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Chapter 5:
A Survey of Current Breeding Habitats

The distribution and abundance of a species across a landscape depends, in part, on the distribution and abundance of appropriate habitat. If basic resource needs such as food, water, and cover are not present, then that species is excluded from the area. Scarcity of appropriate habitat is generally the key reason for the status of most rare and endangered species. An understanding of an endangered species' habitat characteristics is crucial to effective management, conservation and recovery.

The southwestern willow flycatcher (*Empidonax traillii extimus*) breeds in dense riparian habitats in all or parts of seven southwestern states, from sea level in California to over 2600 m in Arizona and southwestern Colorado. Although other willow flycatcher subspecies often breed in shrubby habitats away from surface water (Bent 1942, McCabe 1991), *E.t. extimus* breeds only in dense riparian vegetation near surface water or saturated soil. Other habitat characteristics such as dominant plant species, size and shape of habitat patch, canopy structure, vegetation height, etc., vary widely among sites. Our objective in this chapter is to present an overview of southwestern willow flycatcher breeding habitat, with an emphasis on gross vegetation characteristics. Although quantitative studies of habitat have begun in some areas (e.g., Spencer et al. 1996, Whitfield and Enos 1996, McKernan and Braden 1999, Paradzick et al. 1999), we focus here on qualitative information on plant species composition and structure. Although many of the details of vegetation characteristics differ among breeding sites, we will draw attention to those common elements or themes that are shared by most sites. All of the breeding sites described herein are within the geographic range currently administered as the southwestern subspecies (*E.t. extimus*) by the U.S. Fish and Wildlife Service. Several on-going studies could ultimately change the accepted boundary designations for *E.t. extimus*. Thus, some of the breeding sites described may eventually be removed from *E.t. extimus* range, while new sites could be added. Any such changes may provide new perspectives on southwestern willow flycatcher habitat.

What is "Habitat"?

Birds and bird communities have played a major role in the development of the concept of habitat, yet specific definitions of the term habitat are often vague and/or differ from one another (Block and Brennan 1993). However, a common theme among different definitions and terms is that "habitat" includes the physical and biological environmental attributes that influence the presence or absence of a bird species (Morrison et al. 1992). Thus, habitat involves many components in addition to vegetation composition and structure. Environmental features (climate, food, patch

size or area), predation, competition, parasitism, disease, disturbance, past history and even chance influence the current distribution and abundance of species (Wiens 1989a, 1989b). Research is usually focused on those habitat components that are most easily or reliably quantified and/or considered most likely to influence the bird community, and no single study can address all of the factors that may influence bird species use in a system.

Many factors underlie habitat selection and these factors do not act equally for all species or even for all populations of a single species (Wiens 1989a, 1989b). A species' morphological and physiological traits allow it to exploit subsets of resources and, hence, certain habitats (Morrison et al. 1992). Life-history traits such as foraging behavior and mating strategies are also mechanisms that underlie habitat selection in a species (Hansen and Urban 1992). Proximate factors such as song perches, nest sites, and the structure and composition of the vegetation determine whether a bird settles in a habitat. These are part of a habitat selection "template" (Wiens 1989a) that results from both an individual's genetic makeup and information learned through experience with different areas and habitats. Ultimately, the suitability of a particular habitat is a function of reproductive success and survivorship. Thus, mere occupancy of a habitat does not imply the habitat is optimal, only that it meets the selection template for those individuals breeding there. There has yet to be developed a comprehensive habitat model for the southwestern willow flycatcher that enables one to determine which breeding habitats, or parts of a single breeding patch, are better than others based on vegetation characteristics alone.

General Vegetation Composition and Structure

Southwestern willow flycatcher breeding habitat can be broadly described based on plant species composition and habitat structure. These two habitat characteristics are the most conspicuous to human perception, but are not the only important components. However, they have proven useful in describing known breeding sites, evaluating suitable survey habitat, and in predicting where breeding flycatchers may be found.

