SOUTHWESTERN WILLOW FLYCATCHER RESPONSE TO CATASTROPHIC HABITAT LOSS

Fire burning in the riparian habitat at PZ Ranch along the San Pedro River, Arizona on 03 June 1996. View is from the east. Photo by Eben Paxton.

Prepared by

Eben Paxton, Jennifer Owen, and Mark Sogge

Colorado Plateau Research Station
U.S. Geological Survey Biological Resources Division
Northern Arizona University, Flagstaff, Arizona

October 21, 1996

SOUTHWESTERN WILLOW FLYCATCHER RESPONSE TO CATASTROPHIC HABITAT LOSS

INTRODUCTION

The southwestern willow flycatcher (Empidonax traillii extimus) is a federally-listed endangered species (USFWS 1995) that nests only in dense riparian habitats in southern California, Arizona, New Mexico, extreme southern Nevada and Utah, and southwestern Colorado (Tibbitts et al. 1995). The breeding population consists primarily of small, scattered groups of five or fewer territories, usually clustered relatively closely within a particular patch of riparian vegetation.

Because the southwestern willow flycatcher is a riparian obligate breeder, and riparian habitat comprises less than 1% of the available terrestrial habitats in the southwest, the flycatcher is particularly susceptible to loss or modification of suitable riparian breeding habitat. Events such as major floods or fires can cause sudden, catastrophic loss or modification of riparian vegetation that the flycatchers rely upon during the breeding season (USFWS 1995).

Recently, attention has been focused on the role of fire as a potential threat to the southwestern willow flycatcher and the riparian habitats upon which it depends. In June 1995, approximately three miles of riparian habitat burned on the Gila River in Pinal County, Arizona (Bureau of Land Management 1996). Based on the distribution of known flycatcher breeding areas upstream and downstream, some of this burned area was probably occupied by willow flycatchers (R. Marshall, USFWS, *pers. comm.*). During April 1996, a fire swept through portions of a known willow flycatcher breeding site at the San Juan Pueblo Bridge, on the Rio Grande, destroying much of the riparian habitat in the area. Although the effects of these two fires on local willow flycatcher breeding population is unknown, these two cases illustrate the fact that fire-induced catastrophic habitat loss does occur, and must be considered as one of the significant current threats that must be considered in flycatcher management and conservation.

In 1996, a fire destroyed willow flycatcher breeding habitat along the lower San Pedro River in Pinal County, Arizona. Biologists from the Arizona Game and Fish Department (AGFD) were already working at the site, and biologists from the National Biological Service Colorado Plateau Research Station were working at a nearby willow flycatcher breeding site and were able to shift their efforts to the burned area immediately after the fire. This provided a unique opportunity to evaluate the response of flycatchers to catastrophic loss of their breeding habitat. This report describes the nature and extent of the fire and associated habitat loss, summarizes the initial response of the territorial flycatchers to the fire, and discusses long-term ramifications to the local flycatcher population.

THE SITE

PZ Ranch, the private property of ASARCO, is located on the lower San Pedro River, approximately 15 km south of Winkleman and the Gila River confluence, Pinal Co, Arizona (Figure 1). It is one of the largest breeding sites of the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) in Arizona (Spencer et al 1996), and one of only four to have greater than ten territories (prior to the fire.)

