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Mono Basin Willow Flycatcher Project
2005 Progress Report

Chris McCreedy
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PRBO Conservation Science
4990 Shoreline Highway
Stinson Beach, CA 94970
Cmccreedy@prbo.org

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TABLE OF CONTENTS

SUMMARY

In 2005, PRBO Conservation Science (PRBO) completed the third year of the Mono Basin Willow Flycatcher Project (MBWFP). The project is designed as a long-term study to investigate the apparent reoccupation of Inyo National Forest (Inyo NF) and Los Angeles Department of Water and Power (LADWP) holdings on lower Rush Creek, Mono County, California, by a population of Willow Flycatchers (*Empidonax traillii*). Willow Flycatchers are a California State Endangered species (CDFG 1993) and United States Forest Service Region V Sensitive Species. There are only approximately 500 known annual Willow Flycatcher territories remaining in California today (McCreedy and Heath 2004), and approximately 200 known annual Willow Flycatcher territories in the Sierra Nevada (Green et al. 2003).

From June through August 2005, PRBO documented 7 territorial males on lower Rush Creek, and seven nesting females. Two males were polygynous, each with two nest-building females.

Fourteen territorial adults detected in 2005 are a drop from 16 territorial adults observed in 2004 (McCreedy 2004c). However, all seven nesting females held "active" nests in 2005. Active nests are nests that at some point held at least one Willow Flycatcher egg. This is the highest number of females with active nests that PRBO has recorded on Rush Creek. Twenty-four total nests were located on seven territories. Of these 24 nests, fourteen nests held Willow Flycatcher eggs. Nest building began on June 15, 2005.

Willow Flycatcher clutch size on Rush Creek remained below 3 for the second consecutive year ($mean_{2005}$=2.67, n=9, SD=0.5), and did not differ significantly from low clutch sizes recorded in 2004 (P = .705).

Brown-headed Cowbirds (*Molothrus ater*) significantly and negatively impacted Willow Flycatcher nest success at Rush Creek in 2005. Twelve of the twenty-four total nests (50%) and nine of fourteen active nests (64%) were parasitized by Brown-headed Cowbirds. However, only one of 24 Brown-headed Cowbird eggs laid in Willow Flycatcher nests from 2001-2005 has survived to fledge, and none of the 12 nests that were parasitized in 2005 fledged cowbird young. Repeated Willow Flycatcher nest failure due to high cowbird activity contributed to a dismal 2005 nest success rate (only 14% of active nests fledged host young) and very low fecundity (only 3 Willow Flycatcher young produced by seven nesting females, for a mean fecundity of 0.43).

Willow Flycatchers were unable to escape cowbird parasitism through late-season nest attempts. Cowbird adults were present on Rush Creek from the first day of surveys on June 5, through July 27. The last Willow Flycatcher parasitism event occurred around July 25, when two Willow Flycatcher eggs were ejected and a cowbird egg was laid in a flycatcher female's fifth nest of the summer. All 24 Willow Flycatcher nests were initiated before July 25.

To monitor future juvenile recruitment and population dispersal, all three fledged nestlings were color-banded in 2005. In addition, four adults were mist-netted and color-banded. The entire Willow Flycatcher population at Rush Creek is now color-banded, enabling PRBO to fully assess immigration to Rush Creek and emigration to surrounding riparian areas in 2006 and beyond.

Seven out of eleven of color-banded adults present in 2004 returned to Rush Creek in 2005. In addition, two of six fledglings banded in 2004 returned in 2005 – one female, and one male. These two second-year recruits mated, representing the first documentation of inbreeding on Rush Creek (the female's parents are the male's grandparents).

The United States Geologic Survey (USGS) included Rush Creek in a nationwide colorimetric study of Willow Flycatcher plumage variation by subspecies. PRBO and the USGS captured and measured nine of the 14 Rush Creek adults in 2005. The results from the Rush Creek sample may provide a taxonomic identity to the Rush Creek population, which up to present has remained undefined.

PRBO was also funded by the Inyo NF to complete a Willow Flycatcher habitat assessment of selected sites in the June Lake loop, and at McGee Creek (all in Mono County). PRBO conducted vegetation assessments at 80 randomly-generated sites at Inyo NF Willow Flycatcher habitat polygons for comparison with known Willow Flycatcher habitat at Rush Creek These assessments were combined with a landscape-scale analysis of known threats to Willow Flycatcher success (proximity to pack stations, urban areas, and campgrounds) to investigate the polygons' potential to support breeding Willow Flycatchers.

Finally, PRBO collaborated with the USFS Region V Willow Flycatcher Demography Study (Mathewson et al. 2005) and the University of Nevada-Reno to provide nest site microclimate information at Rush Creek. Rush Creek's biogeography and elevation make it a valuable comparison site to a long-term Region V study at several montane meadow locations in the north-central Sierra Nevada.

PRBO presented on these findings at the third annual Mono Basin Birding Chautauqua (June 2005) and at the August 2005 American Ornithological Union's annual meeting in Santa Barbara, CA.

OBJECTIVES

The Inyo National Forest has provided much of the funding necessary to the success of the Mono Basin Willow Flycatcher Project. The Willow Flycatcher Demography Study and Mono Basin Birding Chautauqua have also provided necessary funds that have enabled PRBO to pursue the objectives below:

- Conduct Willow Flycatcher nest monitoring on lower Rush Creek, to determine factors affecting productivity, parasitism rates, and predation pressures. Conduct nest-site vegetation sampling and territory-scale vegetation sampling to determine Willow Flycatcher nest-site and territory-site selection criteria. **CURRENTLY 66 NESTS DETECTED FROM 2001-2005.**
- Conduct territory spot mapping on color banded individuals to determine population size, phenology, and territory sizes and locations on lower Rush Creek. **SEVEN TERRITORIES MAPPED IN 2003, 7 MAPPED IN 2004, AND 6 MAPPED IN 2005.**
- Conduct genetic sampling/analysis and plumage analysis to gain insight into the lower Rush Creek population's taxonomic status. **COMPLETE. INITIAL**

GENETIC RESULTS FROM UNITED STATES GEOLOGIC SURVEY DEEMED INCONCLUSIVE. PLUMAGE COLORIMETRY PERFORMED ON NINE ADULTS IN 2005, TO BE INCLUDED IN NATIONWIDE USGS WILLOW FLYCATCHER PLUMAGE STUDY. RUSH CREEK SUBSPECIES IDENTITY PENDING THIS USGS ANALYSIS.

