1590	97419	AHY	U	
06/13/97	Rio Blanco Reservoir	1590	97420	AHY	U	
06/12/97	White River at Buford	1590	97421	AHY	M	
06/13/97	Rio Blanco Reservoir	1590	97422	AHY	F	
06/13/97	Rio Blanco Reservoir	1590	97423	AHY	F	
06/13/97	Rio Blanco Reservoir	1590	97424	AHY	U	
06/13/97	Rio Blanco Reservoir	1590	97425	AHY	U	
06/13/97	Rio Blanco Reservoir	1590	97426	AHY	U	
06/13/97	Rio Blanco Reservoir	1590	97427	AHY	F	
06/14/97	Homestake Creek	1590	97430	AHY	U	
06/14/97	Homestake Creek	1590	97431	AHY	M	
06/16/97	Rio Blanco Reservoir	1590	97432	AHY	M	
06/16/97	Rio Blanco Reservoir	1590	97433	AHY	F	
06/16/97	Rio Blanco Reservoir	1590	97434	AHY	M	
06/24/97	Alamosa NWR	1590	97435	AHY	M	O/P:X
06/24/97	Alamosa NWR	1590	97436	AHY	U	P/P:X
06/24/97	Alamosa NWR	1590	97437	AHY	F	D/P:X
06/24/97	Alamosa NWR	1590	97438	AHY	U	KW/P:X
06/25/97	Alamosa NWR	1590	97439	AHY	U	UW/P:X
06/25/97	Alamosa NWR	1590	97440	AHY	U	WK/P:X
06/25/97	Alamosa NWR	1590	97441	AHY	U	PD/P:X
06/25/97	Alamosa NWR	1590	97442	AHY	M	WU/P:X
06/25/97	Alamosa NWR	1590	97443	AHY	F	X:R/P
06/27/97	McIntire Springs	1590	97444	AHY	M	X:K/P

Section 2 - continued: Willow flycatchers banded in 1997						
DATE	SITE	USFWS BAND NUMBER		AGE	SEX	COLOR BAND COMBINATION
06/27/97	McIntire Springs	1590	97445	AHY	U	X:D/P
06/27/97	McIntire Springs	1590	97446	AHY	U	X:G/P
06/27/97	McIntire Springs	1590	97447	AHY	U	X:Y/P
06/28/97	Clear Creek	1590	97448	AHY	U	X:Y/B
06/28/97	Clear Creek	1590	97449	AHY	U	X:W/B
06/28/97	Clear Creek	1590	97451	AHY	F	X:O/B
06/29/97	Beaver Creek	1590	97452	AHY	U	X:D/B
06/29/97	Beaver Creek	1590	97453	AHY	U	X:KW/B
06/29/97	Beaver Creek	1590	97454	AHY	F	X:RW/B
06/30/97	Beaver Creek	1590	97455	AHY	U	X:DP/B
06/30/97	Beaver Creek	1590	97456	AHY	U	X:UW/B
07/01/97	Clear Creek	1590	97457	AHY	U	X:B/B
07/01/97	Clear Creek	1590	97458	AHY	F	X:WK/B
07/01/97	Clear Creek	1590	97459	AHY	U	X:WR/B
07/01/97	Clear Creek	1590	97460	AHY	U	X:PD/B
07/09/97	McIntire Springs	1590	97461	AHY	M	X:W/P
07/09/97	McIntire Springs	1590	97462	AHY	F	X:O/P
07/12/97	Vega Reservoir	1590	97463	AHY	U	
07/13/97	Vega Reservoir	1590	97464	AHY	F	
07/17/97	Arapahoe NWR	1590	97465	AHY	M	
07/17/97	Arapahoe NWR	1590	97466	AHY	F	
07/17/97	Arapahoe NWR	1590	97467	AHY	M	
07/17/97	Arapahoe NWR	1590	97468	AHY	M	
07/18/97	Arapahoe NWR	1590	97469	AHY	M	
05/29/97	Escalante SWA	1740	91675	AHY	M	R/G:X

APPENDIX 2.