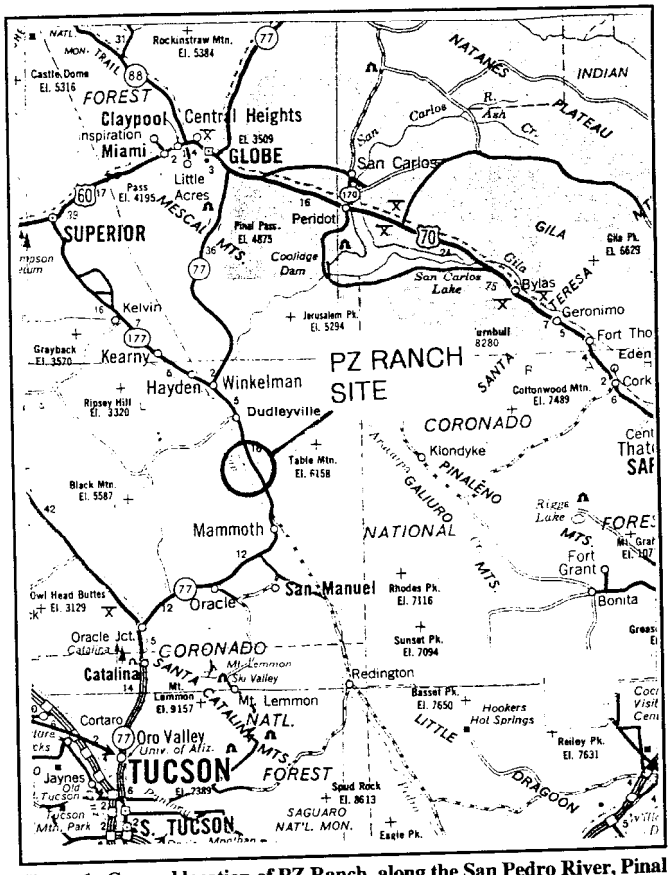

Figure 1. General location of PZ Ranch, along the San Pedro River, Pinal County, Arizona. One inch equals approximately 25 miles.

PZ Ranch consists of agriculture fields within the flood basin and a thin riparian gallery forest between the cultivated fields and the San Pedro river. The riparian gallery is characterized by a mature cottonwood (*Populus fremontii*) overstory, and a willow (*Salix goodingii*) and tamarisk (*Tamarix ramosissima*) understory (Figure 2). The willows grow only around a small seep at the southern end of the breeding area, with tamarisk occupying the drier areas. The tamarisk is the sole nesting substrate for the flycatchers, and occurs in a patchy strip at the edge of the cottonwoods (on the cultivated side) up to the northern end, where it becomes much denser and forms larger patches.

Willow flycatchers were first discovered breeding at PZ Ranch in 1994 (although they may have been present for many years prior) and have been monitored there ever since as part of the AGFD's willow Flycatcher survey program. For these last three years there have been 21 territories detected in 1994, 16 in 1995, and 15-16 in 1996 before the burn. The site is significant not only as a major breeding area, but also because it lies between several other breeding areas on the San Pedro, forming a potentially important corridor for the movement of the willow flycatchers along the river.

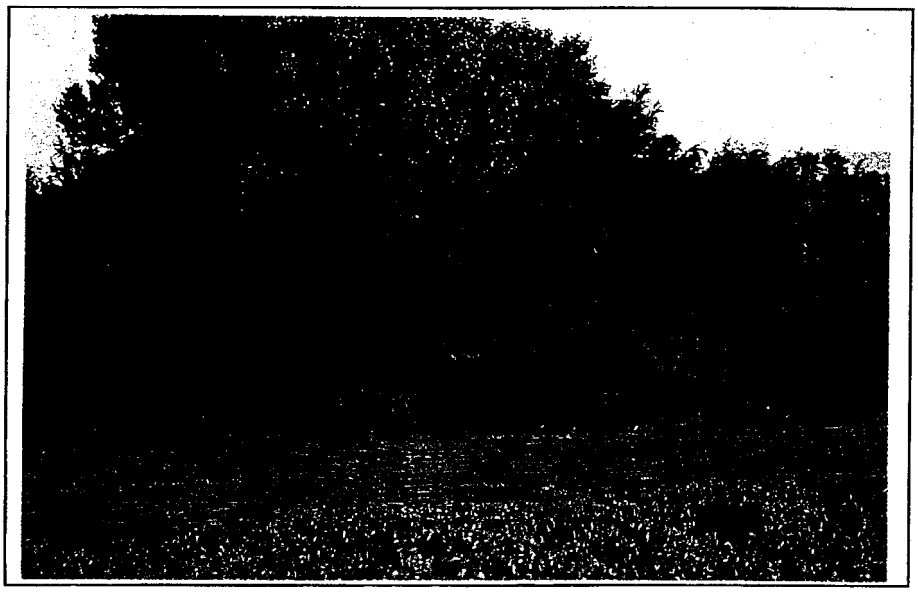

Figure 2. Unburned riparian habitat at the PZ Ranch site, July 1996. This is representative of the habitat structure over the entire site prior to the fire. Photo by John Grahame.