- Color band nestlings and captured adults to determine site fidelity, survivorship, and if nestlings return, recruitment. **14 ADULTS AND 26 NESTLINGS COLOR BANDED (2003-2005).**
- Assist land managers in implementing the Sierra Nevada Forest Plan by incorporating findings into USFS WIFL databases, CDFG WIFL databases, and regional WIFL census networks. **ONGOING. DATA WILL BE INCLUDED IN 2005 SIERRA NEVADA WILLOW FLYCATCHER DEMOGRAPHY STUDY. RUSH CREEK NEST DATA USED FOR COMPARISON WITH OTHER INYO NATIONAL FOREST WILLOW FLYCATCHER HABITAT POLYGONS IN 2005.**

BACKGROUND

The Mono Basin Willow Flycatcher Project represents a PRBO, USFS (Inyo NF), and Los Angeles Department of Water and Power (LADWP) collaboration to monitor the recovery of the Willow Flycatcher on lower Rush Creek and in the greater Mono Lake Basin. Lower Rush Creek is under long term, passive restoration after decades of grazing and municipal water diversions. Lower Rush Creek now receives near natural flow, and a grazing moratorium on lower Rush Creek (and across the Mono Basin Scenic Area) has been in place for over ten years (McCreedy and Heath 2004).

PRBO's Eastern Sierra Riparian Songbird Conservation Project first documented two territorial Willow Flycatcher males on lower Rush Creek in 2000. As described in McCreedy and Heath (2004) and McCreedy (2004c), the number of detected territorial adults on lower Rush Creek increased in each year since 2000, with eight in 2001, eleven in 2002, thirteen in 2003, and sixteen in 2004. Notably, the number of detected females has increased from zero in 2000 to three in 2001, four in 2002, six in 2003, and eight in 2004. This is the only known breeding population of Willow Flycatchers in the Inyo National Forest.

Over the twentieth century, Willow Flycatchers have experienced precipitous declines across California, particularly in the Sierra Nevada and along the Colorado River (Craig and Williams 1998, Serena 1982). After several trips to the Mono Basin and Eastern Sierra in the early twentieth century, biologist Joseph Grinnell termed Willow Flycatchers to be "fairly common", and noted nesting material carries near the Mono Inn, on Mono Lake's western shore (Grinnell and Dixon field notes at the Museum of Vertebrate Zoology). In addition, several Rush Creek nesting records exist prior to the initiation of municipal diversions to Los Angeles in 1941 (unpublished records at the Western Foundation of Vertebrate Zoology). However, subsequent Willow Flycatcher nesting records in the Mono Basin are nearly nonexistent. David Gaines reported the most recent, nearby confirmed Willow Flycatcher breeding at Mammoth Creek, Mono County, in the early 1970s (Gaines 1992). Prior to their detection by PRBO biologists in 2000, singing Willow Flycatchers had not been found on lower Rush Creek since 1982 (Joe Jehl, personal communication). Due to these population declines, the USFS Region V has placed a high research priority on Sierra Nevada Willow Flycatcher populations, and the Mono Basin Willow Flycatcher Project complements larger research efforts in the northern Sierra Nevada near

Truckee (Mathewson et al. 2005), and in the southern Sierra Nevada near Weldon (Whitfield et al. 1997).

Unlike many Willow Flycatcher breeding sites in California and Arizona, the population at lower Rush Creek is experiencing population increases. In addition, the lower Rush Creek population has expressed nest site and territory habitat attributes anomalous to other Willow Flycatcher populations in California. These attributes include a predilection for Woods' Rose (*Rosa woodsii*) (through 2005, 66 out of 66 located nests have been built in Woods' Rose), and a lack of territory and nest site correlation to surface water (McCreedy and Heath 2004). Research into the use of these anomalous habitats will identify alternatives to typically surveyed habitats, which will assist the USFS and California Department of Fish and Game (CDFG) in the conservation of this endangered species. Continued monitoring of the Rush Creek population will provide a unique glimpse into the establishment and survival of a small population of this endangered species

CHAPTER ONE: RUSH CREEK DEMOGRAHPY

METHODS

At 37.93 N° and 119.07° W, lower Rush Creek spans the final seven kilometers of Rush Creek's descent to Mono Lake, extending from the "Narrows" cataract to the Rush Creek – Mono Lake delta (Figure 1). Rush Creek drops from 2011 meters above sea level at the Narrows to 1945 meters above sea level at its delta with Mono Lake.

Surveys began June 5, 2005, and ended August 24, 2005. Initial surveys consisted of territory spot mapping in accordance with International Bird Conservation Committee recommendations (IBCC 1970) and following Ralph et al. (1993). Lower Rush Creek was divided into four sections of roughly equal size, which were each covered once every four days. All Willow Flycatcher detections were marked with a Garmin GPS V receiver and added to GIS coverage to maximize spot-mapping accuracy. Sex and age of detected adults were noted when possible, and color-band identifications were recorded whenever possible.

NEST MONITORING, NEST VEGETATION ASSESSMENTS, AND NEST ANALYSES

Nests were located and monitored at least once every four days, following protocols described in Martin and Geupel (1993) and Martin et al. (1997). All nests were located during the building or egg-laying phase. On each visit to the nest, nest contents were recorded, and Brown-headed Cowbird parasitism noted. After nesting was complete, 5 m-radius vegetation assessments about each nest were conducted also following Martin (1997). Forty 5 m-radius non-nest vegetation assessments were conducted at randomly-generated locations throughout the lower Rush Creek riparian corridor for comparison.

Nest and non-nest assessments included absolute cover estimates of shrub cover, non-woody cover, and groundcover. Groundcover was broken into "litter", "bare ground", "water",

and "rock". Relative cover (by species) of absolute shrub and non-woody cover were estimated; relative species covers were then multiplied by absolute shrub and non-woody cover to give by-species absolute cover estimates for analysis. Numbers of "tree" stems (by species) were counted in 11.3 m-radius plots around each nest and non-nest point. To qualify as a "tree", a plant must have been over 5 m in height and have a diameter at breast height (DBH) of at least 8 cm. Canopy measurements included: four averaged densiometer readings taken at cardinal points at the nest or non-nest point to measure foliage cover above the nest; "canopy height", the maximum average height of the canopy within 11.3 m of the nest, and "canopy cover", the percent of the 11.3 m-radius plot covered by vegetation greater than 5 meters in height. Distance-to-water measurements and riparian-width measurements were measured using USFS-provided aerial photographs projected onto ArcView 3.2 GIS (ESRI 2000) in cases when accurate field measurements were not possible.

Only nests with clutches observed during laying and after clutch completion were used to calculate clutch size means. Nests were not used in clutch size analysis if cowbird ejection of host eggs prior to clutch completion was suspected.

The majority of 2001-2005 nests were located early in the building stage, and all save one (not used in egg fate analysis) were found prior to clutch completion. Thus the fates of all eggs are known, within reason (Figure 4). Eggs that disappeared in coincidence with the appearance of a new BHCO egg were assumed to be ejected by Brown-headed Cowbirds. Eggs that did not hatch in parasitized nests were presumed to not hatch due to cowbird parasitism. All young dubbed to be fledged were observed after fledging, and young not observed after fledging were counted as depredated from the nest.

Summary statistics and mean comparisons for vegetation measurements were calculated using STATA 8.0's two-sample mean comparison calculator for unequal variances (Stata Corp 2003). A list of all plant species detected is presented in Appendix B.

