

Identifying Key Habitat Features for Managing Breeding Southwestern Willow Flycatchers

2016 Annual summary report

USDA Natural Resources Conservation Service

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Summary

We summarize the first of two seasons of field surveys for southwestern willow flycatchers (*Empidonax traillii extimus*) and other riparian birds in Arizona and New Mexico. Our goal is to use the information gathered during these surveys to identify habitat resources that are essential for breeding habitat of willow flycatchers, yellow-billed cuckoos (*Coccyzus americanus*), and other riparian birds. This information will provide the basis for establishing management targets to help maintain habitat and contribute to the recovery of these species on working landscapes. In 2016, we surveyed birds, vegetation, and other environmental features likely important to habitat for birds on 404 points established along 41 transects at 29 different sites. We detected 185 bird species during surveys, including willow flycatchers on 12 of 41 (29%) transects at 9 of 29 (31%) sites, and yellow-billed cuckoos on 13 of 41 (32%) transects at 11 of 29 (38%) sites. In 2017, we plan to survey riparian birds and vegetation on 60-70 transects at 30-35 sites in Arizona and New Mexico that we did not survey in 2016.

Introduction

The willow flycatcher is an insectivorous songbird that breeds in riparian and wetland communities across North America. There are four subspecies (Unitt 1987, Sedgwick 2000, Sogge et al. 2010), and the endangered southwestern subspecies, *E. t. extimus*, occurs in Arizona, New Mexico, Utah, Nevada, Colorado, and California (USFWS 2013). The U.S. Fish and Wildlife Service listed *E. t. extimus* as Endangered in 1995.

Many of the conservation and management efforts directed at southwestern willow flycatchers are on public lands administered by local, state, and federal governmental agencies. This is due in part to withdrawal of lands owned by private individuals and agricultural producers who perceived risks associated with supporting listed species on their lands. Recently, however, the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) established the Working Lands For Wildlife (WLFW) conservation initiative under the Environmental Quality Incentives Program housed under the Agricultural Act of 2014 that specifically focuses on private land owners and conservation of listed species. The three goals of the WLFW program are to restore populations of declining wildlife species, provide regulatory certainty, and strengthen and sustain rural economies.

WLFW provides incentives and regulatory assurances and predictability to agriculture producers and private landowners who enact conservation practices that benefit targeted listed or candidate species (NRCS 2016). Participants receive technical and financial assistance to voluntarily restore and improve habitat for these species on their lands. Under the guidance of a region-wide biological opinion, WLFW-enrolled participants are covered for incidental take that may result from prescribed conservation activities on their lands for up to 30 years. This provides agricultural producers the assurance that they can maintain their livelihoods, provides economic stability to local communities, and helps conserve both listed species and other target species managed under the umbrella of the listed species.

In the southwestern U.S., NRCS with input from state wildlife agencies and other stakeholders chose the southwestern willow flycatcher as a target species to protect under the WLFW program. Although we understand the primary habitat features required by southwestern willow flycatchers, we know less about the biotic and abiotic processes that maintain habitat for the subspecies. Specifically, the mechanisms that create, maintain, or alter habitat required to support sustainable populations of southwestern willow flycatchers are not well understood.

In conjunction with a current study of riparian vegetation and livestock grazing in Arizona, we surveyed flycatchers and other riparian birds throughout the region with the goal of identify habitat resources that are essential for working landscapes to provide breeding habitat. This research will improve our understanding of the biotic and abiotic features that are essential to habitat of southwestern willow flycatchers. Specifically, we seek to identify key vegetation features that should be protected in grazed riparian areas so that these areas can develop the habitat characteristics required by flycatchers and contribute to the recovery of this subspecies.

Methods

Site selection

We used a stratified random-sampling scheme with major vegetation classes as strata to identify 563 potential survey sites across the area encompassed by NRCS Southwestern Willow Flycatcher Focal Habitat Areas, U. S. Fish and Wildlife Service Final Designated Critical Habitat for willow flycatchers, and riparian vegetation communities. Both the NRCS and UFWFS GIS layers were based on hydrology, FEMA's 100-year floodplain, biological requirements of the flycatcher, riparian vegetation, and political boundaries.

From these 563 potential sites, we selected 201 at random that we assessed with satellite imagery and GIS. We identified a final subset of 91 sites that fit all selection criteria, had suitable vegetation and extent, and were accessible legally and logistically. We excluded potential sites that were on private lands unless we had knowledge that landowners may be amenable to allow access to their property (e.g., The Nature Conservancy, NRCS program-enrolled landowners).

In 2016, we surveyed 23 of these randomly selected sites, an additional 3 chosen purposefully to capture potential breeding habitat at high elevation, and an additional 3 added at the request of NRCS program-enrolled private landowners. These 29 sites were located across southern and central Arizona and southwestern New Mexico (Figure 1). Depending on the extent of appropriate vegetation, we established 1-2 transects at each site. Transects were spaced ≥ 500 meters apart and consisted of 8-12 survey points that were spaced ≥ 150 meters apart.

Study Area

Sites ranged in elevation from 68-2823 m. Sites occurred along rivers and streams that ranged from highly controlled, impounded, diverted, or managed waterways such as the Colorado River to free-flowing reaches of smaller streams (e.g., Eagle Creek, Apache County, AZ) and larger rivers (e.g., Gila River, Grant County, NM) that retained natural dynamic hydrological processes.

Vegetation communities varied with elevation, gradient, and edaphic conditions, and included willow-arrowweed-salt cedar, cottonwood-willow, cottonwood-willow-salt cedar, mid-elevation native broadleaf riparian, and high elevation willow riparian and wet meadows. Dominant plant species consisted generally of a mature overstory canopy of native Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and/or salt cedar (*Tamarix* sp.), bordered by shrubs such as seep willow (*Baccharis salicifolia*), mesquite (*Prosopis* sp.), and catclaw acacia (*Acacia greggii*). Many of these shrubs occurred as codominants and/or as understory components depending on succession, flood events, or hydrology. In most cases, floodplains were dominated by seep willow, burrobrush (*Hymenoclea monogyra*), arrowweed, annual and/or perennial grasses, and/or annual forbs. The

adjacent uplands were generally xeric and dominated by desert scrub, though at higher elevations uplands generally consisted of coniferous woodlands or forests.