We have organized habitat descriptions into three broad types - native vegetation dominated, exotic vegetation dominated, and mixed native/exotic. These broad habitat descriptors reflect the fact that southwestern willow flycatchers now inhabit both native and non-native dominated riparian habitats. Saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) are used as nesting substrates and in some cases, flycatchers breed where these species dominate the canopy or occur in nearly monotypic stands. Data on the most conspicuous plant species at 106 flycatcher breeding sites (Table 5-1) demonstrate the widespread use of both native and exotic trees and shrubs.

Narrative descriptions of the general vegetation types used throughout the southwestern willow flycatcher's range are provided below, with a focus on the dominant tree and shrub components. The habitat types described include a continuum of plant species composition (from nearly monotypic to diverse assemblages) and vegetation structure (from simple, single stratum patches to complex, multiple strata patches). Because pictures are often more effective than verbal descriptions at conveying the general nature of a riparian patch, we include one or more photographs of each type of occupied breeding habitat. The intent of the descriptions and photographs is to provide a basic understanding of the types of habitat occupied by the flycatcher, not to create a standardized definition or classification. All known breeding sites are not described or illustrated, so every potential variant is not shown. However, the sites presented capture most of the known range of patch floristics, structure, and size.

Native Vegetation Dominated

Many of the areas used by breeding southwestern willow flycatchers are dominated by native trees and shrubs, especially, as one might expect based on the bird's common name, willows (*Salix* spp.). The floristic and gross structural variation of occupied native-dominated habitats is quite broad. Occupied sites vary from monotypic, single strata patches to multi-species, multi-layered strata with complex canopy and subcanopy structure. Overall, low to mid-elevation sites and high elevation sites differ substantially, and are treated separately below.

Low to Mid-Elevation Native Sites:

General characteristics: These sites range from single plant species to mixtures of native broadleaf trees and shrubs including (but not limited to) Goodding's (*Salix gooddingii*) or other willow species, cottonwood (*Populus* spp.), boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus occidentalis*). Average canopy height can be as low as 4 m or as high as 30 m. Gross patch structure is generally characterized by trees of different size classes, often forming a distinct overstory of cottonwood, willow or other broadleaf tree with recognizable subcanopy layers and a dense understory of mixed species. Although some descriptions of flycatcher breeding habitat emphasize these multi-species, canopied associations, flycatchers also breed at sites with tall (>5 m or greater) monotypic willow.

Table 5-1. Frequency of occurrence of different types of southwestern willow flycatcher breeding sites based on whether the tree and shrub components are dominated by native or exotic species, or a mixture of both. Data are for 106 known breeding sites (as of 1998) from Ahlers and White (1999), Sferra et al. (1997), McKernan and Braden (1998), Cooper (1997), and USFWS unpublished data.

State	Native Dominated	Exotic Dominated	Mixed Native/Exotic	Total
Arizona	12	3	30	45
California	11	0	8	19
Colorado	8	0	2	10
New Mexico	14	0	10	24
Nevada	0	0	1	1
Utah	4	2	1	7
Total	49	5	52	106

Exotic or introduced trees and shrubs may be a rare component at these sites, particularly in the understory. In an unusual site along the upper San Luis Rey River in San Diego County, CA, willow flycatchers breed in a streamside area dominated by live oak (*Quercus agrifolia*), where willows once predominated but were eliminated by a phreatophyte control program several decades ago (W. Haas, pers. comm.).

Examples

South Fork Kern River at Lake Isabella, Kern County, CA. Elevation 780 m. (see Whitfield and Enos 1996). This is one of the largest tracts of monotypic native-dominated flycatcher habitat in the Southwest (Figure 5-1). The site includes roughly 500 ha of riparian woodland dominated by a dense overstory of red willow (*Salix laevigata*) and Goodding's willow, interspersed with open areas often dominated by nettle (*Urtica dioica*), mule fat (*Baccharis salicifolia*), cattails (*Typha* spp.), and tules (*Scirpus* spp.). Canopy height is typically 8 to 12 m. This site has numerous river channels, sloughs, and marshes that provide surface water and saturated soils throughout most of the breeding season (Figure 5-2).