COLOR-BANDING AND PLUMAGE COLORIMETRY

Target netting began in late June 2005. We used a combination of passive mist netting (setting 5 m or 2 m mist nets across common flight paths on territories) and active mist netting (using hidden speakers placed near nets and playing a series of vocalizations to bring flycatchers to nets).

Willow Flycatchers have exhibited a high sensitivity to leg injury if improperly banded. Special care was used in fashioning customized bands to minimize leg injuries, following recommendations from the Southern Sierra Research Station. Celluloid bands were ground to half-length using a Dremel tool, and ground edges were filed to ensure smooth edges. Only two half-length color bands were placed on one leg, and one metal FWS band was placed on the other leg. Beginning in July 2005, PRBO switched to using one metal FWS band on one leg, and one pinstriped metal band (with two colors applied to the metal) on the other leg. Pinstriped metal bands have been shown to dramatically decrease band-induced injuries to *Empidonax* flycatchers (Koronkiewicz et al. 2005) and were graciously provided by the Southern Sierra Research Station and by SWCA Consultants. As in previous years, all adults were banded with a metal FWS band on the right leg, and all young were banded with a metal FWS band on the left leg.

PRBO and the Inyo NF have partnered with the United States Geologic Survey to determine the taxonomic status of the Rush Creek Willow Flycatcher population. Rush Creek lies at the confluence of three Willow Flycatcher subspecies ranges (*Empidonax traillii adastus, E.t. extimus,* and *E.t. brewsteri* (Unitt 1987), and the taxonomic identity of the Rush Creek population remains unknown. In 2005, the USGS analyzed blood from three Rush Creek Willow Flycatchers sampled by PRBO in 2003. However, mitochondrial DNA sequences from Rush Creek birds are of a type not restricted to any particular Willow Flycatcher subspecies, and thus blood sampling produced inconclusive results (Eben Paxton, personal communication).

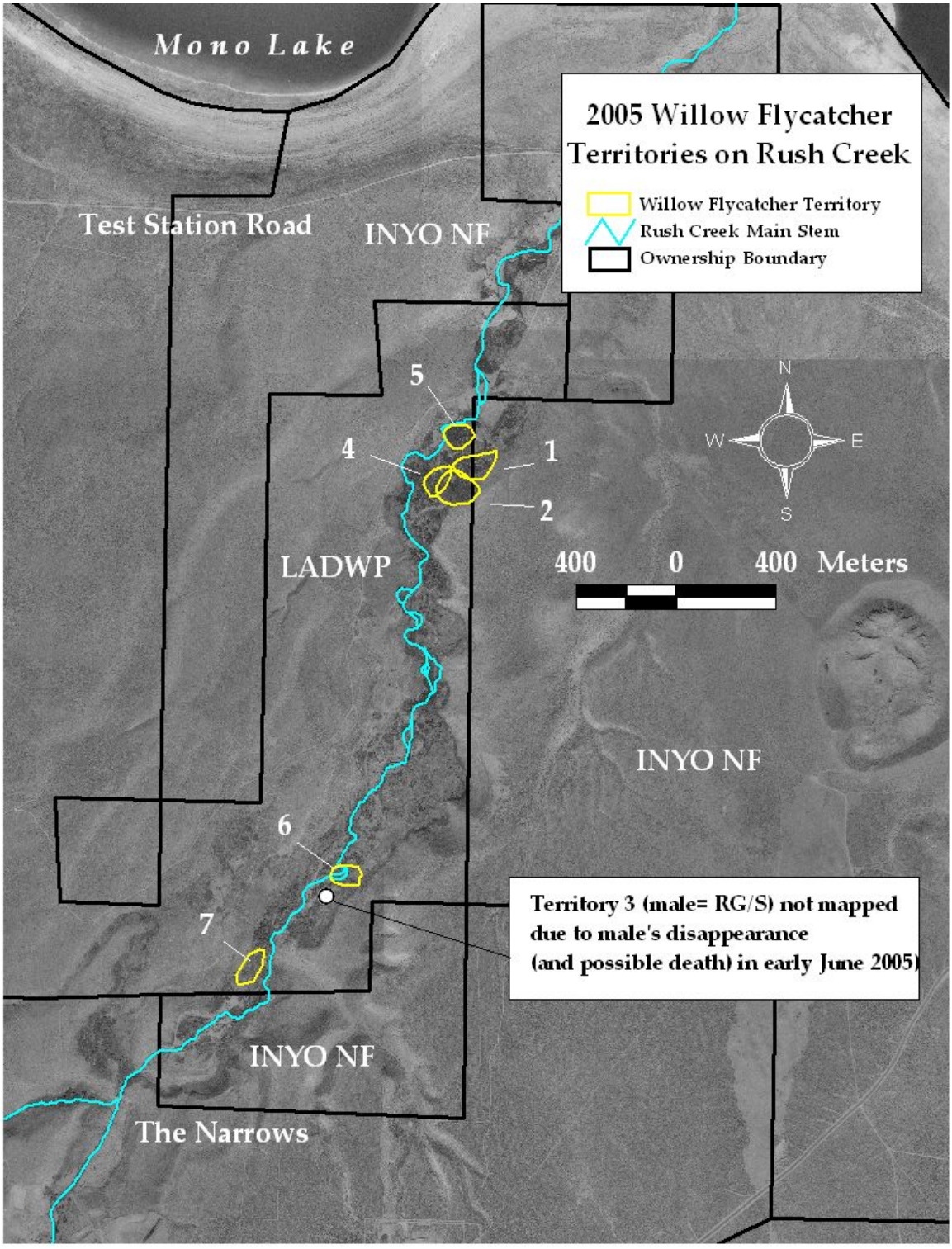
However, the USGS has devised another method to determine Willow Flycatcher subspecies identity, using a Minolta colorimeter (Paxton et al. 2005) to quantitatively measure Willow Flycatcher plumage color. The USGS considered the Rush Creek geographic location important enough for inclusion in a United States-wide colorimetric study of Willow Flycatcher plumage variation by subspecies, and PRBO assisted one of the study's principal investigators in the capture and measurement of one female in July 2005. A better sample size was necessary, and PRBO captured and measured eight additional Rush Creek adults (with the colorimeter on loan) in late July 2005. The results from the Rush Creek sample will be included in the USGS study, which will be completed in late 2005.

RESULTS AND DISCUSSION

We detected seven territorial males during the course of the 2005 breeding season on lower Rush Creek. Seven females were detected on each of the territories. Two polygynous males each held two nesting females. One polygynous male (WR/S) relinquished his second female to a late-arriving male (YO/S) that arrived just as the female completed her clutch (around July 15) – thus it is impossible to know which male sired which of her eggs. The other polygynous male (OO/S) acquired his second mate when her longtime mate (RG/S) disappeared in early June.