Bird surveys

We used a two-part point count method to survey birds. When we arrived at a survey point, we waited one minute before beginning the survey to allow birds to resume normal activities. We then began a 9-minute survey, which we divided into a 6-minute passive portion, followed by a 3-minute active portion during which we broadcast vocalizations of southwestern willow flycatchers to elicit responses. The active portion consisted of three cycles of three components: (1) an audio broadcast of 15 seconds of song, (2) 15 seconds of call notes, and (3) 30 seconds of silence during which we listened for responses.

During the 6-minute passive portion of the survey, we used standard distance-sampling protocols to collect data that will allow us to estimate density of 13-16 focal riparian species (number varied with depending on elevation; species listed below). Whenever possible, we measured the distance from observer to the target species with a laser rangefinder and estimated distances otherwise. We did not survey birds when wind speeds exceeded 12 mph (19 km/h) or if precipitation was heavier than an intermittent drizzle. We did not record birds that flew over points without having initiated their flight from within the survey area and took particular care to not count birds more than once at each point. We did not search for or monitor nests of any species, but did record behaviors and nest locations when observed. We also recorded all species detected at sites incidental to the surveys.

We focused surveyed on southwestern willow flycatchers; however, we also recorded observations of other focal bird species obligate to riparian areas. These included the federally-threatened yellow-billed cuckoo, Gila woodpecker (*Melanerpes uropygialis*), brown-crested flycatcher (*Myiarchus tyrannulus*), Bell's vireo (*Vireo bellii*), Lucy's warbler (*Oreothlypis luciae*), common yellowthroat (*Geothlypis trichas*), yellow warbler (*Setophaga petechia*), yellow-breasted chat (*Icteria virens*), Abert's towhee (*Melospiza aberti*), song sparrow (*Melospiza melodia*), summer tanager (*Piranga rubra*), and blue grosbeak (*Passerina caerulea*). At high elevation sites, we included MacGillivray's warbler (*Geothlypis tolmiei*), Lincoln's sparrow (*Melospiza lincolnii*), and green-tailed towhee (*Pipilo chlorurus*). We also recorded observations of brown-headed cowbirds (*Molothrus ater*), because they are a brood parasite of many riparian species including southwestern willow flycatchers, and often implicated as contributing to local declines of some riparian species. We did not broadcast vocalizations for these species.

Vegetation surveys

At each point, we characterized vegetation at three spatial scales, with a focus on features potentially important to southwestern willow flycatchers. At the plot scale, we estimated cover of water, debris, bare ground, trees (6-15 m), shrubs (1-5 m), grass, and other understory species (< 1 m) visually. On a series of 5-m subplots established at random, we estimated ground cover (water, sand, gravel/rock, woody debris, leaf litter, grass, aquatic vegetation, annual plants, perennial plants) and composition (species and cover) of overstory plants at seven height classes (0-1 m, 1-2 m, 2-3 m, 3-4 m, 4-5 m, 5-6 m, 6-15 m). We allocated more sampling effort towards midstory height classes (i.e., 0-6 m) than canopy classes (e.g., > 6m) because vegetation in these height classes are most vulnerable to grazing by livestock and include the range of heights where willow flycatchers build nests.

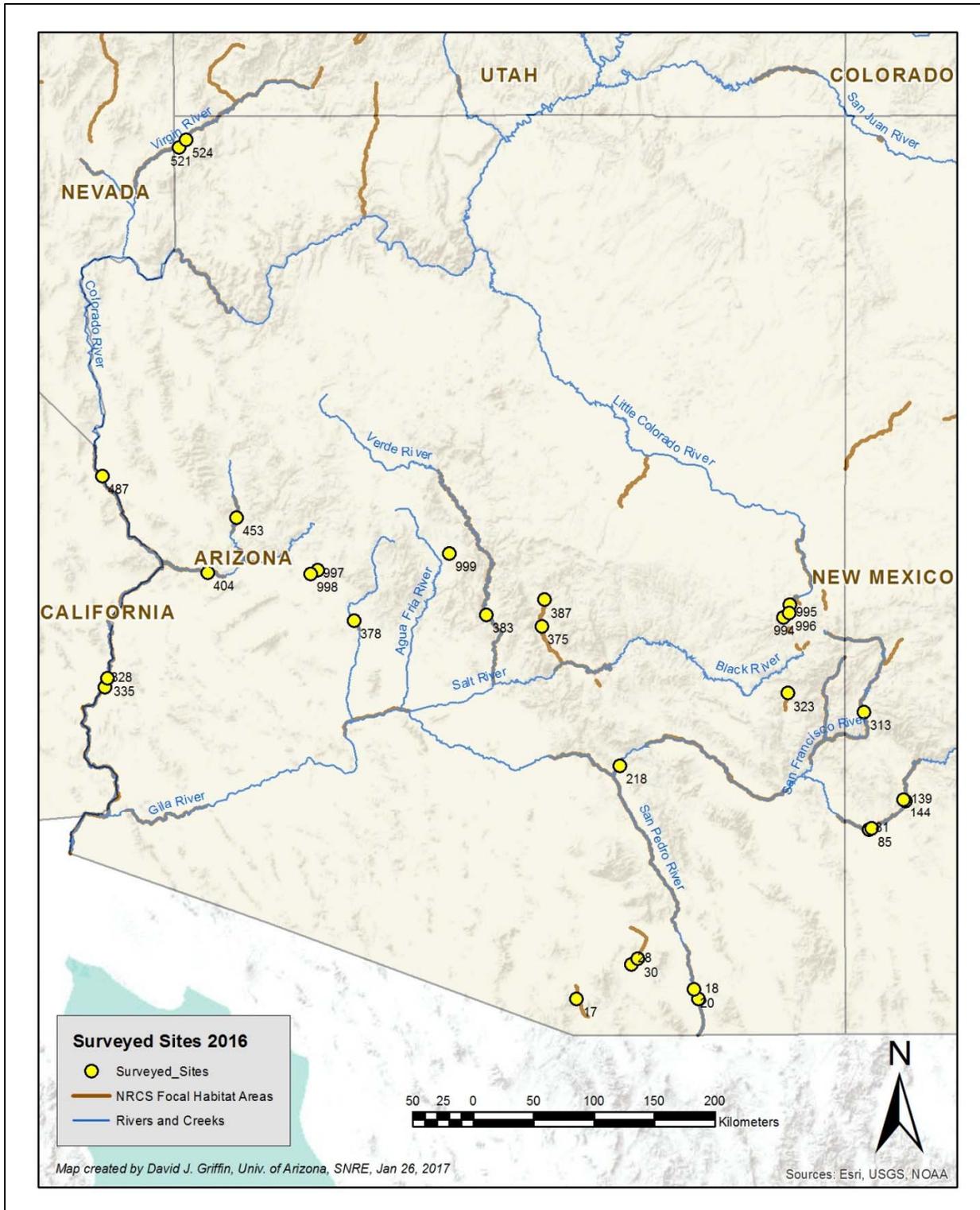


Figure 1. Survey sites for southwestern willow flycatcher and other riparian birds in Arizona and New Mexico, 2016.