Santa Ynez River, Santa Barbara County, CA. (see Holmgren and Collins 1995). Willow flycatchers breed

Figure 5-1. Breeding site at the South Fork, Kern River, CA. Note the canopy height and breadth of floodplain at this cottonwood-willow dominated site. Photo by Mark Sogge.

Figure 5-2. Breeding site at the South Fork, Kern River, CA. Note the dense tangle of willow understory and small openings directly above surface water. Photo by Mark Sogge.

at several areas along the perennial Santa Ynez River between Buellton (elevation approximately 150 m) and the ocean. These species-rich riparian sites (Figure 5-3) are comprised of red willow, black cottonwood (*Populus trichocarpa*), and box elder, with dense, shrubby thickets of willows (*Salix lasiolepis* and *S. exigua*), mulefat, poison oak (*Toxicodendron diversilobum*), and blackberry (*Rubus* spp.). Beaver dams pond water in may areas along the river, creating slow-water and emergent marsh conditions.

San Pedro River, Pinal County, AZ. Elevation 600 m. (see Spencer et al. 1996). Several flycatcher breeding sites along this narrow riparian system are dominated primarily by cottonwood and willow, with some ash

Figure 5-3. Breeding site on the Santa Ynez River, CA. Note the structural complexity and density of the multiple native broadleaf species, and the proximity to surface water. Photo by Mark Sogge.

and boxelder overstory. Understory is comprised of younger trees of these same species, with saltcedar as a major to minor component in some areas. Overstory canopy height averages 15 to 20 m. Open water, marshes and seeps (including cattail and bulrush; Figure 5-4), and saturated soil are present in the immediate vicinity.

Gila River, Grant County, NM. Elevation 1,480 m. (see Skaggs 1996, Stoleson and Finch 1998). The largest known population of breeding southwestern willow flycatchers is found in a series of riparian patches distributed over a 13 km stretch of the Gila River. Flycatchers breed in two distinct structural types; riparian scrub and riparian forest. Riparian scrub (Figure 5-5) is dominated by 4 to 10 m tall shrubby willows and seepwillow (*Baccharis glutinosa*) that grow along the river bank or in old flood channels. These shrub strips are sometimes less than 10 m wide

Figure 5-4. Breeding site on the San Pedro River, AZ. Note the emergent plants bordering the dense willow and buttonbush-dominated patch. Surface water is present throughout this site. Photo by Mark Sogge.

Figure 5-5. Breeding site on the Gila River, NM. Note the stringers of riparian "scrub," some of which are less than 10 m wide, but in total form a wider mosaic. The exposed banks are the result of past livestock grazing. Photo by Rob Marshall.

and rarely more than 20 m. Riparian forest patches (Figure 5-6) were 100 to 200 m wide, and dominated by trees such as Fremont cottonwood (*Populus fremontii*), Goodding's willow, Arizona sycamore (*Plantanus wrightii*) and boxelder. Understory includes young trees of the same species. Canopy height generally ranges between 20 and 30 m. Much of this forest vegetation is sustained by water from the river and small, unlined water diversions that function much like a dendritic stream system.

High-Elevation Native Sites

General characteristics: As a group, these sites are more similar than low elevation native sites. All known high elevation (1,900 m and above) breeding sites are comprised completely of native trees and shrubs. Most sites are dominated by a single species of willow, such as Coyote willow (*Salix exigua*) or Geyer's willow (*S. geyeriana*). Average canopy height is generally only 3 to 7 m. Gross patch structure is characterized by a single vegetative layer with no distinct overstory or understory. There is usually very dense branch and twig structure in the lower 2 m, with high live foliage density from the ground to the canopy. Tree and shrub vegetation is often associated with sedges, rushes, nettles and other herbaceous wetland plants. These willow patches are usually found in mountain meadows and are often associated with stretches of stream or river that include many beaver dams and pooled water.