THE FIRE

On 1 June 1996, a small fire started on the river side of the cottonwood gallery, which was quickly put out by local volunteer fire fighters. Two days later, on 3 June 1996, the fire flared up, this time quickly spreading into an intense fire. The ensuing fire took a day and a half to put out with air and ground fire fighters. By the morning of June 4, the fire was contained and the firefighters spent the rest of the day "mopping up."

The fire started in approximately the center of the willow flycatcher breeding habitat, and spread north and south burning approximately 75% of the entire cottonwood gallery riparian forest (Figure 3). When the fire was over, only the northern third of the 1995-96 flycatcher breeding area was left unburned. Most of the burned breeding habitat was totally destroyed, although sufficient vegetation remained in a small portion of the burned breeding area that it may have remained marginally suitable for breeding attempts. The fire was primarily a ground fire, burning the canopy only in several areas. However, the fire killed many of the cottonwoods, resulting in a 75% defoliation of the canopy within a month's time. The tamarisk understory (in which the flycatchers had nested) was completely burned, with just blackened branches remaining (Figure 4 and 5).

Of the estimated 13 territories (12 pairs and one unmated male) that were known to be occupied by flycatchers before the burn, four were totally burned (territories 5,6,7, and 9), three were partially burned (territories 8, 10, and unnumbered), and the remaining six were unburned (Figure 6). The unburned territories were in an area to the north of the burned area, and two of the three partially burned territories were in a small patch around a seep that was only partially burned.

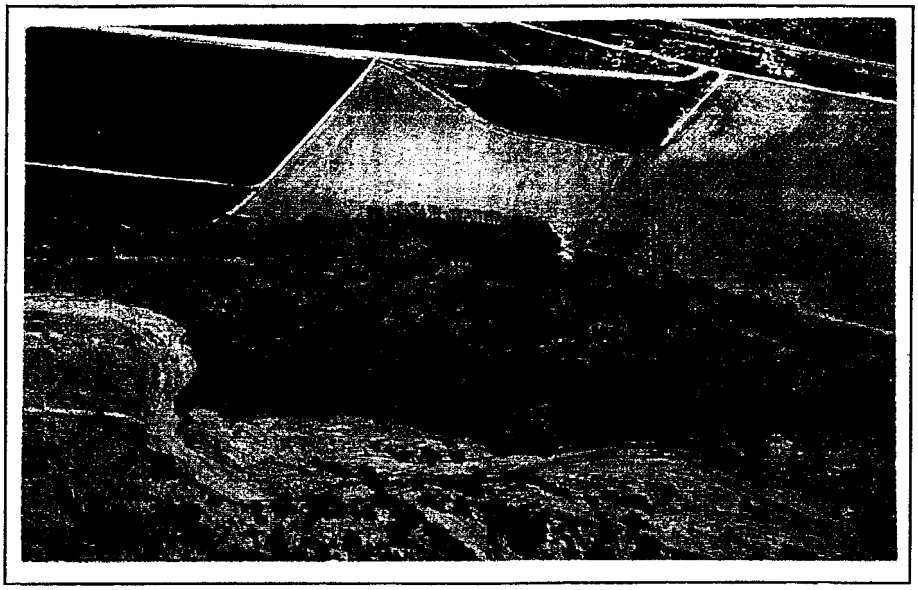

Figure 3. Aerial view of the PZ Ranch site, 20 September 1996. Note the extent of the burned overstory vegetation, which appears as gray vegetation within the riparian matrix. River flow is from right to left.