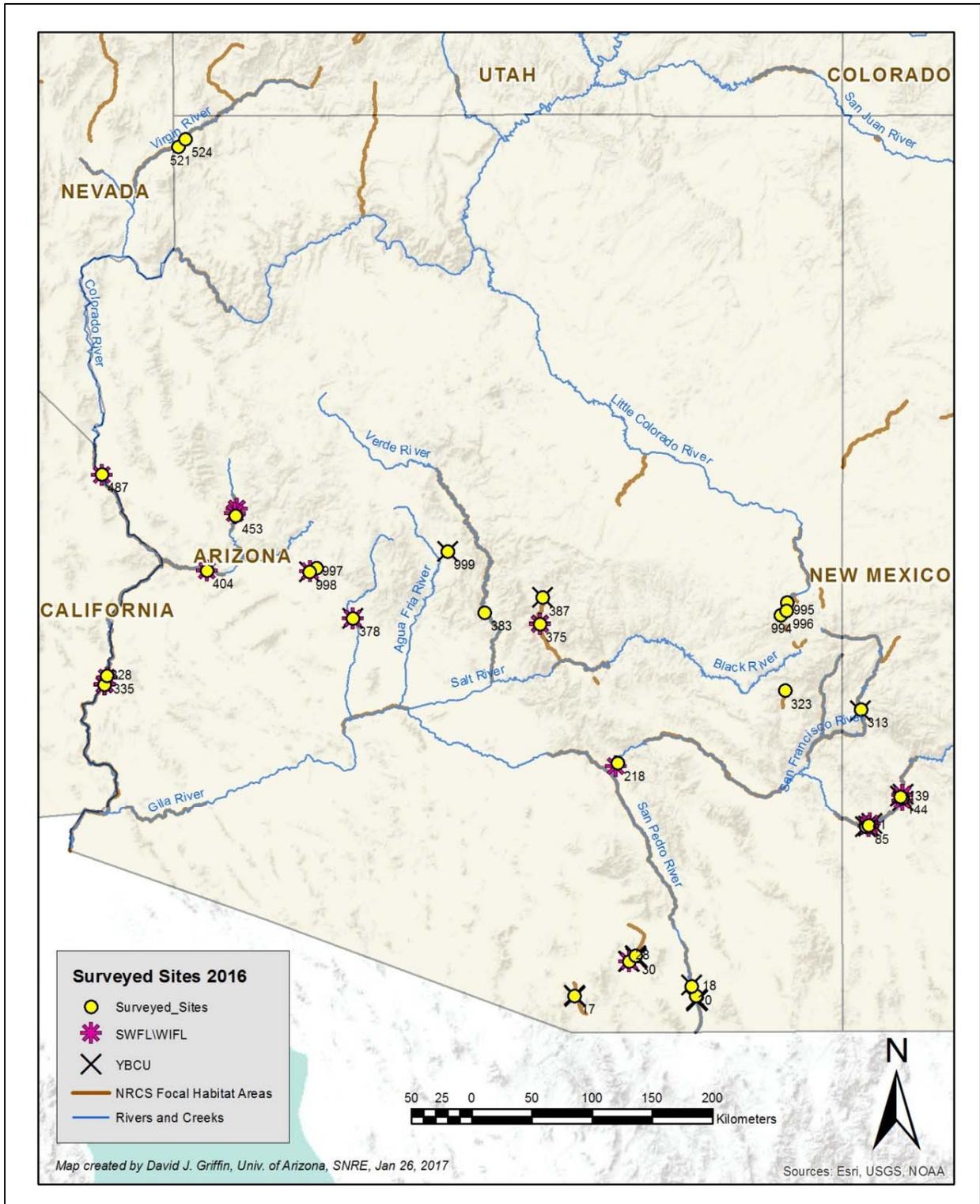


Figure 2. Survey sites for southwestern willow flycatcher and other riparian birds in Arizona and New Mexico with locations of southwestern willow flycatchers and yellow-billed cuckoos, 2016.

Results

We surveyed 404 points on 41 transects at 29 sites between May 24 and July 29, 2016. Because the breeding season for most riparian birds begins earlier at lower elevations than at higher elevations, we surveyed lower-elevations sites earlier than higher elevation sites. We detected a total of 185 species during and incidental to surveys (Appendix 1).

Willow flycatchers

We detected 19 willow flycatchers during surveys on 12 of 41 (29%) transects at 9 of 29 (31%) sites between 25 May and 27 July (Table 1, Figure 2). Incidental to surveys, we detected 5 willow flycatchers at 4 sites; willow flycatchers were not detected at these sites during surveys.

Yellow-billed cuckoos

We detected yellow-billed cuckoos during surveys on 13 of 41 (32%) transects at 11 of 29 (38%) sites between 9 June and 26 July (Table 2, Figure 2). Incidental to surveys, we detected 8 cuckoos at 5 sites; cuckoos were not detected at 3 of these sites during surveys.

Other species

We detected all 18 focal bird species during surveys. The highest numbers of focal species detected during and incidental to surveys was 14 at the Hassayampa River site (AZ_HASS_378), and 13 species at the Big Sandy River (AZ_BISA_453), Bill Williams River (AZ_BIWI_404), Santa Cruz River (AZ_SACR_017), Cienega Creek (AZ_LACI_028, AZ_LACI_030), and Gila River sites (NM_GILA_139). The fewest focal species detected during and incidental to surveys was at the lowest and highest elevation sites. Species detected at the highest number of sites included blue grosbeak and brown-headed cowbird (90% of sites), yellow warbler (86% of sites), and yellow-breasted chat (83% of sites, Table 3). Yellow warbler and yellow-breasted chat were the species detected most commonly across sites. Details of presence of cattle, burros, and beavers are provided in Appendix 2.

Bird density and habitat associations

Examples of preliminary density estimates and measures of habitat association are given in figures 3-6.