Examples

Little Colorado River near Greer, Apache County, AZ. Elevation 2500 m. (see Spencer et al. 1996, Langridge and Sogge 1997). This 14 ha site is a mosaic of dense, shrubby Geyer's willow (Figure 5-7), dense herbaceous ground cover, and open water. The river and associated beaver ponds create marshes, wet meadows and saturated soil conditions. Average willow canopy height is 4 to 6 m. The willow matrix is a combination of clumps and thin (3 to 5 m wide) strips. The shrubby vegetation is structurally composed of a single layer of live vegetation, with dense branch and twig structure and high live foliage density from ground level to canopy. Habitat surrounding the broad valley is primarily ponderosa pine (*Pinus ponderosa*) and scattered houses and cabins.

Beaver Creek, Dolores County, CO. Elevation 2,440 m. (see Owen and Sogge 1997). This is a large site, at least 3,200 m long and 400 to 500 m wide, located in a broad, wide mountain valley. The shrubby vegetation (Figure 5-8) is dense, almost monotypic willow with small amounts of hawthorne (*Crataegus rivularis*). Numerous stream channels and associated beaver ponds create wet or flooded substrates, as well as openings within the dense vegetation.

Exotic Vegetation Dominated

General characteristics: Exotic plant species such as saltcedar and Russian olive were not introduced or

Figure 5-6. Breeding site on the Gila River, NM. Note the openings within the dense cottonwood and boxelder and the channel with agricultural tailwater in the bottom foreground. Photo by Rob Marshall.

Figure 5-7. Breeding site on the Little Colorado River in the White Mountains, AZ. Note the dense shrubby appearance of these high elevation willows not yet fully in leaf. Beaver dams retain surface water throughout the patch during the breeding season. Photo by Mark Sogge.

Figure 5-8. Breeding site on Beaver Creek, CO. Another site where beaver dams pond surface water. Note density and height of willows and patch opening in foreground. Photo by Jen Owen (USGS).

widespread in southwestern riparian systems until approximately 100 years ago. Thus, southwestern willow flycatchers evolved in and until fairly recently (from an evolutionary perspective) bred exclusively within thickets of native riparian vegetation such as willows, cottonwoods and seepwillow. However, southwestern willow flycatchers have responded to the widespread loss and modification of native riparian habitats by nesting within some exotic-dominated habitats. From the standpoint of flycatcher productivity and survivorship, the suitability of exotic-dominated sites is not known. Flycatcher productivity in some exotic-dominated sites is lower than in some native-dominated habitats (Sferra et al. 1997, Sogge et al. 1997), but other factors such as small patch size may be more important correlates of productivity at those sites. The reverse is also true, with some saltcedar-dominated sites having similar or higher flycatcher productivity than nearby native sites (McKernan and Braden 1999, Paradzick et al. 1999). Thus, there is currently no clear evidence that the exotic-dominated habitats in which southwestern willow flycatchers now breed are generally suboptimal.

Southwestern willow flycatchers do not nest in all exotic species that have invaded and sometimes dominate riparian systems. For example, flycatchers do not use arundo (*Arundo donax*) or tree of heaven

(*Ailanthus altissima*). Even in the widespread saltcedar, flycatchers tend to use only two conspicuous life forms: (a) low to mid-stature saltcedar (3-6 m tall) found as a component in the understory of a native cottonwood-willow gallery forest, or (b) tall (6-10 m) mature stands of saltcedar that have a high percentage of canopy closure. Thus, willow flycatchers are largely absent as a breeding species throughout most of the saltcedar habitats of the Southwest, where saltcedar stands are often too short, sparse, or dry.

Most exotic habitats range below 1,200 m elevation. As a group, they show almost as much variability as do low elevation native-dominated sites. Most exotic sites are nearly monotypic, dense stands of exotics such as saltcedar or Russian olive that form a nearly continuous, closed canopy (with no distinct overstory layer). Canopy height generally averages 5 to 10 m, with canopy density uniformly high. The lower 2 m of vegetation is often very difficult to penetrate due to dense branches. However, live foliage density may be relatively low from 0 to 2 m above ground, but increases higher in the canopy.