Photographs of occupied willow flycatcher breeding habitat in Colorado, 1996 and 1997

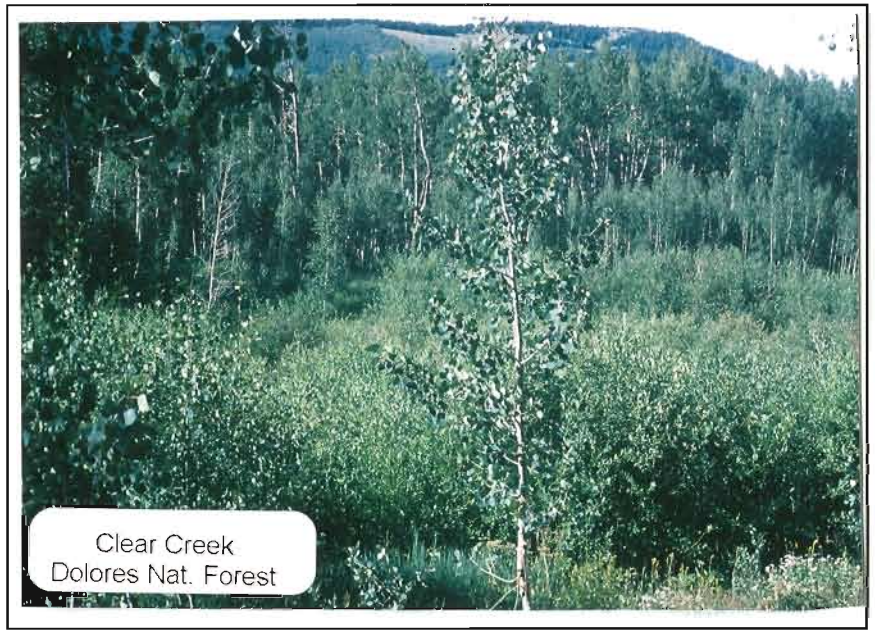
These photographs are provided in order to show some of the range of vegetation structure and composition at known flycatcher breeding sites in Colorado. They are not intended to show, nor do they include, all possible habitat types that breeding willow flycatcher might use. Note that no photograph is available for the Plateau Creek site. Photographs by Jen Owen, Renee Netter, Suzanne Langridge and Michael Moore.