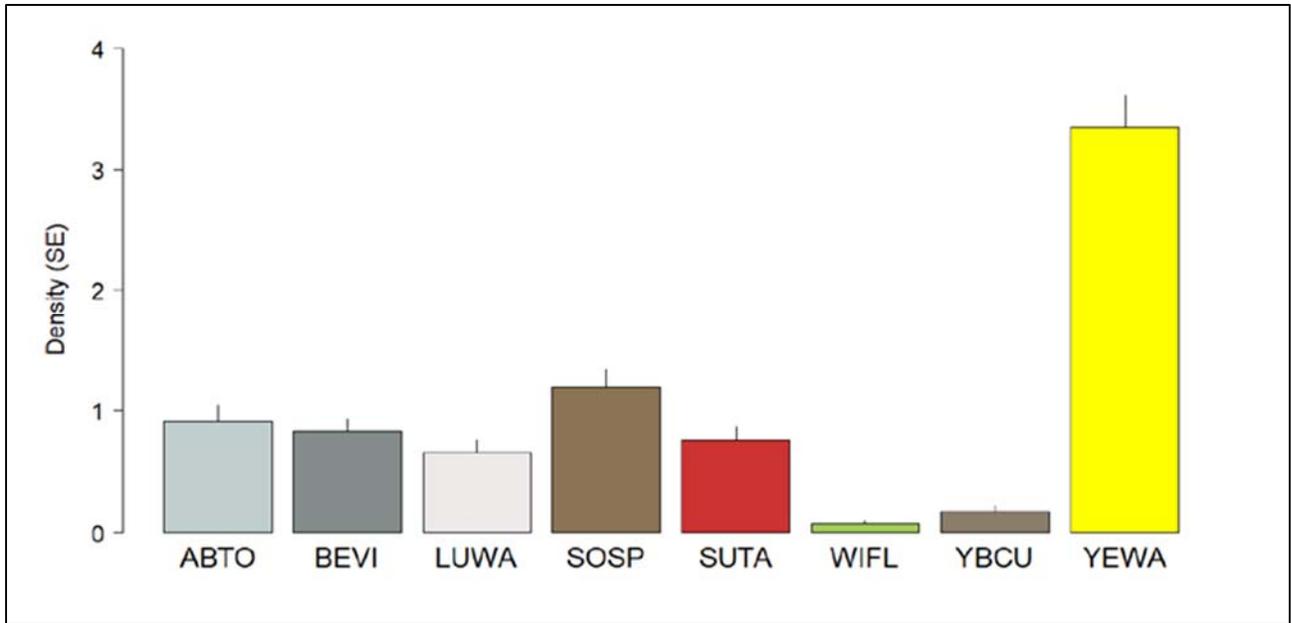


Figure 3. Density estimates for eight riparian bird species: Abert's towhee (ABTO), Bell's vireo (BEVI), Lucy's warbler (LUWA), song sparrow (SOSP), summer tanager (SUTA), willow flycatcher (WIFL), yellow-billed cuckoo (YBCU), and yellow warbler (YEWA). Observations per species ranged from 22-355.

Feature	LUWA	SUTA	WIFL	YBCU	YEWA
Elevation	-0.59	0.38	-1.14	1.12	-0.13
Canopy height		0.38		1.12	0.47
Water cover					-0.22
Tree cover			0.69		
Shrub cover		-0.62			
Midstory 4			0.48		
Midstory 5	0.19				
Midstory 6		0.16		0.35	0.11

Figure 4. Influence of habitat features on density of five focal riparian bird species: Lucy's warbler (LUWA), summer tanager (SUTA), willow flycatcher (WIFL), yellow-billed cuckoo (YBCU), and yellow warbler (YEWA). Positive regression coefficients indicate that density increased with increasing values of the habitat feature.