Examples

Roosevelt Lake, Gila County, AZ. Elevation 640 m. (see Spencer et al. 1996, Sferra et al. 1997). Two of the largest known southwestern willow flycatcher populations in Arizona breed in large, contiguous stands of dense, mature saltcedar at the Tonto Creek and Salt River inflows to Roosevelt Lake (Figures 5-9 and 5-10). The Salt River site is monotypic saltcedar, while the Tonto Creek site includes a few scattered, large cottonwood trees that emerge above the saltcedar canopy, which averages 8 to 12 m in height. Within the patches, there are numerous small openings in the canopy and understory. As is usually the case in such mature saltcedar stands, there is little live foliage below a height of 3 to 4 m within the interior of the patch (although live foliage may be continuous and thick at the outer edges of the patch), and virtually no herbaceous ground cover. However, numerous dead branches and twigs provide for dense structure in the lower 2 to 3 m strata (Figure 5-11). In normal or wet precipitation years, surface water is adjacent to or within the saltcedar patches.

Figure 5-9. Breeding site on Salt River inflow to Roosevelt Lake, AZ. Note dense, tall, monotypic stand of saltcedar with openings in the patch interior. No surface water was present when photo was taken. Photo by Mark Sogge.

Figure 5-10. Breeding site on the Salt River inflow to Roosevelt Lake, AZ. Note the breadth of this floodplain habitat and the numerous openings interspersed within the dense mature saltcedar stand. Surface water was present when this photo was taken in June 1996 by the U.S. Bureau of Reclamation.

Figure 5-11. Breeding site at Topock March, Colorado River, AZ. This illustrates the dense vegetative structure (often dead branches) in the lower 3 to 4 m, and the numerous small branches providing potential nest sites, common to occupied saltcedar stands. Photo by Mark Sogge.

Colorado River in Grand Canyon, Coconino County, AZ. Elevation 850 m. (see Sogge et al. 1997). The willow flycatcher breeding sites along the Colorado River in the Grand Canyon (Figure 5-12) are very small (0.6 to 0.9 ha), dense patches of mature saltcedar, bordered on the upslope side by acacia (*Acacia greggii*) and along the river's edge by a thin band of willow. Saltcedar canopy height averages 8 to 12 m. Live foliage is dense and continuous along the edge of the patch, but does not begin until 3 to 4 m above ground within the patch interior. A dense layer of dead branches and twigs provides for a thick understory below the live vegetation. These sites have almost no herbaceous understory due to a dense layer of fallen saltcedar branches and needles. All patches are no further than 5 m from the river's edge.

Rio Grande at San Juan Pueblo, Rio Arriba County, NM. Elevation 1,800 m. (see Maynard 1995, Cooper 1997). Southwestern willow flycatchers breed in dense riparian vegetation (Figure 5-13) dominated

Figure 5-12. Colorado River in Grand Canyon, AZ. Tall, dense saltcedar borders a backwater channel on the Colorado River. Note the dense live vegetation from ground to upper canopy along the outer edge of the patch. Photo by Mark Sogge.

Figure 5-13. Breeding site on Rio Grande, NM. This dense Russian olive-dominated patch is bordered by emergent marsh and slough channel adjacent to the Rio Grande. Photo by Mark Sogge.

by Russian olive. Several large cottonwoods rise above the Russian olive canopy. The patch is bordered by emergent marsh on one side and the Rio Grande on the other. Canopy height of the Russian olive averages 8 to 12 m in height.

Mixed Native and Exotic Habitats

General characteristics: Many southwestern willow flycatcher breeding sites are comprised of dense mixtures of native broadleaf trees and shrubs mixed with exotic/introduced species such as saltcedar or Russian olive. The exotics are often primarily in the understory, but may be a component of overstory. At several sites, saltcedar provides a dense understory below an upper canopy of gallery cottonwoods, forming a habitat that is structurally similar to the cottonwood-willow habitats in which flycatchers historically nested. A particular site may be dominated primarily by natives or exotics, or be a more-or-less equal mixture. The native and exotic components may be dispersed throughout the habitat or concentrated in distinct, separate clumps within a larger matrix. Sites almost always include or are bordered by open water, cienegas, seeps, marshes, and/or agricultural runoff channels. However, during drought years surface water at some sites may be gone early in the breeding season. Generally, these habitats are found below 1,200 m elevation.