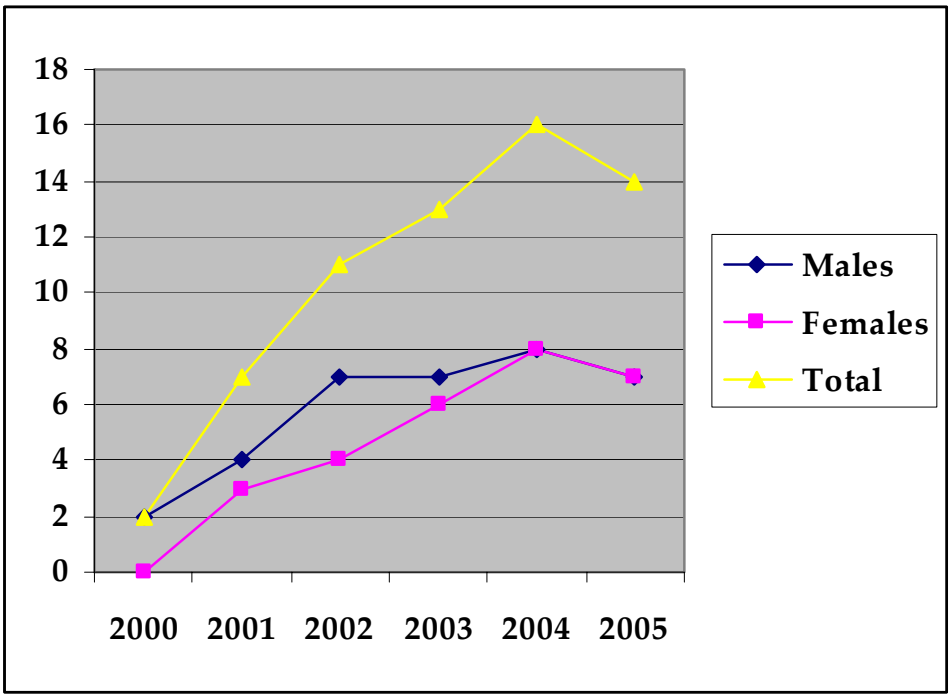
Figure 1 depicts the seven 2005 territories. Five of the twenty-four 2005 nests were on Inyo NF land. Territories 1, 2, and 5 straddled the LADWP/Inyo NF property boundary (Figure 1), and the remaining 19 nests and 4 territories were on LADWP land.

Figure 1. Willow Flycatcher territories on Rush Creek, Mono County, 2005. Territory numbers are referred to in subsequent tables and text.



The Rush Creek population declined from the high of 16 adults in 2004 (Figure 2).

Figure 2. Number of detected territorial Willow Flycatchers on Rush Creek, Mono County, CA 2000-2005. The entire lower Rush Creek corridor was first surveyed in 2002.



NESTS

A summary of 2005 females, nests, and outcomes is provided in Table 1. In total, PRBO located 24 nests for 7 nesting females in 2005.

Table 1. Willow Flycatcher color combinations, nests initiated, and nest outcomes at lower Rush Creek, 2005. Numbered females correspond to Figure 1. Active nests (nests that held at least one host egg) in **bold.**

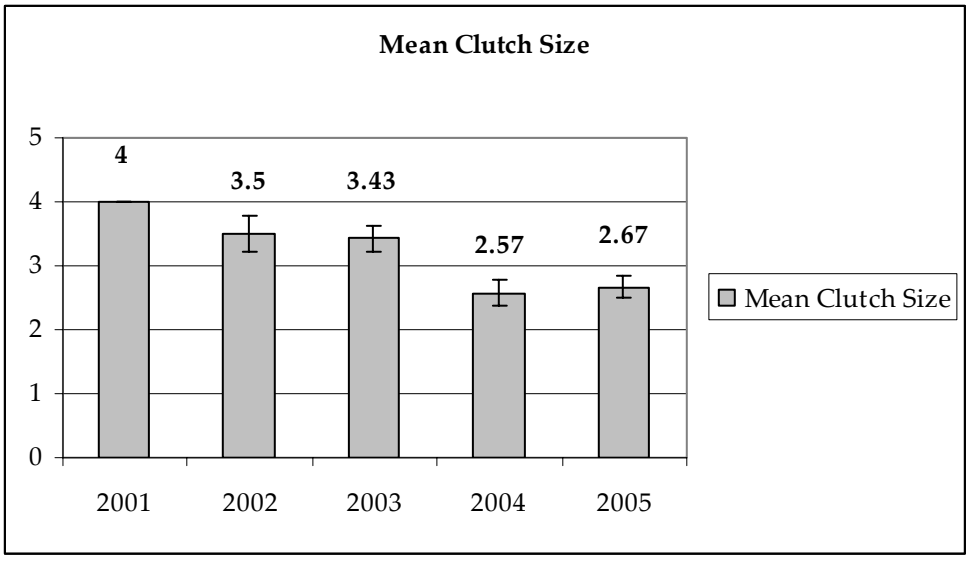
Female	Male color combination	Female color combination	Date of first egg	Date of fledge or failure	Outcome
1	RM/S	S/WB	-	19 June	Abandoned
	RM/S	S/WB	-	24 June	Abandoned one BHCO egg
	RM/S	S/WB	-	30 June	Abandoned
	RM/S	**S/WB**	**4 July**	**5 July**	**Abandoned two eggs and one BHCO egg**
	RM/S	**S/WB**	**13 July**	**31 July**	**Two young die while hatching**
					One egg removed by BHCO female
					Adults abandon one BHCO young
2	WR/S*	GK/S	-	15 June	Abandoned
	WR/S*	**GK/S**	**20 June**	**23 June**	**Preyed upon at least one egg while laying**
	WR/S*	**GK/S**	**2 July**	**8 July**	**Abandoned two eggs and one BHCO egg**
					One egg removed by BHCO female
	WR/S*	**GK/S**	**13 July**	**13 August**	**Fledged two young**
					GK/S buries BHCO egg
3	OO/S*	GO/S	-	21 June	Abandoned
	OO/S*	**GO/S**	**21 June**	**23 June**	**Abandoned one egg and one BHCO egg**
	OO/S*	**GO/S**	**5 July**	**25 July**	**Preyed upon 3 young**
4	WR/S*	MR/S	-	28 June	Found during deconstruction
	WR/S*	MR/S	-	30 June	Abandoned
	WR/S* and YO/S	**MR/S**	**12 July**	**6 August**	**Preyed upon BHCO young and egg**
					Preyed upon 2 WIFL young 8 days later
					One WIFL egg fails to hatch
5	**OK/S**	**YY/S**	**23 June**	**14 July**	**Preyed upon 2 young**
	OK/S	**YY/S**	**21 July**	**11 August**	**Preyed upon BHCO young**
					Preyed upon 2 WIFL young 7 days later
					One WIFL egg fails to hatch
6	**OO/S***	**RK/S**	**20 June**	**21 June**	**Preyed upon one egg while laying**
	OO/S*	RK/S	-	28 June	Abandoned one BHCO egg
	OO/S*	RK/S	-	3 July	Abandoned one BHCO egg
	OO/S*	RK/S	-	6 July	Found during deconstruction
	OO/S*	**RK/S**	**10 July**	**5 August**	**Fledged one young**
					BHCO female removed two eggs
					BHCO egg fails to hatch
7	**S/RR**	**S/OK**	**9 July**	**11 July**	**BHCO female removes two eggs while laying**
	S/RR	**S/OK**	**19 July**	**3 August**	**Two eggs fail to hatch due to BHCO**
					Adults abandon BHCO young

Table 1. continued

Colors Used: **R**= Red; **M**= Mauve; **B**=Blue; **W**=White; **G**=Green; **K**= Black; **O**=Orange; **Y**=Yellow; **S**= Silver FWS Band. Combinations are read left leg/right leg, and body to toe. BHCO=Brown-headed Cowbird, and WIFL=Willow Flycatcher. (*) denotes polygynous male. YO/S arrived on territory 4 roughly around the completion of MR/S's third attempt, and remained until the nest failed. Territory 3 male (RG/S) disappeared before GO/S initiated first nest. GO/S was banded as GB/S in 2003, celluloid bands were removed for pinstriped metal band in July.