Figure 4. Eastern edge of the burned habitat patch at the PZ Ranch site, July 1996. Photo by John Grahame.

Figure 5. Burned tamarisk understory at the PZ Ranch site, July 1996. Photo by John Grahame.

SHORT TERM FLYCATCHER RESPONSE

In terms of immediate, direct impacts of the fire, AGFD documented four active willow flycatcher nests that were destroyed by the fire. However, the exact number of eggs or young burned are not known. In order to look at the effects of the loss of occupied breeding habitat in the burned area, as opposed to loss of actual nests, we embarked on a capture and banding effort.

On 5 June, the National Biological Service (NBS) banding crew received permission from ASARCO to enter the site for a three day effort to band the flycatchers in order to determine how the birds responded to the fire. This was the first morning the birds could have come back after the fire, as the previous morning the fire was still being extinguished. We used mist nets and tape-broadcast flycatcher songs to live-capture 17 adult willow flycatchers. Each bird was banded with a individually numbered USFWS aluminum band, plus a unique combination of color bands (see Figure 6 and Appendix I).

We detected flycatchers at all known pre-burn territories, with the exception of territory 9. Although AGFD had established a breeding pair at territory 9 prior to the fire, these birds were never located post-fire. The fire burned particularly hot at this territory, as demonstrated by the almost total loss of vegetation. The flycatchers with territories in the unburned area appeared to continue their breeding attempts normally.

The majority of willow flycatchers from the burned territories were observed in the cottonwood, along the edge of the burned area. These birds were singing from multiple perches in the cottonwood canopy (which was defoliated within a month after the burn). Some birds, however, were singing and perching on the actual blackened branches of the burned tamarisk. The flycatchers were highly territorial, responding aggressively to a tape playback of their song (as evidenced by the fact that 17 were caught in three days). Over those three days the birds gradually began to spend more time in the cottonwoods, and less time in the burned area. For example, at territory 5, the pair of birds spent most of the first day perched and singing on their burned nest tree, often near the location of their burned nest. By the end of the three days, the male was singing high in the cottonwoods, but would not respond to a tape playback, and we were unable to detect the female. As this shift of habitat use occurred, the birds gradually became less territorial, and spent less time singing.