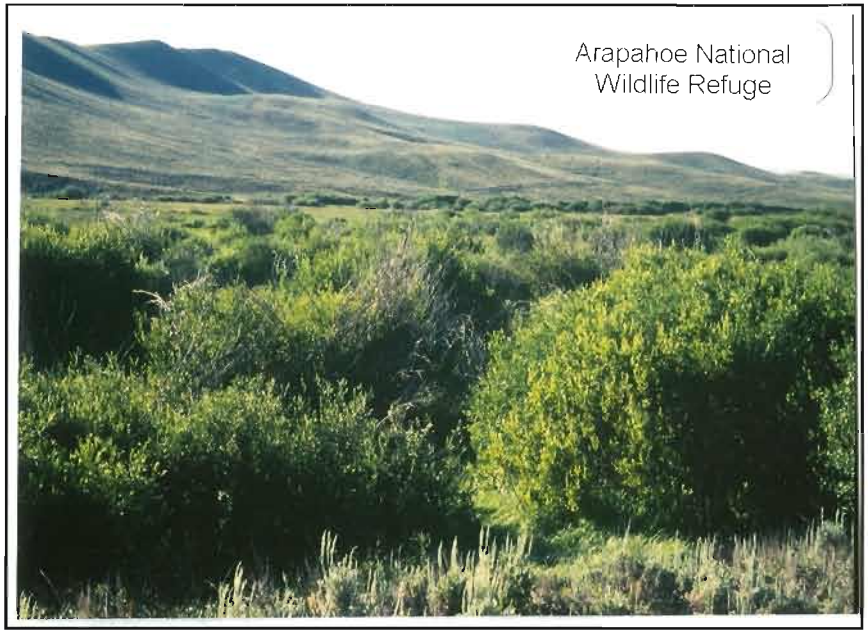

Alamosa National
Wildlife Refuge

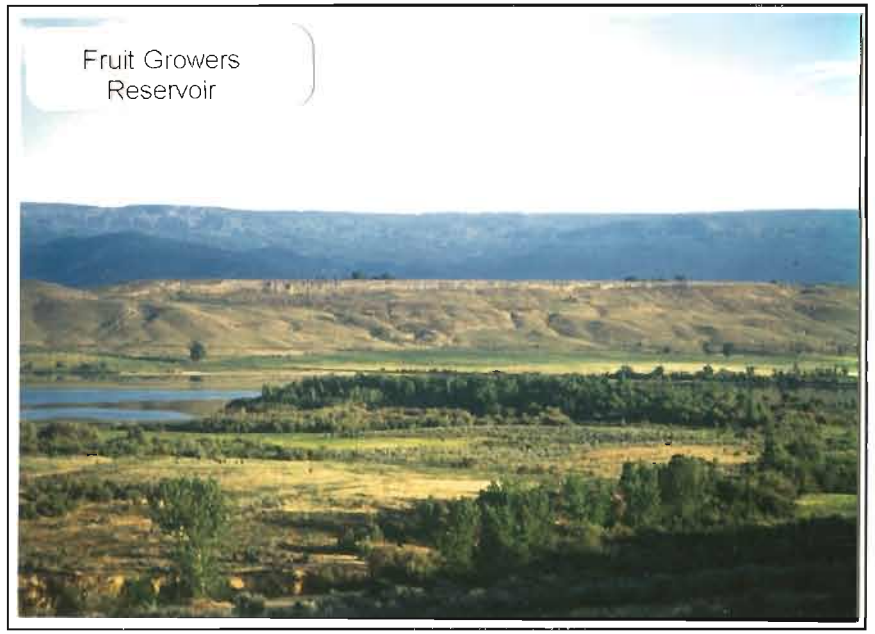

McIntire Springs


McIntire Springs
(interior)