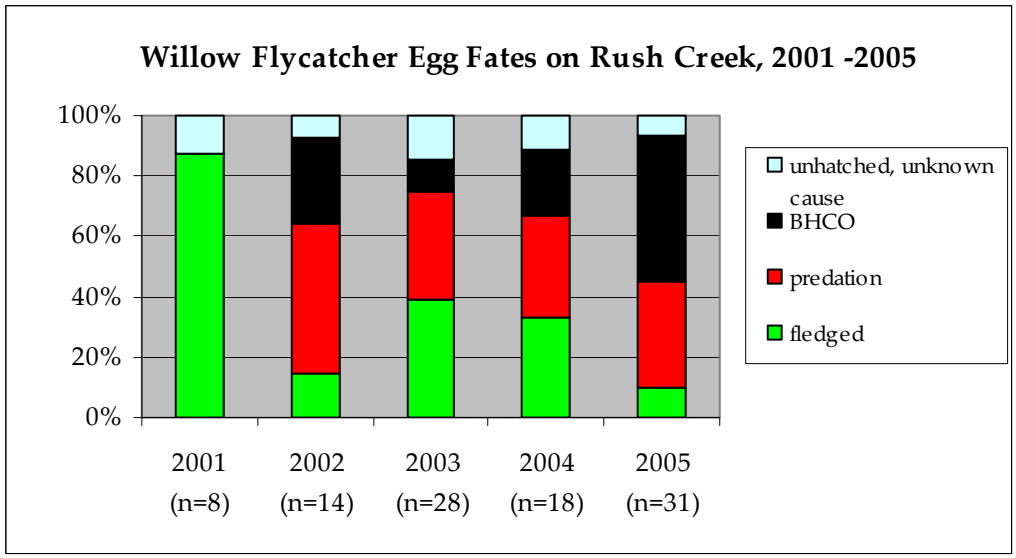
The Rush Creek population again displayed low clutch sizes in 2005, just as in 2004 (Figure 3). Low clutch size was shown to decrease nest productivity in 2004, when nests were proportionally quite successful (McCreedy 2004c).

Figure 3. Average Willow Flycatcher clutch size at Rush Creek, CA (2001-2005)



Drought conditions in 2004 possibly contributed to low Willow Flycatcher clutch sizes in that season (from Sedgwick 2000). However, Willow Flycatcher clutch sizes were also low on Rush Creek in 2005, which followed a relatively wet winter (Mono Basin Clearinghouse, prepared by the Mono Lake Committee at http://www.monobasinresearch.org/). Mathewson et al. (2005) reported that first Willow Flycatcher clutches are larger than subsequent clutches in the season. Due to multiple early-season nest failures (the majority caused by Brown-headed Cowbird parasitism and nest abandonment), only one of the nine complete clutches observed in 2005 was initiated prior to July 1. Brown-headed Cowbird activity may have precluded Willow Flycatcher females from laying large clutches in June.

Figure 4. Fates of 99 Willow Flycatcher eggs at lower Rush Creek, 2001-2005.



Less than 10% of Willow Flycatcher eggs laid in 2005 made it to fledging (Figure 4). Only uncommon circumstances prevented more losses attributable to cowbirds in 2005: two nests held cowbird young that hatched well earlier than the projected host hatch date, and each of these cowbirds was then eaten by a predator. In both nests, untouched Willow Flycatchers eggs subsequently hatched, only to later be lost to depredation as well. If not for the earlier depredation of the cowbird young, the host eggs would likely not have hatched.

The proportion of Willow Flycatcher eggs lost to non-cowbird predators has remained relatively stable throughout the study (generally below 40%, Figure 4). Nest depredation has been shown to be the leading cause of passerine nest failure by several authors (McCleod et al. 2005, Munzer et al. 2005, McKernan and Braden 2002, Heath et al. 2001), and the proportion of Willow Flycatcher eggs lost to non-cowbird predation at Rush Creek is not markedly different than results from these comparable studies.

At Rush Creek, only two of 31 (6%) eggs failed to hatch for unknown reasons in 2005, and only 10 of 99 eggs from 2001-2005 failed to hatch for unknown reasons. Mathewson et al. (2005) investigated the possibility that un-hatched Willow Flycatcher eggs may be a significant reason for low fecundity at Willow Flycatcher sites in the central Sierra Nevada. The Rush Creek Willow Flycatcher population faces several obstacles to its growth, but the problem of un-hatched eggs seems to be a relatively minor one.

Proportionally, Rush Creek's Willow Flycatcher nests faired very poorly in 2005. Only two of the fourteen nests (14%) that held Willow Flycatcher eggs ("active nests") fledged young. Table 2 presents Mayfield success estimates (Mayfield 1975, 1961) for the 2005 nests. Mayfield total nest survival in 2005 (17%) was the lowest over the course of the study.

Table 2. Willow Flycatcher nest success (*n*=14) on Rush Creek, Mono County CA, 2005.

Period	# Nests	Losses	Observer days	Standard Period Days	Daily nest survival	Total Nest Survival	Standard Error
Laying	14	5	17.5	2.5	0.714	0.43	0.11
Incubation	9	3	120.5	12	0.975	0.74	0.01
Nestling	6	4	54	13	0.926	0.37	0.04
Laying and Incubation	14	8	138	13.5	0.942	0.45	0.02
Incubation and Nestling	9	7	174.5	25	0.960	0.36	0.01
Laying, Inc, and Nestling	14	12	192	27.5	**0.938**	**0.17**	**0.02**

Table 3 details Rush Creek proportional success in relation to other Willow Flycatcher sites in California, Nevada, and Arizona.

Table 3. Willow Flycatcher study sites in California, Arizona, and Nevada, ranked by proportional nest success.