Examples

San Pedro River, Pinal County, AZ. Elevation 600 m. (see Spencer et al. 1996). Parts of the extensive riparian tracts of the lower San Pedro River are dominated by cottonwood and willow, but include substantial amounts of dense saltcedar. In some cases, the saltcedar occurs as a dense understory amidst a cottonwood, willow, ash or boxelder overstory (Figure 5-14), while in others it borders the edge of the native vegetation (Figure 5-15). Overall canopy height ranges from 10 to 18 m.

Verde River at Camp Verde, Yavapai County, AZ. Elevation 940 m. (see Spencer et al. 1996). Southwestern willow flycatchers breed here in a mixture of willow, cottonwood, and saltcedar habitat (Figure 5-16). Most of the territories are found in a cluster of dense decadent saltcedar (6 to 8 m tall) bordered by narrow bands of young willow, which in turn are surrounded on one side by a large (>50 ha) stand of mature cottonwoods and willows (15-20 m tall) with little understory. Although the patch itself is located on a sandy terrace approximately 4 m above typical summer river level, the Verde River flows along the eastern edge of the patch and a small intermittently flowing irrigation ditch provides water to a small pond adjacent to the saltcedar and willows. Patches of herbaceous ground cover are scattered throughout the site, but are absent under the saltcedar canopy.

Figure 5-14. Breeding site on the San Pedro River, AZ. Note the dense 5 to 6 m tall saltcedar interspersed with the taller cottonwood overstory. Photo by Renee Netter (USGS).

Figure 5-15. Breeding site on San Pedro River, AZ. Note the height, density and openings at this mixed native-exotic site. Surface water is present outside the frame. Photo by Eben Paxton (USGS).

Figure 5-16. Breeding site on the Verde River at Camp Verde, AZ. Note the tall cottonwoods and willows mixed with saltcedar. Photo by Mark Sogge.

Virgin River, Washington County, UT. Elevation 1,100 m. (USFWS unpublished data). Along one portion of Virgin River riparian corridor near St. George, flycatchers breed in a mixture of dense willow, Russian olive and saltcedar near an emergent marsh (Figure 5-17). The native trees form a tall (10-12 m) overstory, which is bordered by a shorter (10-12 m) band of saltcedar, and a strip of 4 to 8 m tall willow. The stretch of occupied habitat is approximately 60 m wide and 100 m long, and is located in an old meander channel through which the river no longer flows. In normal and wet years return channels and river flows seasonally inundate the base of the vegetation.

Patch Size and Shape

The riparian patches used by breeding flycatchers vary greatly in size and shape. They may be a relatively dense, linear, contiguous stand or an irregularly-shaped mosaic of dense vegetation with open areas. Southwestern willow flycatchers have nested in patches as small as 0.6 ha in the Grand Canyon (Sogge et al. 1997), and as large as 100 ha or more at Roosevelt Lake (Spencer et al. 1996) and Lake Mead (McKernan 1997). Most sites fall between these two extremes, and overwhelmingly toward the smaller end (probably because large blocks of suitable riparian habitat are uncommon). Flycatchers have not been found nesting in narrow, linear riparian habitats where the entire patch is less than approximately 10 m wide, although they will use such linear habitats during migration.

Figure 5-17. Breeding site on Virgin River, UT. This dense mixture of native and exotics is bordered by slough channels which create openings within the patch. The person in foreground is on a terrace 2 to 3 m higher than the terrain in which the riparian vegetation is rooted. Photo by Mark Sogge.

Except in the extreme smallest cases (such as the saltcedar patches in the Grand Canyon), all flycatcher breeding patches are larger than the sum total of the flycatcher territory sizes at that site. This is because flycatchers, typically, do not pack their territories into all available space within a habitat. Instead, some territories are bordered by additional riparian vegetation that is not defended as a nesting territory, but may be important in attracting flycatchers to the site and/or in providing an environmental buffer (from wind or heat) and in providing post-nesting use areas. Based on numerous habitat use studies (Whitfield and Enos 1996, Paxton et al. 1997, Sferra et al. 1997, Sogge et al. 1997) it is clear that flycatchers often cluster their territories into small portions of riparian sites, and that major portions of the site may be occupied irregularly or not at all. It is currently unknown how size and shape of riparian patches relate to factors such as flycatcher site selection and fidelity, reproductive success, predation, and brood parasitism.