Beaver Creek
Dolores Nat. Forest


Clear Creek
Dolores Nat. Forest


Arapahoe National
Wildlife Refuge


Fruit Growers
Reservoir


Fruit Growers
Reservoir

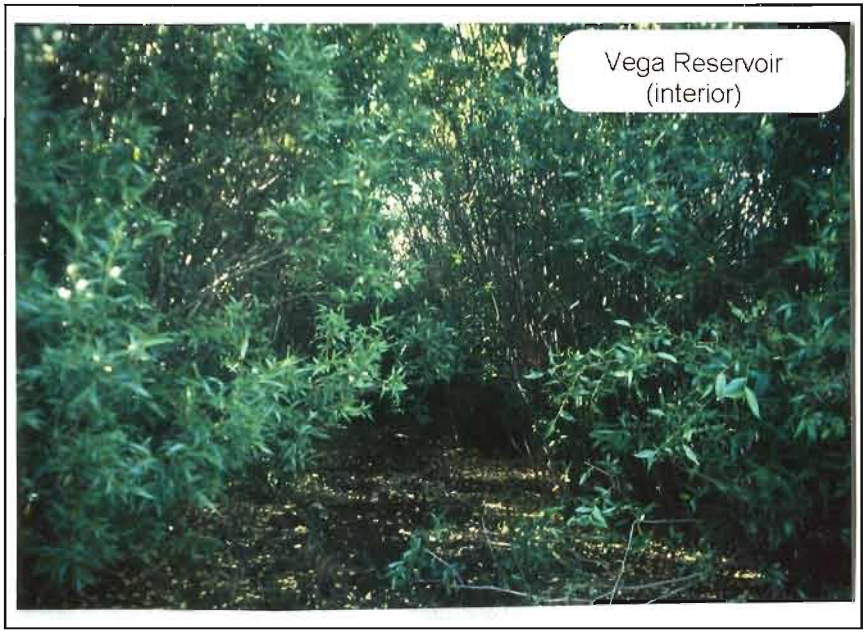

Escalante State
Wildlife Area (pre-burn)
5 24 '98

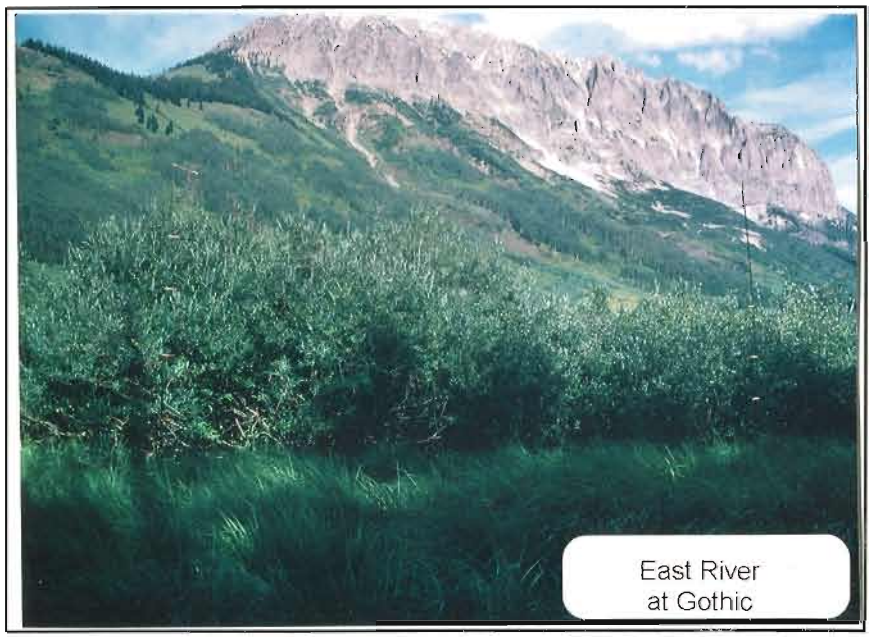

Escalante State
Wildlife Area (pre-burn)

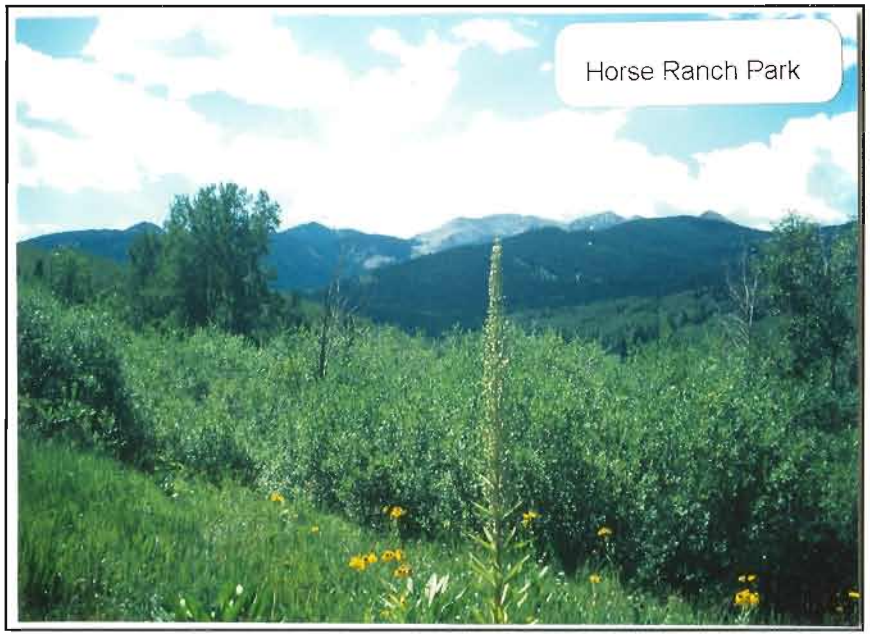

Escalante State
Wildlife Area (post-burn)