Site	Years	BHCO Control?	*n*	Proportional Nest Success (%)
ARIZONA SITES[c]	**2004**	**Some trapping***	**389**	**47**
SIERRA NEVADA DEMOGRAPHY STUDY				
Sierra Nevada Demography Study, North Sites[b]	2004	Egg addling	49	51
Sierra Nevada Demography Study, All Sites[b]	2004	Egg addling	100	44
Sierra Nevada Demography Study, Central Sites[b]	2004	Egg addling	51	37
Sierra Nevada Demography Study, Original Sites[b]	**1997-2004**	**Egg addling**	**376**	**43**
LOWER COLORADO RIVER SITES				
Bill Williams National Wildlife Refuge, AZ[a]	1997-2004	No	18	61
Pahranagat National Wildlife Refuge, NV[a]	1998-2004	Trapping	132	49
Havasu National Wildlife Refuge, CA and AZ[a]	1996-2004	Trapping	148	41
Mesquite, NV (Virgin River)[a]	1997-2004	Trapping	94	40
Mormon Mesa, NV (Virgin River)[a]	1997-2004	Trapping	103	34
All Lower Colorado River sites[a]	**1997-2004**	**Trapping**	**518**	**42**
RUSH CREEK				
Rush Creek, Mono County California	2005	No	14	14
Rush Creek, Mono County California	**2001-2005**	**No**	**35**	**37**

[a] McLeod et al. (2005)
[b] Mathewson et al. (2005)
[c] Munzer et al (2005)
Asterisk (*) denotes trapping at some sites. In Arizona, BHCO trapping occurred at Havasu National Wildlife Refuge, and the Greer/Alpine Study Area (Munzer et al.2005). BHCO trapping was initiated at Lower Colorado River Valley sites in 2003. McLeod et al. (2005) found that post-trapping, Willow Flycatcher nest success only increased at Pahranagat NWR. Other Lower Colorado River Valley sites' nest success has not responded to BHCO trapping.

Table 3 illustrates that Willow Flycatcher proportional nest success at long-term, large-scale efforts in Arizona, the north-central Sierra Nevada, and in the lower Colorado River valley (ranging from 34%-61%) was generally higher than nest success at Rush Creek (37%) over a comparable period. While proportional nest success is a key measure of Willow Flycatcher success, it is important to note that the site in Table 3 with the highest proportional nest success (Bill Williams NWR) held no Willow Flycatcher nests in 2004, likely due to drought conditions (McLeod et al. 2005).

Table 4. Willow Flycatcher study sites in California, Arizona, and Nevada, ranked by annual fecundity, the total number of fledglings produced by the total number of nesting females.

Site	Years	Percent of Active Nests Parasitized by BHCO (%)	Annual Fecundity
ARIZONA SITES[c]	**2004**	**6**	**1.69**
SIERRA NEVADA DEMOGRAPHY STUDY			
Sierra Nevada Demography Study, North Sites[b]	2004	9	1.62
Sierra Nevada Demography Study, Central Sites[b]	2004	9	1.46
Sierra Nevada Demography Study, Original Sites[b]	**1997-2004**	**10**	**1.55**
LOWER COLORADO RIVER SITES			
Pahranagat National Wildlife Refuge, NV[a]	2004	0	2.50
Mormon Mesa, NV (Virgin River)[a]	2004	17	1.00
Havasu National Wildlife Refuge, CA and AZ[a]	2004	32	0.93
Mesquite, NV (Virgin River)[a]	2004	47	0.92
All Lower Colorado River sites[a]	**2004**	**27**	**1.32**
RUSH CREEK			
Rush Creek, Mono County, California	2004	14	0.75
Rush Creek, Mono County California	2005	64	0.43
Rush Creek, Mono County California	**2001-2005**	**43**	**1.07**

[a] McLeod et al. (2005)
[b] Mathewson et al. (2005)
[c] Munzer et al (2005)
Asterisk (*) denotes trapping at some sites. In Arizona, BHCO trapping occurred at Havasu National Wildlife Refuge, and the Greer/Alpine Study Area (Munzer et al.2005). BHCO trapping was initiated at Lower Colorado River Valley sites in 2003. McLeod et al. (2005) found that post-trapping, Willow Flycatcher nest success only increased at Pahranagat NWR. Other Lower Colorado River Valley sites' nest success has not responded to BHCO trapping.

Rush Creek's Willow Flycatcher population had relatively low fecundity from 2001-2005, and very low fecundity in 2004 and 2005. Table 4 summarizes the proportion of nests parasitized by Brown-headed Cowbirds and annual host fecundity at the same sites in Table 4. Rush Creek's 2004 fecundity is included as well as that from 2005, as other fecundities reported in Table 4 are from 2004. Table 4 also demonstrates that sites with the highest annual fecundity typically have the lowest Brown-headed Cowbird parasitism.

Modeling the fecundity necessary to maintain the Rush Creek population requires additional years of productivity data (Nur et al. 1999), and the fecundity required to maintain the Rush Creek population remains unknown. While Rush Creek's fecundity was very low in 2004 and 2005, the population has managed to maintain itself during this time period (six females in 2003, eight females in 2004, seven females in 2005). Using estimated juvenile recruitment and adult survivorship rates, Mathewson et al. (2005) reported that a fecundity of 3.33 would be necessary to maintain Willow Flycatcher populations in the central Sierra Nevada. It is of note that none of the sites in Table 4 approaches a fecundity of 3.33, and additional data may revise the Demography Study's parameter estimates. Yet in any outcome, Rush Creek's 2001-2005 fecundity of 1.07 appears to be quite low.

Remarkably, the Rush Creek Territory 2 pair (RM/S and GK/S) have successfully fledged young in every season since Willow Flycatchers were first detected on Rush Creek in 2001 (five consecutive seasons, 12 total young fledged) – in spite of Rush Creek's relatively low overall productivity. The genealogy of at least 3 of Rush Creek's 12 other adults observed in 2005 can be traced back to this successful pair.

BANDING and RESIGHTING

We captured or recaptured nine adults (four of them new captures of unbanded birds) and color-banded three young in 2005. Seven of eleven (63%) 2004 color-banded adults returned in 2005. Two of six (33%) 2004 color-banded young returned in 2005. GB/S (celluloid) was captured and changed to GO/S (metal) in mid-July.

To coordinate with USFS Willow Flycatcher research in the Sierra Nevada, color combinations and estimated arrival and departure dates are presented in Table 6.

Table 5. Color combinations observed in 2005 on Rush Creek. Color combination abbreviations described in Table 1. "AHY" = After Hatch Year, and "HY" = Hatch Year. **New combinations banded in 2005 in bold type.** Asterisk (*) denotes bird that was likely present before 2005 surveys began on 5 June.