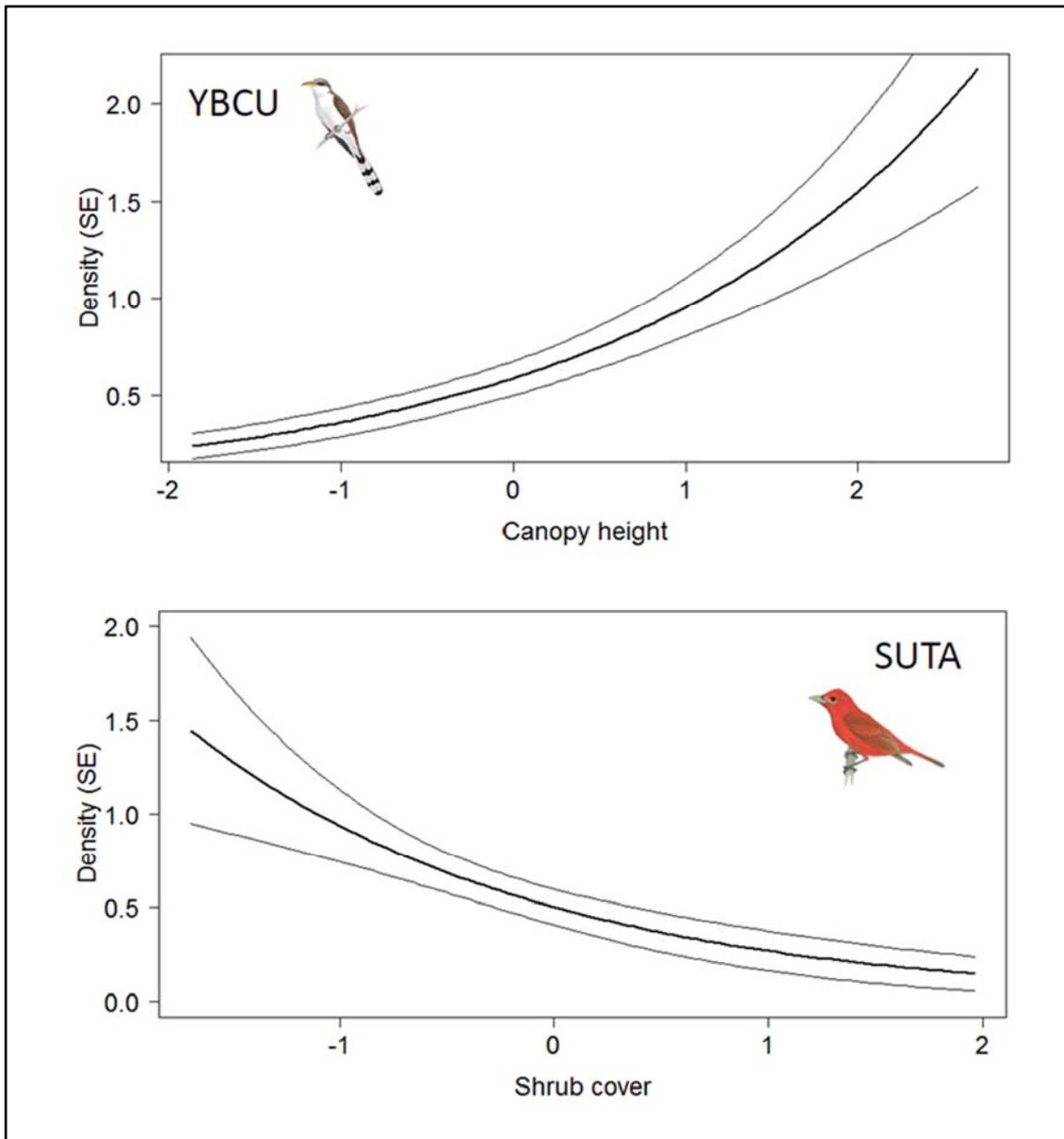


Figure 5. Effect of canopy height on density of yellow-billed cuckoos (YBCU, top), and effect of shrub cover on density of summer tanagers (SUTA, bottom). Gray outer lines represent 95% confidence intervals.

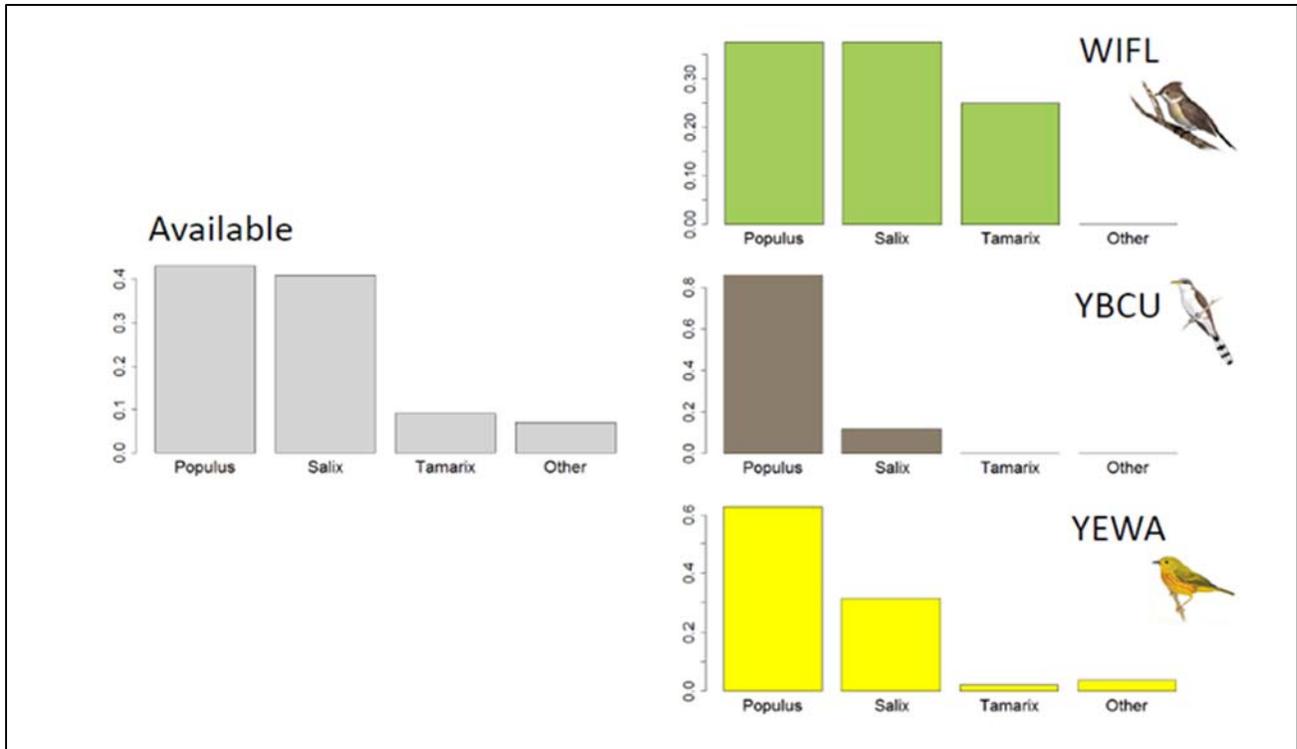


Figure 6. Availability and use of various tree species by three focal species of riparian birds: willow flycatcher (WIFL), yellow-billed cuckoo (YBCU), and yellow warbler (YEWA).

Nests

We did not search for nests, but discovered incidentally one willow flycatcher and one yellow-billed cuckoo nest.

Southwestern willow flycatcher – We discovered one nest on the Gila River at the US Forest Service’s Gila River Bird Area, Grant County, New Mexico. The nest was located on June 22, 2016 at 12N, 724586 m E, 3636269 m N (WGS84), at an elevation of 1332 m. The nest site was a patch of tall coyote willow (*S. exigua*), about 10 m from where a male southwestern willow flycatcher was singing above in a Fremont cottonwood tree. The nest was 7.5 m above the ground and the nest tree was 9.5 m tall with a diameter at breast height of 8 cm. The nest tree was multi-stemmed and the stem that held the nest had the largest diameter in patch; the patch was comprised of larger coyote willow surrounded by smaller diameter suckers. Other major plant species within 5 m of the nest included *S. exigua*, *Celtis reticulata*, *Ulmus pumila*, *Baccharis salicifolia*, and *Bromus* sp. The nest patch was between the Gila River and a large forest of mature Fremont cottonwood, which dominated the immediate area as the major overstory component. We did not examine the contents of the nest, but while we inspected the area, we observed the bill of a bird over the lip of the nest.

Yellow-billed cuckoo – We discovered one nest along Cienega Creek at the BLM’s Las Cienegas National Conservation Area, Pima County, Arizona. This nest was located on July 21, 2016 south of the confluence of Cienega Creek and Cedar Canyon at 12N, 538902 m E, 3519281 m N (WGS84). The nest was 19 m above the ground in a 26 m tall Fremont cottonwood tree. The tree was large and had a diameter at breast height of about 2 m. The nest was in a fork of a branch 10 m from the trunk of the tree and 7 m from the end of the branch. The nest branch orientation from the trunk was 90°. The

general vegetation in the area was native willow-cottonwood-canyon hackberry with a grassy understory and dense shrubs, while the nest site habitat was a dry cottonwood-willow riparian type with little to no understory bordered by giant sacaton (*Sporobolus wrightii*) grasslands.