Presence of Water

Flycatcher breeding habitats usually include or are near open water, cienegas, marshy seeps, or saturated soil. In many cases, nest plants are rooted in or overhang standing water (Sferra et al. 1997, Whitfield and Enos 1996). As a general rule, flycatcher territories are seldom farther than a few dozen meters from water or saturated soil. However, it is critical to keep in mind that in the Southwest, hydrological conditions at a site can vary remarkably within a season and between years. At some locations, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e., May and part of June). At other sites, vegetation may be immersed in standing water during a wet year, but be hundreds of meters from surface water in dry years. This is particularly true of reservoir sites such as the Kern River at Lake Isabella, Tonto Creek and Salt River at Roosevelt Lake, and the Rio Grande near Elephant Butte Reservoir. Human-related factors such as river channel modifications (e.g. by creation of pilot channels) or altered subsurface flows (e.g. from agricultural runoff) can temporarily or permanently dry a site. Similarly, where a river channel has changed naturally (Sferra et al. 1997), there may be a total absence of water or visibly saturated soil for several years. In such cases, the riparian vegetation and any flycatchers nesting within it may persist for several years. However, we do not know how long such sites will continue to support riparian vegetation and/or remain occupied by breeding flycatchers.

Other Habitat Components

Other potentially important aspects of southwestern willow flycatcher habitat include distribution and isolation of vegetation patches, hydrology, prey types and abundance, parasites, predators, and interspecific competition. Population dynamics factors such as demography (i.e. birth and death rates, age-specific fecundity), distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, site fidelity, philopatry, and conspecific sociality also influence where flycatchers are found and what habitats they use. Environmental factors (e.g. temperature, humidity), may play an important role in habitat selection, breeding success and persistence, particularly in lowland desert riparian areas. Most of these factors are poorly understood, but may be critical to understanding current population dynamics and habitat use.

Common Factors and Mechanism for Selection

Clearly, willow flycatchers breed in widely different types of riparian habitat across a large elevational range and geographical area in the Southwest. Breeding patch size, configuration, and plant species composition can vary dramatically across the subspecies' range. However, certain patterns do emerge and are seen at most sites. Regardless of the plant species composition or height, occupied sites always have dense vegetation in the patch interior. In most cases this dense vegetation occurs within the first 3 - 4 m above ground. These dense patches are often interspersed with small openings, open water, or shorter/sparser vegetation, creating a mosaic that is not uniformly dense. In almost all cases, slow-moving or still surface water and/or saturated soil will be present at or near breeding sites during wet or normal precipitation years.

These themes common to flycatcher breeding sites – dense vegetation and proximity to water – probably relate directly to the underlying mechanisms driving habitat selection and site suitability. For example, breeding riparian birds in the desert Southwest are potentially exposed to extreme environmental conditions (Hunter 1988, Rosenberg et al. 1991). Dense riparian vegetation with surface water or saturated soil may be needed to provide suitable micro-climatic conditions, therefore limiting the distribution of flycatchers to a subset of available riparian habitats. Given that willow flycatchers are one of the latest nesting birds in Southwestern desert riparian systems (Hunter 1988), their nests may require substantial buffering against extreme environmental conditions. Dense vegetation and surface water may also function to reduce nest predation and cowbird nest parasitism, both of which may be important factors in site suitability.

Currently, we can not distinguish the relative importance of each of the many factors that influence southwestern willow flycatcher habitat use. The relative importance of particular factors may vary geographically, and at the local scale males and females may be selecting for different factors or habitat characteristics (Sedgwick and Knopf 1992). All of this complicates our ability to develop quantitative predictions of flycatcher habitat use. Ongoing and future research (e.g., Paradzick et al. 1999, McKernan and Braden 1999, Ahlers and White 1999, others) on local and landscape patch configuration, vegetation characteristics, productivity, and environmental factors will better determine the mechanisms responsible for habitat use patterns and spur development of accurate and comprehensive habitat suitability models for the southwestern willow flycatcher.