Territory	Age/Sex	Color Combination	First Encountered/Fledge	Last Seen
1	After 5th year male	RM/S	5 June*	8 August
	Third year female	S/WB	11 June*	8 August
2	After 6th year male	WR/S	5 June*	17 August
	After 6th year female	GK/S	5 June*	23 August
	HY	**S/BR**	**13 August**	**23 August**
	HY	**S/OW**	**13 August**	**23 August**
3	Fifth year male	RG/S	6 June*	6 June
	After 4th year female	**GB/S to GO/S**	**6 June***	**25 July**
4	**AHY female**	**MR/S**	**28 June**	**5 August**
	AHY male	**YO/S**	**17 July**	**5 August**
5	After 4th year male	OK/S	5 June*	10 August
	AHY female	**YY/S**	**12 June***	**10 August**
6	After 4th year male	OO/S	6 June*	9 August
	AHY female	**RK/S**	**10 June**	**19 August**
	HY	**S/YR**	**August 3**	**19 August**
7	Second year male	S/RR	21 June	3 August
	Second year female	S/OK	4 July	3 August

CHAPTER TWO: WILLOW FLYCATCHER HABITAT ASSESSMENTS

METHODS

NEST-SITE HABITAT ASSESSMENTS

In addition to demography and plumage colorimetric work on Rush Creek, the Inyo National Forest funded PRBO to assess potential Willow Flycatcher breeding locations at McGee Creek and in the June Lake loop (Figures 5a and 5b). We conducted eighty 5 m-radius non-nest vegetation assessments (at randomly generated locations) at McGee Creek (20 in each of two WIFL habitat polygons) and in the June Lake loop (10 in each of 4 WIFL habitat polygons). Vegetation assessments followed protocols described in Chapter One. We used ArcView 3.2a (ESRI 2000) to measure distances from Inyo NF flycatcher polygons to potential threats to flycatcher breeding success, such as pack stations, campgrounds, and urban areas.

Summary statistics and mean comparisons for vegetation measurements were calculated using STATA 8.0's two-sample mean comparison calculator for unequal variances (Stata Corp 2003). A list of all plant species detected is presented in Appendix B.

Figure 5a. June Lake loop Willow Flycatcher habitat polygons, Mono County, CA

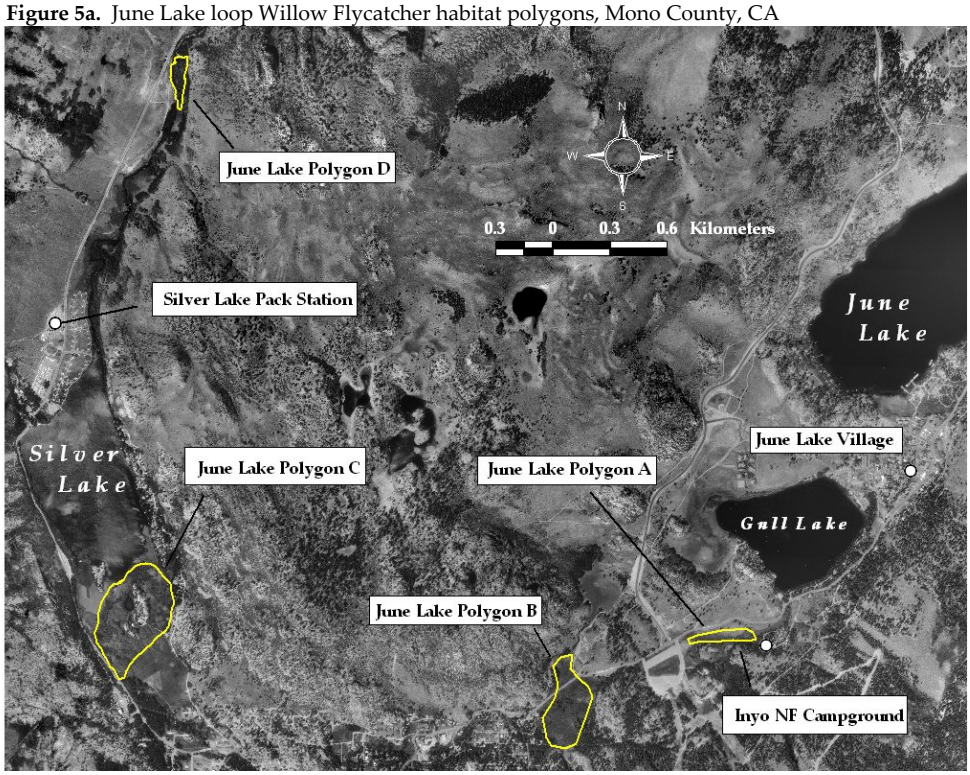
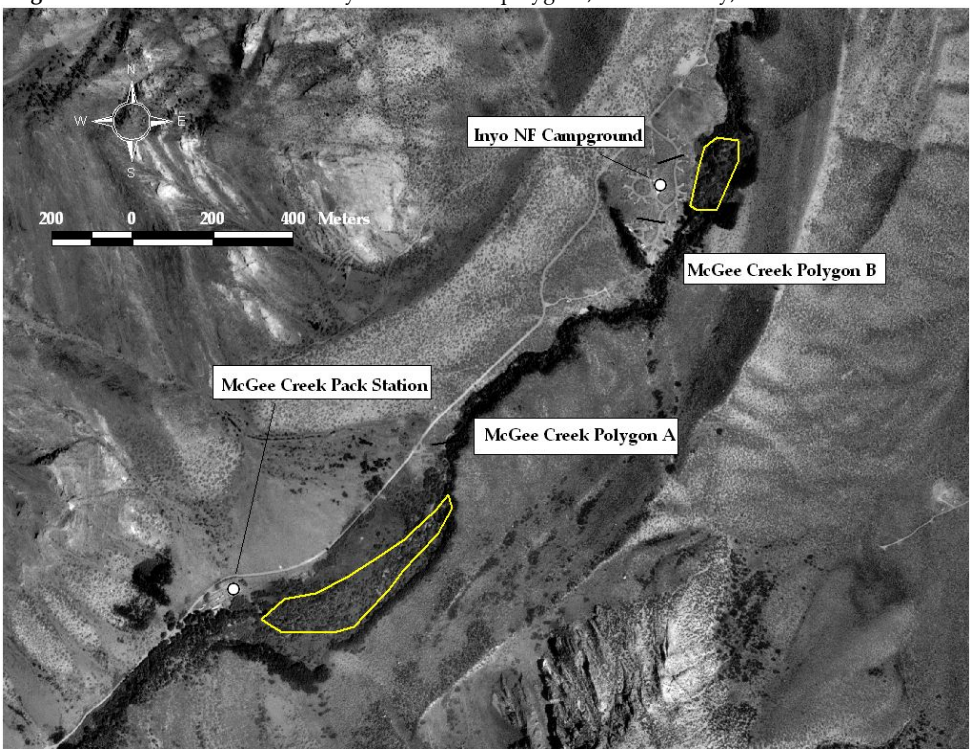


Figure 5b. McGee Creek Willow Flycatcher habitat polygons, Mono County, CA.



SITE DESCRIPTIONS

Rush Creek's habitat is in many ways different than that found at the Willow Flycatcher polygons in Figures 5a and 5b, though Rush Creek lies within 25 km of June Lake loop and 50 km of McGee Creek. It is also crucial to understand that the Rush Creek Willow Flycatcher's habitat is atypical from all other known Willow Flycatcher populations in California (McCreedy and Heath 2004). The Willow Flycatcher polygons assessed in this report were created following other known Willow Flycatcher habitat associations in the Sierra Nevada, which typically occur in wetter, sub alpine meadows.