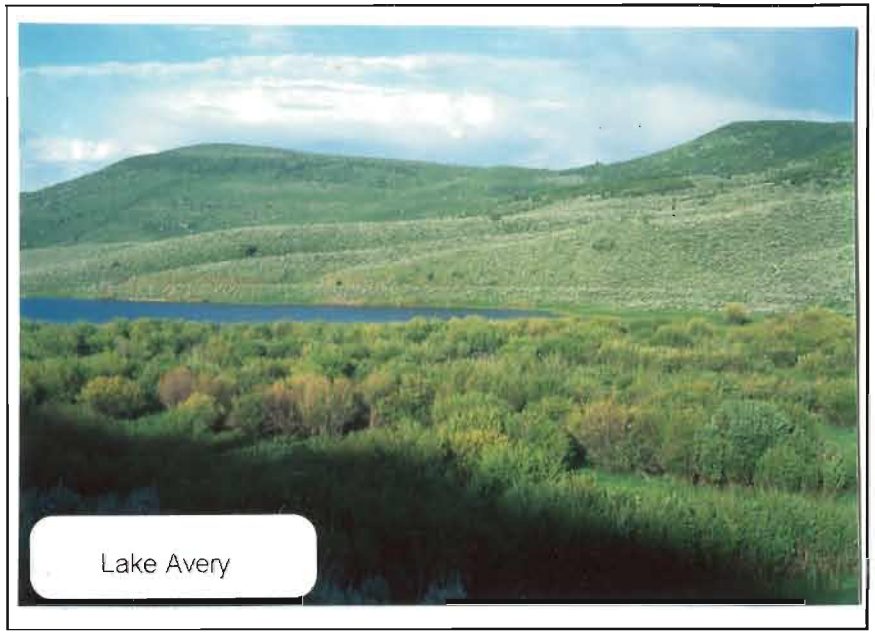

Escalante State
Wildlife Area (post-burn)


Vega Reservoir

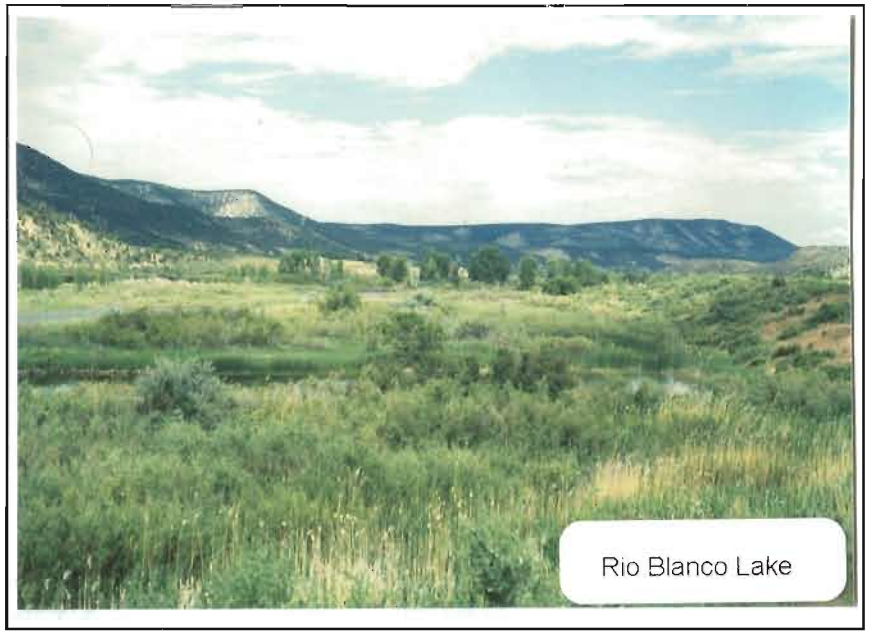

Vega Reservoir
(interior)


East River
at Gothic


Horse Ranch Park



Lake Avery



Rio Blanco Lake

White River
at Buford

Homestake Creek