Habitat Suitability

The ultimate measure of habitat suitability is not simply whether or not a site is occupied. Suitable habitats are those in which flycatcher reproductive success and survivorship results in a stable or growing population. Without long term data showing which sites have stable or growing populations, we cannot determine which habitats are suitable or optimal for breeding southwestern willow flycatchers. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam 1988).

What is not Southwestern Willow Flycatcher Breeding Habitat

Cottonwood-willow gallery forests that are devoid of an understory and that appear park-like do not provide nesting habitat for southwestern willow flycatchers. Similarly, isolated, linear riparian patches less than approximately 10 m wide generally do not provide nesting habitat. However, mosaics made up of aggregations of these small, linear riparian "stringers" may be used by breeding flycatchers, particularly at high elevations. High-elevation willow patches devoid of live vegetation structure in the lower strata (0-2 m from ground) are not used for nesting. Short stature (< 4 m) saltcedar stands, as well as sparse stands of saltcedar characterized by a scattering of trees of any height, also do not provide nesting habitat for flycatchers. See Figures 5-18 – 5-21 for examples of some of the common riparian habitat

types that are not suitable for nesting southwestern willow flycatchers.

Migrant willow flycatchers may occur in non-riparian habitats and/or be found in some riparian habitats unsuitable for breeding. Such migration stopover areas, even though not used for breeding, may be critically important resources affecting local and regional flycatcher productivity and survival. Furthermore, such sites may be appropriate candidates for restoration efforts designed to create additional willow flycatcher breeding habitat.

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Figure 5-18. Native riparian vegetation that is not suitable flycatcher breeding habitat. This park-like gallery forest along a river in Colorado is tall and wide, but devoid of understory does not provide breeding habitat for the flycatcher. Photo by Mark Sogge.

Figure 5-20. High-elevation native riparian vegetation that is not suitable flycatcher breeding habitat. The cropping of these willow is a result of livestock grazing. The low stature, low density, and lack of breadth keeps this area from attaining the attributes necessary for flycatcher breeding. Photo by Mark Sogge.

Figure 5-19. Native riparian vegetation that is not suitable flycatcher breeding habitat, along Crystal Creek in the Grand Canyon, AZ. Such extremely narrow, linear riparian habitats do not provide breeding habitat for the flycatcher. Photo by Tim Tibbitts (NPS).

Figure 5-21. Saltcedar-dominated riparian vegetation that is not suitable flycatcher breeding habitat. This sparse, low-stature saltcedar stand at Roosevelt Lake, AZ does not provide the tall, dense overall vegetative structure needed by breeding flycatchers. Photo by Mark Sogge.

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Status, Ecology, and Conservation of the Southwestern Willow Flycatcher

Abstract

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This publication was prepared in response to a need expressed by southwestern agencies and organizations for a comprehensive assessment of the population status, history, biology, ecology, habitats, threats, and conservation of the southwestern willow flycatcher (*Empidonax traillii extimus*). The southwestern willow flycatcher was federally listed as an Endangered subspecies in 1995. A team of flycatcher experts from multiple agencies and organizations identified components of the publication, wrote chapters, and cooperatively assembled management recommendations and research needs. We hope this publication will be useful in conserving populations and habitats of the southwestern willow flycatcher.

Key words: southwestern willow flycatcher, endangered species, riparian, Southwest, exotic woody plants, rivers, recovery, habitat restoration, Neotropical migratory bird, brown-headed cowbird

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Top left photo: *Adult southwestern willow flycatcher, White Mountains, Arizona. Photo by Suzanne Langridge*

Top right photo: *Southwestern willow flycatcher adult, nest, and nestlings, Kern River Preserve. Photo by Sean Rowe*

Bottom photo: *Southwestern willow flycatcher adult, nest, and nestlings, along irrigation ditch, Gila National Forest. Photo by Jean-Luc Cartron*