Future Work

In 2017, we plan to survey riparian birds and vegetation on 60-70 transects at 30-35 sites in Arizona and New Mexico that were not surveyed in 2016.

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Table 1. Willow flycatchers observed during and incidental to surveys in Arizona and New Mexico, 2016 (coordinates WGS84).

Survey Date	# Birds	Incidental Observation	River	Site/Transect	Survey Point	UTM Zone	UTM Easting	UTM Northing	Vegetation Community	Notes
5/24/2016	1	X	Colorado	AZ_COLO_335_A	NA	11N	728537	3717626	Prosopis/Pluchea	incidental observation
5/25/2016	1		Colorado	AZ_COLO_328_A	1	11N	727251	3713063	Tamarix	singing, foraging, moving upstream in uplands; also detected at point 10
5/25/2016	1		Colorado	AZ_COLO_328_A	4	11N	726953	3712772	Tamarix	singing, foraging
5/26/2016	1		Colorado	AZ_COLO_487_A	8	11N	721458	3856045	Salix/Pluchea	singing bird
5/27/2016	1		Big Sandy	AZ_BISA_453_A	1	12N	264345	3833633	Populus/Salix/Tamarix	territorial, chasing
5/27/2016	1		Big Sandy	AZ_BISA_453_A	1	12N	264345	3833633	Populus/Salix/Tamarix	territorial, chasing
5/27/2016	1		Big Sandy	AZ_BISA_453_A	2	12N	264275	3833490	Populus/Salix/Tamarix	paired, territorial
5/27/2016	2		Big Sandy	AZ_BISA_453_B	8	12N	263186	3830415	Populus/Salix/Tamarix	calling, loosely paired
5/30/2016	2	X	Bill Williams	AZ_BIWI_404_A	NA	12N	242607	3791780	Populus/Salix/Tamarix	incidental observation; singing, calling, chasing, paired
6/9/2016	1	X	Hassayampa	AZ_HASS_378	NA	12N	343671	3755846	Populus/Salix/Prosopis	incidental observation; calling, present through season, later netted by TNC = female with brood patch
6/10/2016	1		Date Creek	AZ_DACR_DCR_A	8	12N	313744	3789480	Populus/Salix/Baccharis	bird sang prior to playback; then responded to playback and sang from dense mesquite thicket with a soft "FITZ-bew" song. Bird then gave a soft "whitt" or "whip" call
6/15/2016	1		Tonto Creek	AZ_TOCR_375_A	1	12N	471678	3752156	Populus/Salix	singing, territorial
6/15/2016	2		Tonto Creek	AZ_TOCR_375_B	1	12N	471654	3751810	Populus/Salix	singing, calling
6/21/2016	1		Gila	NM_GILA_139_A	2	12N	724793	3631975	Populus/Salix	calling; breeding season date
6/22/2016	1		Gila	NM_GILA_144_A	3	12N	724537	3636170	Populus/Salix	singing, calling prior to playback; perched high above nest. also detected at point 4 (nest found)
7/6/2016	1		Gila	NM_GILA_085_A	2	12N	702558	3614999	Populus/Salix	singing, territorial
7/6/2016	2		Gila	NM_GILA_085_A	10	12N	703828	3615112	Populus/Salix	singing, calling, chasing; territorial
7/6/2016	1		Gila	NM_GILA_085_B	9	12N	701615	3613461	Populus/Salix	singing
7/26/2016	1	X	Empire Gulch	AZ_LACI_028_A	NA	12N	534022	3516998	Populus/Salix/Prosopis	incidental observation; silent bird foraging; late breeding season date or early migrant/wanderer. Days later BLM mist-netted adult female with brood patch.
7/27/2016	1		Gila	AZ_GILA_218_A	3	12N	524438	3653598	Salix/Tamarix/Baccharis	singing, territorial male foraging and returning to dense willow-tamarisk woodland on east side of river

Table 2. Yellow-billed cuckoos observed during and incidental to surveys in Arizona and New Mexico, 2016 (coordinates WGS84).