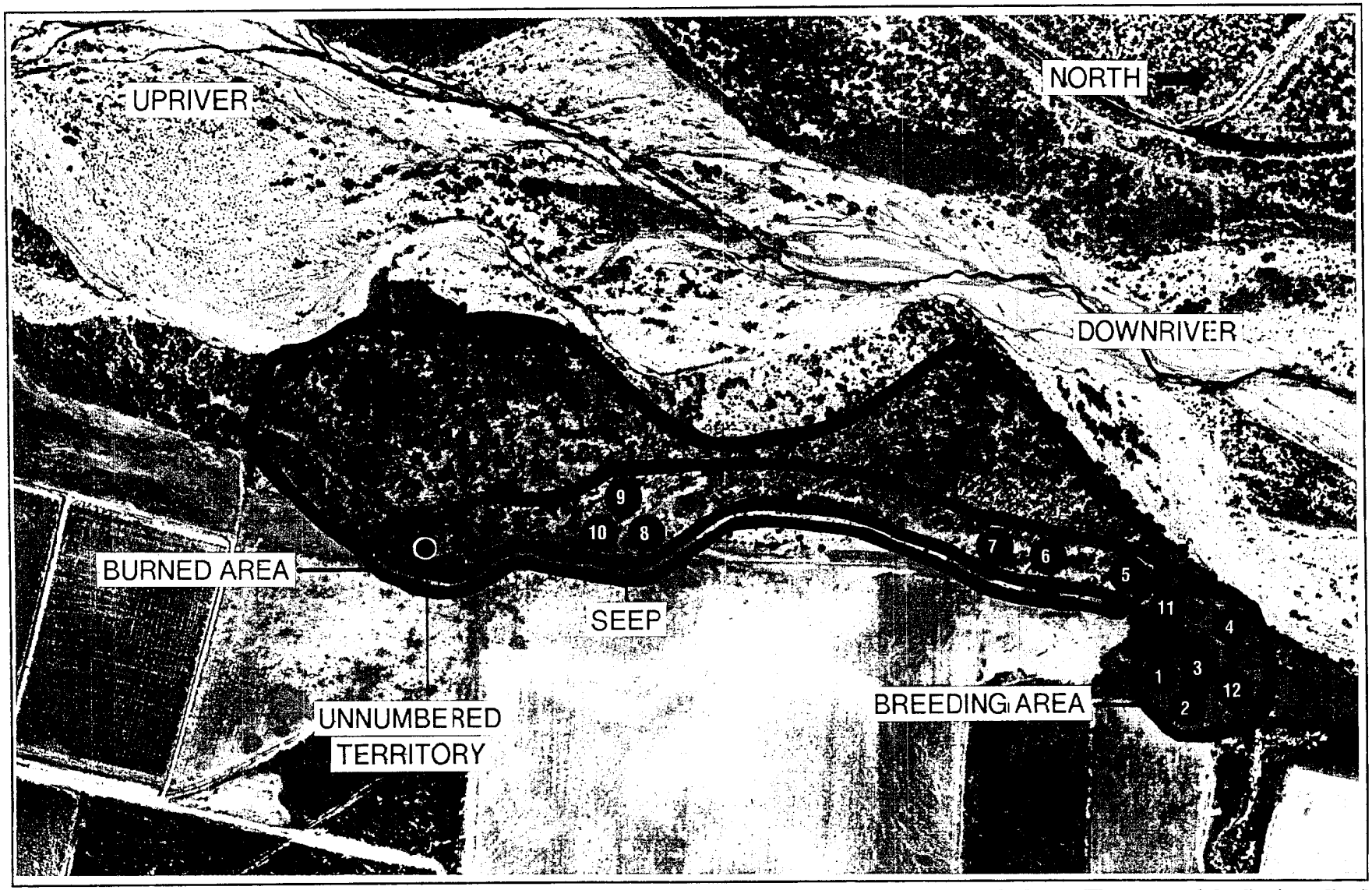

Figure 6. Aerial photograph (false color infrared) of the PZ Ranch site, taken approximately one month after the burn. The extent of the fire is outlined in blue, and the 1995-96 flycatcher breeding area is outlined in green. Numbered dots represent the locations of willow flycatcher pairs and associated breeding territories (following AGFD territory numbering designations), and the one unnumbered territory with an unmated male. Colorband combinations for all banded individuals are in appendix 1.

The willow flycatchers eventually left the burned area, but we do not know the exact dates that the birds departed. At the end of the three days of banding the flycatchers were beginning to be inconspicuous, but most were still present. The NBS crew did not receive written permission to re-enter the site again until early July, and the Arizona Game and Fish Department's crew did not visit the site again until 15 June. At that point, all of the flycatchers were absent from the fully burned area. At the partially-burned territories 8 and 10, the resident birds abandoned their (unburned) nests by 17 and 30 June, respectively, though it is not known if these birds failed due to the fire. It does not appear that there was any mortality of adult birds, with the possible exception of the pair at territory 9, where the territorial pair were never resighted after the fire.

Of the nine flycatchers banded in the burned area (out of 13+ pre-fire residents), only one was later observed away from the burned area: a flycatcher originally captured in an unnumbered territory was later confirmed nesting at territory 3, a distance of about 400 m away. This is the only case we observed of definite movement and resettlement within the patch. We do not know where the remaining flycatchers from the burned area moved to, but we do know that they were not seen at other nearby breeding areas where flycatcher monitoring was conducted (such as Cook's Lake or Kearny). It is probable they left the entire area, or spent the rest of the breeding season in local areas where they were not observed.