Survey Date	# Birds	Incidental Observation	River	Site/Transect	Survey Point	UTM Zone	UTM Easting	UTM Northing	Vegetation Community	Note
6/9/2016	2	X	Sycamore Creek	AZ_SYCR_SCR_A	7-9	12N	408468	3801768	Populus/Salix/Fraxinus/Celtis	incidental; sang & called between points 5 & 7
6/9/2016	2	X	Hassayampa	AZ_HASS_378_A	NA	12N	342607	3756780	Populus/Salix	incidental; singing
6/10/2016	1		Date Creek	AZ_DACR_DCR_A	6	12N	313329	3789310	Populus/Salix, with Fraxinus velutina, Prosopis	silent, perched in willow and flew away
6/10/2016	1	X	Date Creek	AZ_DACR_DCR_A	10	12N	314101	3789607	Populus/Salix, with Fraxinus velutina, Prosopis	incidental, calling
6/14/2016	1	X	Tonto Creek	AZ_TOCR_387_A	NA	12N	473607	3769780	Populus/Salix	incidental; singing
6/16/2016	1		Santa Cruz	AZ_SACR_017_A	1	12N	495652	3491947	Populus/Salix	singing, foraging
6/16/2016	1		Santa Cruz	AZ_SACR_017_A	8	12N	495552	3493126	Populus/Salix	foraging
6/20/2016	1	X	Gila	NM_GILA_144_B	NA	12N	724512	3634285	Populus/Salix	incidental; singing
6/20/2016	1	X	Gila	NM_GILA_144_B	NA	12N	724387	3634236	Populus/Salix	incidental; singing
6/21/2016	1		Gila	NM_GILA_144_B	7	12N	723592	3635221	Populus/Salix	singing
6/21/2016	1		Gila	NM_GILA_139_A	4	12N	725076	3631798	Populus/Salix	foraging, perched, flying
6/22/2016	1		Gila	NM_GILA_144_A	7	12N	725020	3636579	Populus/Salix	singing, flying
6/23/2016	1		San Francisco	NM_SAFR_313_A	6	12N	693962	3693577	Populus/Fraxinus	calling, perched, foraging
7/6/2016	1		Gila	NM_GILA_085_A	9	12N	703653	3615083	Populus/Salix	singing
7/7/2016	2		Gila	NM_GILA_081_B	2	12N	699274	3612964	Populus/Salix	singing
7/19/2016	1		San Pedro	AZ_SAPE_018_A	2	12N	581993	3490611	Populus/Salix	calling
7/19/2016	1		San Pedro	AZ_SAPE_018_A	4	12N	582176	3490343	Populus/Salix	calling
7/19/2016	2		San Pedro	AZ_SAPE_018_A	6	12N	582360	3490071	Populus/Salix	singing, calling
7/19/2016	1		San Pedro	AZ_SAPE_018_A	8	12N	582393	3489746	Populus/Salix	singing
7/19/2016	1		San Pedro	AZ_SAPE_018_A	9	12N	582348	3489571	Populus/Salix	perched in cottonwood
7/19/2016	1		San Pedro	AZ_SAPE_018_A	10	12N	582299	3489433	Populus/Salix	singing
7/20/2016	1		San Pedro	AZ_SAPE_020_B	8	12N	578197	3500410	Populus/Salix	perched in cottonwood
7/21/2016	2		Cienega Creek	AZ_LACI_030_A	4	12N	538902	3519281	Populus/Salix	male feeding female, female on nest
7/21/2016	1		Cienega Creek	AZ_LACI_030_A	6	12N	538979	3518986	Populus/Salix	calling, singing
7/21/2016	1		Cienega Creek	AZ_LACI_030_B	2	12N	538704	3520284	Populus/Salix	calling
7/21/2016	1		Cienega Creek	AZ_LACI_030_B	4	12N	538671	3520557	Populus/Salix	calling
7/21/2016	1		Cienega Creek	AZ_LACI_030_B	5	12N	538698	3520718	Populus/Salix	calling
7/26/2016	1		Empire Gulch	AZ_LACI_028_A	4	12N	534254	3516993	Populus/Salix	calling, singing
7/26/2016	1		Empire Gulch	AZ_LACI_028_A	8	12N	533632	3516934	Populus/Salix	calling
7/26/2016	1		Empire Gulch	AZ_LACI_028_A	9	12N	533487	3516868	Populus/Salix	calling

Table 3. Focal bird species detected during or incidental to surveys for southwestern willow flycatcher in Arizona and New Mexico, 2016.

Species	Number of sites	Percent of sites
blue grosbeak	26	90
brown-headed cowbird	26	90
yellow warbler	25	86
yellow-breasted chat	24	83
Bell's vireo	23	79
common yellowthroat	22	76
Abert's towhee	21	72
summer tanager	20	69
brown-crested flycatcher	19	66
Gila woodpecker	18	62
Lucy's warbler	18	62
song sparrow	17	59
yellow-billed cuckoo	14	48
willow flycatcher	10	34
MacGillivray's warbler	3	10
green-tailed towhee	3	10
Lincoln's sparrow	2	7

Appendix 1. Avian species observed during and incidental to surveys for southwestern willow flycatcher (*Empidonax traillii extimus*) at sites in Arizona and New Mexico, 2016. Species in **bold** are focal riparian species.

Family	Common Name	Scientific Name	Lower Colorado River	Lower Colorado River	Lower Colorado River	Big Sandy River	Bill Williams River	Virgin River	Virgin River	Hassayampa River	Tonto Creek	Tonto Creek	Santa Cruz River	Gila River	Gila River	San Francisco River	Eagle Creek	Verde River	Gila River	Gila River	W Fork Little Colorado River	Benny Creek	W Fork Little Colorado River	San Pedro River	San Pedro River	Cienega Creek	Empire Gulch	Gila River
			AZ COLO 335 A	AZ COLO 328 A	AZ COLO 487 A	AZ BISA 453 A&B	AZ BIWI 404 A	AZ VIRG 521 A	AZ VIRG 524 A	AZ HASS 378 A&B	AZ TOCR 387 A&B	AZ TOCR 375 A&B	AZ TUMA 017 A	NM GILA 139 A	NM GILA 144 A&B	NM SAFR 313 A	AZ EACR 323 A	AZ VERD 383 A&B	NM GILA 085 A&B	NM GILA 081 A&B	(Gov't Spgs) AZ LICO GOV A	AZ LICO BCR A	AZ LICO SHC A&B	AZ SAPE 018 A&B	AZ SAPE 020 A&B	AZ LACI 030 A&B	AZ LACI 028 A	AZ GILA 218 A
Anatidae																												
	Mallard (northern)	<i>Anas platyrhynchos</i>							+	+		+	+															
	Cinnamon Teal	<i>Anas cyanoptera</i>			+																							
Odontophoridae																												
	Gambel's Quail	<i>Callipepla gambelii</i>	+	+		+	+	+	+		+		+	+	+	+		+		+								+
Phasianidae																												
	Wild Turkey	<i>Meleagris gallopavo</i>														+	+											
Podicipedidae																												
	Pied-billed Grebe	<i>Podilymbus podiceps</i>		+																								
	Eared Grebe	<i>Podiceps nigricollis</i>			+																							
Threskiornithidae																												
	White-faced Ibis	<i>Plegadis chihi</i>	+																									
Phalacrocoracidae																												
	Double-crested Cormorant	<i>Phalacrocorax auritus</i>	+		+													+			+							
Ardeidae																												
	Great Blue Heron	<i>Ardea herodias</i>			+		+	+	+	+		+	+					+		+		+	+		+	+		
	Great Egret	<i>Ardea alba</i>		+																								
	Snowy Egret	<i>Egretta thula</i>																+										
	Green Heron	<i>Butorides virescens</i>	+			+	+											+				+						

	Mourning Dove	<i>Zenaida macroura</i>	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+		+		+	+	+	+		
Cuculidae																												
	Yellow-billed Cuckoo	<i>Coccyzus americanus</i>							+	+		+	+	+	+			+	+					+	+	+	+	
	Greater Roadrunner	<i>Geococcyx californianus</i>		+	+	+	+	+		+				+		+												
Tytonidae																												
	Barn Owl	<i>Tyto alba</i>													+											+		
Strigidae																												
	Western Screech-Owl	<i>Megascops kennicottii</i>	+			+	+				+			+														
	Great Horned Owl	<i>Bubo virginianus</i>	+	+	+									+		+	+											
	Northern Pygmy-Owl	<i>Glaucidium gnoma</i>																										
	Elf Owl	<i>Micrathene whitneyi</i>				+	+				+			+														
Caprimulgidae																												
	Lesser Nighthawk	<i>Chordeiles acutipennis</i>	+	+	+	+	+				+																	
	Common Nighthawk	<i>Chordeiles minor</i>												+		+	+									+		
	Common Poorwill	<i>Phalaenoptilus nuttalli</i>				+					+			+		+												
Apodidae																												
	White-throated Swift	<i>Aeronautes saxatalis</i>		+				+	+					+		+												
Trochilidae																												
	Black-chinned Hummingbird	<i>Archilochus alexandri</i>	+	+	+	+		+	+	+	+	+		+	+	+	+	+							+	+	+	+
	Anna's Hummingbird	<i>Calypte anna</i>	+							+																		
	Costa's Hummingbird	<i>Calypte costae</i>				+																						
	Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>																			+	+	+					
	Rufous Hummingbird	<i>Selasphorus rufus</i>																			+							
	Broad-billed Hummingbird	<i>Cynanthus latirostris</i>								+		+														+		
	Unknown Hummingbird					+		+																				
Alcedinidae																												
	Belted Kingfisher	<i>Megaceryle alcyon</i>																								+		
Picidae																												
	Gila Woodpecker	<i>Melanerpes uropygialis</i>				+	+			+	+	+	+					+	+	+					+	+	+	+
	Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>																								+	+	

Appendix 2. Sites with and without cattle (*Bos taurus*), wild burros (*Equus africanus*), and/or North American beaver (*Castor canadensis*) during surveys for southwestern willow flycatcher (*Empidonax traillii extimus*) in Arizona and New Mexico, 2016.

SITE	SURVEY DATE	CATTLE	WILD BURRO	NOTES
AZ_COLO_335	24-May-16	N	N	BEAVERS OBSERVED
AZ_COLO_328	25-May-16	N	N	BEAVERS OBSERVED
AZ_COLO_487	26-May-16	N	N	
AZ_BISA_453	27-May-16	Y	Y	APPROX. 6-10 CATTLE; UNKNOWN # BURROS, BUT SAW 3 AND MUCH DAMAGE TO CREEK AND VEG FROM BURROS
AZ_BIWI_404	30-May-16	N	Y	UNKNOWN # OF BURROS; HEARD BUT NOT SEEN; BEAVERS OBSERVED - VERY LARGE DAM ON RIVER (VIS. GOOGLE EARTH)
AZ_VIRG_521	2-Jun-16	N	N	BEAVER PRESENT; DAM ON IRRIGATION CHANNEL
AZ_VIRG_524	3-Jun-16	Y	N	APPROX. 8-10; INCLUDING SEVERAL COW-CALF PAIRS; CREATING TRAIL ALONG RIVERSIDE IN DENSE COYOTE WILLOW
AZ_SYCR_SCR	8-Jun-16	Y	N	APPROX. 20-25; FORAGING IN STREAM CHANNEL, BANKS, ETC...NOT PROPERTY OF LANDOWNER (WADE LEUCK) - TRESPASS CATTLE. LEUCK WAS ACTIVELY FENCING PROPERTY WHILE WE WERE THERE
AZ_HASS_TNC	9-Jun-16	Y	N	APPROX. 5-10 FORAGING IN STREAM CHANNEL AND FLOODPLAIN; TRESPASS CATTLE NOT TNC PROPERTY
AZ_DACR_DCR	10-Jun-16	N	N	BEAVER PRESENT; ACTIVE POND NEAR PT8 WHERE WIFL DETECTED
AZ_TOCR_387	14-Jun-16	N	N	BEAVERS OBSERVED, DAMS, WORKINGS, ETC
AZ_TOCR_375	15-Jun-16	N	N	BEAVERS PRESENT, DAMS, WORKINGS, ETC
AZ_SACR_017	16-Jun-16	Y	N	APPROX. 5-10 FORAGING IN FLOODPLAIN; TRESPASS CATTLE NOT OWNED BY NPS
NM_GILA_139	21-Jun-16	N	N	
NM_GILA_144	22-Jun-16	N	N	
NM_SAFR_313	23-Jun-16	N	N	BEAVER DAMMED/STOPPED ENTIRE RIVER FLOW NEAR PT #3
AZ_EACR_323	24-Jun-16	N	N	
AZ_VERD_383	30-Jun-16	N	N	
AZ_DACR_OXR	1-Jul-16	Y	N	APPROX. 15-30 FORAGING IN FLOODPLAIN UNDER COTTONWOOD FORESTS - IN THOSE AREA ALMOST NO GROUND COVER; BEAVER PRESENT NEAR PTS 9-10, SMALL DAM, LARGE 1-AC AREA OF BEAVER-CUT TREES
NM_GILA_085	6-Jul-16	N	N	MASSIVE FLOOD EVENT 1-2 DAYS PRIOR TO VISIT; DEBRIS, QUICKSAND, EROSION, DEPOSITION, MUD, ETC; BEAVERS
NM_GILA_081	7-Jul-16	N	N	MASSIVE FLOOD EVENT 1-2 DAYS PRIOR TO VISIT; DEBRIS, QUICKSAND, EROSION, DEPOSITION, MUD, ETC; BEAVERS
AZ_LICO_GOV	12-Jul-16	N	N	
AZ_LICO_BCR	13-Jul-16	N	N	
AZ_LICO_SHC	14-Jul-16	N	N	UPPER TRANSECT "A" SHOWED EVIDENCE OF HEAVY BROWSING/BROWSE LINES ON WILLOWS BY ELK IN OPEN MEADOW AREAS
AZ_SAPE_018	19-Jul-16	N	N	
AZ_SAPE_020	20-Jul-16	N	N	MASSIVE FLOOD EVENT LESS THAN 10 HRS PRIOR TO OUR VISIT; MUD, DEBRIS, BENT VEGETATION, EROSION, DEPOSITION, ETC
AZ_LACI_030	21-Jul-16	Y	N	APPROX. 10-25 FORAGING THROUGHOUT RIPARIAN AREA, BUT MOVING AND NOT CONCENTRATED
AZ_LACI_028	26-Jul-16	N	N	FLOOD EVENT PRIOR TO OUR SURVEY; FLOOD WATER APPROX 15CM DEEP FLOWING DOWNSTREAM FROM ROAD CROSSING
AZ_GILA_218	27-Jul-16	N	N	