If the willow flycatchers that left the breeding site following the burn attempted to breed elsewhere (either locally or more distant), they faced delays in breeding and nesting efforts due to the need to locate suitable breeding habitat, establish territories, and possibly attract a new mate. Late breeding attempts and renesting efforts are both known to reduce reproductive success of willow flycatchers. For example, willow flycatcher clutch size (number of eggs laid per nest) is significantly reduced each time a flycatcher renests within a season (Holcomb 1974). In addition, fledglings from nests started later in the breeding season have a significantly lower probability of surviving and returning to breed the following year (Whitfield and Strong 1995). Therefore, even if the affected flycatchers relocated and attempted to continue breeding, their reproductive success would probably be much lower than if the fire had not occurred. Because of the currently low numbers of breeding flycatchers, any loss in productivity may be an important loss to the population as a whole.

LONG-TERM FLYCATCHER RESPONSE

The implications of this fire on the future of PZ Ranch as a significant breeding site won't be known for several years. Willow flycatchers have high nest site fidelity (Whitfield 1990), and it is probable that many of the birds will return, at least initially, to their pre-burn territories in 1997. However, tamarisk regrowth may not be sufficient to support willow flycatcher nesting attempts in 1997, and loss of the associated cottonwood overstory may reduce the overall suitability of the breeding site. Indeed, the cottonwood may have been an essential habitat component at this site.

Tamarisk can survive fires, even those as intense as the one at PZ Ranch. After a fire, tamarisk will begin resprouting shoots from the ground, with a growth exceeding 2 m in height within 5

months (Stevens 1989). Nonetheless, it will still be a year or two, at least, before the tamarisk is tall and dense enough for nesting, assuming the plants survived the fire. Although willow flycatchers may be able to nest in relatively young tamarisk that are associated with a cottonwood canopy, the majority of cottonwoods appeared to have been killed by the fire. In other breeding areas in Arizona where tamarisk is dominant without a broadleaf overstory, willow flycatchers usually nest only in denser, taller, and more decadent tamarisk stands (Spencer et al. 1996).

Therefore, it may be over a decade before the tamarisk at the site reaches the necessary density and structure to support breeding flycatchers. Even if the revegetation of the site occurred in just several years, it is unlikely many of the pre-burn residents will be alive to reoccupy it, given that the willow flycatcher has an estimated mean lifespan of only three to four years. Thus, the burned portion of the breeding area may have to be recolonized by other willow flycatchers, if at all.

If the willow flycatchers arrive and find the breeding habitat unsuitable, then they may disperse to look for nearby suitable breeding habitat. There is currently occupied breeding habitat both upriver and downriver of PZ Ranch. If there is a local movement of these displaced breeders, then it may tell us a lot about the suitability of the Lower San Pedro River for breeding flycatchers. If some of the flycatchers begin breeding in currently occupied areas, then it may indicate that the area is not at a maximum carrying capacity for breeding. Alternatively, if the displaced flycatchers begin breeding in nearby areas previously unoccupied, it may indicate that the local willow flycatcher population has been too small to utilize all potentially suitable habitat in the general area. On the other hand, if the birds disperse and leave the area, then it may indicate that the amount of suitable breeding habitat may limit the current number and distribution of willow flycatchers in the lower San Pedro River.

Any discussion of the suitability of a given site or habitat must take into account the fact that occupancy alone is <u>not</u> a reliable indicator that the area is truly suitable for the willow flycatcher. It is possible for flycatchers to establish territories and attempt to breed in an area, yet fail to raise young because the vegetation structure, prey base, predator community, and/or other ecological factors are not favorable (Sogge 1994). Such an area would be considered a habitat sink, as opposed to a source (Pulliam 1988). True suitability is best determined by whether the population at a site produces young at a rate greater than the rate of adult loss, such that the population is self-sustaining or increasing.

An effort to continue the color banding and monitoring of the flycatchers at PZ Ranch and the surrounding area may answer some of these questions. This unfortunate event may prove valuable for our understanding of the willow flycatcher's reactions to catastrophic events, and could help land managers and policy makers better evaluate any future actions concerning the willow flycatcher.

SUMMARY

On 3 June 1996 a fire consumed a large portion of the breeding habitat of the southwestern willow flycatcher at PZ Ranch, an important breeding site in Arizona. Approximately two-thirds of the breeding area was damaged to the point where nesting was not possible. This damage will effect the breeding of flycatchers at the site for several years (or longer) until the overstory and understory can rejuvenate and mature to create the suitable vegetation density and twig structure to become suitable breeding habitat again.

Seven to eight territories were completely burned, with an additional three territories partially burned. Only the resident pairs from the six territories that were not burned remained throughout the breeding season. Almost all flycatchers were present in the burned areas the morning after fire suppression ended, singing and behaving territorial. Three days after the fire the flycatchers were beginning to leave the burned area, moving into the cottonwood forest gallery and away from their burned territories. Within twelve days after the fire the birds were no longer present in the burned area.

All but one of the willow flycatchers color banded in the burned areas were not resighted for the remaining breeding season at any of the other nearby breeding areas, and are assumed to have left the general area or occupied non-breeding areas that researcher did not go to. One female from a partially burned territory was later found renesting at a different territory approximately 400 m away. The long-term response by the flycatchers to the fire will not be known for several years. A long term study of the future habitat use and possible dispersement of willow flycatchers from the burned area may provide a great deal of information useful for the management of this endangered sub-species.

ACKNOWLEDGMENTS

The southwestern willow flycatcher banding and demography study that supported this effort was funded by the U.S. Bureau of Reclamation, Phoenix. The support and efforts of Henry Messing (Bureau of Reclamation) were crucial to the project. We thank the Arizona Game and Fish Department willow flycatcher survey crew for their field support and for sharing their observational data. We also thank ASARCO for granting permission to access and work at the PZ Ranch site. In particular, the timely cooperation and rapid assistance of Diane Laush (U.S. Bureau of Reclamation) and Neil Gambell (ASARCO) made it possible for us to access the site immediately after the burn, which was critical to our ability to band the flycatchers before they left their territories. Therese Littlefeather and John Grahame (Colorado Plateau Research Station) assisted with field efforts. Robert Marshall (USFWS) reviewed an earlier draft of this report and provided helpful comments and insights.

LITERATURE CITED

Bureau of Land Management. 1996. Biological evaluation for livestock grazing on 13 allotments along the Gila River. BLM, Phoenix Resource Area.

Holcomb, L.C. 1974. The influence of nest building and egg laying behavior on clutch size in renests of the willow flycatcher. Bird Banding 45:320-325.

Pulliam, H.R. 1988. Sources, sinks, and population regulation. American Naturalist 132:652-661.

Sogge, M.K. and T.J. Tibbitts. 1994. Distribution and Status of the Southwestern Willow Flycatcher along the Colorado River in the Grand Canyon - 1994. Summary Report. National Biological Service Colorado Plateau Research Station/Northern Arizona University and U.S. Fish and Wildlife Service, Phoenix. 37 pp

Spencer, J. A., S. J. Sferra, T. E. Corman, J. W. Rourke, and M. W. Sumner. 1996. Arizona Partners in Flight 1995 southwestern willow flycatcher survey. Nongame and endangered Wildlife Program Technical Report 97. Arizona Game and Fish Department, Phoenix, Arizona.

Stevens, L. E. 1989. The status of ecological research on tamarisk in Arizona. pp 99-105 in Kunzman, M. R., R. R. Johnson, and P. S. Bennet. Tamarisk control in southwestern United States. Cooperative National Park Resources Studies Unit. Special report no. 9.

Tibbitts, T.J., M.K. Sogge, and S.J. Sferra. 1994. A Survey Protocol for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*). National Park Service Technical Report NPS/NAUCPRS/NRTR-94/04.

U.S. Fish and Wildlife Service. 1995. Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher. Federal Register 60:10694 (February 27, 1995).

Whitfield, M. J. 1990. Willow flycatcher reproductive response to brown-headed cowbird parasitism. MS thesis. California State University, Chico.

Whitfield, M.J. and C.M. Strong. 1995. A brown-headed cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1995. California Department of Fish and Game Bird and Mammal Conservation Program Report 95-4.

Appendix 1. Band numbers, color combination, gender and response of breeding southwestern willow flycatchers at 13 breeding territories at PZ Ranch, to the fire that occurred on 3 June 1996. Birds are presented in order of territory numbers, which follow designations by Arizona Game and Fish Department. All but two territories (#7, #9) had at least one flycatcher of the pair banded. Three flycatchers were banded in territory 3, which may represent the capture of a bird from an adjacent territory.

Date Banded	Band Number	Colorbands	Sex	Territory	Fate of Territory	Response of Bird Post-fire
6/7/96	1740-91518	BW/BW : X	Female	Terr. 1	unburned	not affected
6/7/96	1740-91519	BP/W : X	Female	Terr. 1	unburned	not affected
6/7/96	1740-91522	W/W : X	Female	Terr. 2	unburned	not affected
6/6/96	1740-91610	R/BW : X	Female	Terr. 3	unburned	not affected
6/7/96	1740-91520	DB/W : X	Unknown	Terr. 3	unburned	not affected
6/7/96	1740-91521	Y/W : X	Male	Terr. 3	unburned	not affected
6/6/96	1740-91516	RW/BW : X	Male	Terr. 4	unburned	not affected
6/6/96	1740-91517	BP/BW : X	Female	Terr. 4	unburned	not affected
6/5/96	1740-91513	Y/BW : X	Unknown	Terr. 5	burned	Nest destroyed by fire. Bird present for several days after fire, then dispersed to unknown area
6/5/96	1740-91515	O/BW : X	Unknown	Terr. 5	burned	Nest destroyed by fire. Bird present for several days after fire, then dispersed to unknown area
6/5/96	1740-91608	BP/BK : X	Female	Terr. 6	burned	Nest destroyed by fire. Bird present for several days after fire, then dispersed to unknown area
6/5/96	1740-91607	RW/BK : X	Unknown	Terr. 6	burned	Nest destroyed by fire. Bird present for several days after fire, then dispersed to unknown area
n/a	unbanded	n/a	Pair	Terr. 7	burned	Nest destroyed by fire. Birds observed in territory immediately following burn, but not caught. Dispersed from territory by 3 days post-fire.
6/5/96	1740-91690	BW/BK : X	Unknown	Terr. 8	partially burned	present for several days after fire, then dispersed to unknown area

Date Banded	Band Number	Colorbands	Sex	Territory	Fate of Territory	Response of Bird Post-fire
n/a	unbanded	n/a	Pair	Terr. 9	burned	Pair present in territory pre-fire, never observed post-fire. Either dispersal or fire-related mortality. Nest destroyed by fire.
6/6/96	1740-91611	G/BW : X	Unknown	Terr. 10	partially burned	present for several days after fire, then dispersed to unknown area
6/6/96	1740-91612	B/BW : X	Unknown	Terr. 10	partially burned	present for several days after fire, then dispersed to unknown area
6/5/96	1740-91514	W/BW : X	Male	Terr. 11	unburned	not affected. Originally caught in territory 5, which is adjacent to territory 11.
7/3/96	1740-91529	X : R/BW	Female	Terr. 11	unburned	not affected
7/4/96	1740-91530	X : G/BW	Male	Terr. 12	unburned	not affected
7/4/97	1740-91531	X : B/BW	Female	Terr. 12	unburned	not affected
6/7/96	1740-91613	BK/BW : X	Female	unnumbered	partially burned	orignally banded in unnumbered territory, present for several days after fire, then later verified nesting at territory 3

Note: Color bands are read top/bottom, Left : Right leg. R = red, BK = black, G = green, B = light blue, DB = dark blue, Y = yellow, W = white, O = orange, BW = black or white striped split band, RW = red over white striped split band, BP = dark blue over dark pink striped split band, and X = USFWS numbered aluminum band.s