Rush Creek

Lower Rush Creek is at roughly 6500 feet above sea level, and lies within a matrix of Great Basin Big Sagebrush scrub (Sawyer and Keeler-Wolf 1995). After decades of heavy diversion, it has been under passive restoration for 22 years. Livestock grazing, once heavy on lower Rush Creek, has been banned from the riparian corridor for over ten years by the Inyo NF and the LADWP.

Large amounts of litter from diversion-killed trees and shrubs still exist across the corridor. Many historic stream side channels have been plugged with gravel and cobbles deposited during heavy water releases (with resultant debris) by the LADWP in the 1960's and 1970's (G. Reis, personal communication). Though lower Rush Creek (often referred to as the "Rush Creek Bottomlands") has one of the widest riparian corridors in the Eastern Sierra, the

corridor's riparian vegetation can be patchy, with significant amounts of sagebrush scrub mixed within patches of riparian obligates that are supported by current and historic side channels.

Vegetation can be termed early-succesional, with the majority of vegetation under 6 m in height. Woody riparian species include (in order of abundance) Woods' Rose (*Rosa woodsii*), Narrowleaf Willow (*Salix exigua*), Yellow Willow (*Salix lutea*), Big Sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus* sp.), Shiny Willow (*Salix lucida* ssp. *lasiandra*), Buffaloberry (*Shepherdia argentea*), and Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*). Non-woody cover can be sparse, and is nearly entirely represented by graminoid species such as Creeping Wild Rye (*Leymus triticoides*), Wooly Sedge (*Carex lanuginosa*), Douglas' Sedge (*Carex douglasii*), Mexican Rush (*Juncus mexicanus*), and Nevada Rush (*Juncus nevadensis*).

June Lake

Polygons A and B

These polygons are in the Reversed Creek drainage, at roughly 7500 feet above sea level. Though surrounded by Big Sagebrush scrub, these polygons lie adjacent to stands of Lodgepole Pine (*Pinus contorta*), White Fir (*Abies concolor*), and Trembling Aspen (*Populus tremuloides*). Black Cottonwood, the largest tree species on lower Rush Creek, does not exist here. Throughout the June Lake loop polygons, Woods' Rose and Narrowleaf Willow are rare. Woods' Rose is most often found in upland transition areas, mixed with Big Sagebrush. Lodgepole Pines are encroaching into the meadows, and average canopy height is over 8 m. All of Polygon A is less than 100 m in width.

Late-summer grazing by pack station livestock has occurred repeatedly, and it was immediately apparent when visiting these polygons that grazing had occurred in the recent past (sculpted willow understories from browsing, decreased forb diversity in sections of the meadows). Polygon B in particular seemed to carry the heaviest traces of livestock grazing.

Polygons C and D

These polygons are on Rush Creek, at roughly 7200 feet above sea level. Like Polygons A and B, they exist in a matrix of Big Sagebrush, Lodgepole Pine, and Trembling Aspen. Polygon C has a large rock outcropping over 250 m in length in the center of the meadow.

Polygon C is the sole polygon assessed at June Lake or McGee Creek that may have actually held breeding Willow Flycatchers in recent years. Harris et al. (1987) reported a singing male in this polygon in the 1980's. It is the wettest of all 6 polygons assessed in this report. Much of Polygon C was inundated with over 75 cm of water during surveys on July 15. The riparian corridor at Polygon C is over 500 m in width.

Polygon D is the most overgrown of the six polygons assessed in this report, with an average canopy height of nearly 11 m, and an absolute shrub cover of 48 percent, nearly equal to that found on lower Rush Creek. Among all six polygons, its mix of willow species most closely resembled that of lower Rush Creek. Polygon D's riparian width is under 100 m.

All June Lake Polygons

Vegetation fits under Sawyer and Keeler-Wolf's (1995) Subalpine Wetland Shrub habitat series. Geyer's Willow (*Salix geyeriana*) is the most common woody shrub, with Yellow Willow,

Shiny Willow, Booth's Willow, Trembling Aspen, and gooseberry (*Ribes* sp.) as other common species.

McGee Creek

The McGee Creek polygons held several intriguing habitat affinities with habitat at Rush Creek. In addition, Joseph Grinnell and James Dixon repeatedly found territorial Willow Flycatchers in similar habitats at nearby Convict Creek (unpublished Grinnell and Dixon field notes at the Museum of Vertebrate Zoology), and McGee Creek displays a remarkable diversity of breeding riparian songbirds (Appendix A).

Polygons A and B are at roughly 7500 feet above sea level, an elevation comparable to the June Lake polygons. They also exist within a matrix of Big Sagebrush and stands of mature Trembling Aspen. However, the McGee Creek polygons lack encroaching Lodgepole Pine that is found throughout the June Lake loop, and instead contain patches of large Black Cottonwood trees. McGee Creek's polygons also most closely match the Sawyer and Keeler-Wolf (1995) Sub alpine Wetland Shrub habitat series.

Water birch (*Betula occidentalis*) occupies a significant portion of McGee Creek's shrub cover, and birch stems can often reach over 8 m in height – a structural aspect found neither at Rush Creek nor the June Lake loop.

The McGee Creek Pack Station uses Polygon A for livestock grazing, though it appeared that its horses primarily remained in drier portions of the polygon, on its northern edge (McCreedy, personal observation). Much of Polygon A bore no obvious signs of grazing, unlike Polygon B in the June Lake Loop.

The most common shrub species at McGee Creek include (from most common to least) Yellow Willow, Booth's Willow, Water Birch, Geyer's Willow, Woods' Rose, Shiny Willow, and gooseberry (*Ribes* sp.)

BREEDING CONFIRMATION AT POLYGON SITES, AND BHCO SURVEYS

The Inyo NF requested all-bird species lists and Brown-headed Cowbird surveys at June Lake and McGee Creek Willow Flycatcher polygons. A PRBO biologist visited sites in the June Lake loop on June 29 and July 15, and the McGee Creek on June 30 and July 12. In addition, all bird species detected during vegetation assessments in late August at June Lake loop and McGee Creek were also noted. Species lists are detailed in Appendix A.

Breeding status was determined for all species encountered at all study sites between June 29 and September 12, 2005. These statuses were supplemented by those reported by Heath et al. (2001), who surveyed the same sections of McGee Creek from 1998-2000. Species were ranked by site, using the following four criteria of the Riparian Habitat Joint Venture breeding scale, modified from breeding bird atlas criteria (see Shuford 1993 or http://www.prbo.org/calpif/plans.html.)

0 No evidence of breeding: Species not detected during its breeding season, or detected in habitat known only as stopover habitat.

2 Possible breeding: Individual encountered singing or acting territorial only once during the breeding season (in suitable habitat).

3 Probable breeding: Singing individual encountered on two or more different days of standardized censuses (at least one week apart); territorial behavior noted more than once at the same location; pair observed in courtship behavior.

1 Confirmed breeding: Distraction display; nest building (except woodpeckers and wrens); fecal sac carry or repeated food carries by adult; dependent juveniles with adults; active nest observed.

Cowbird surveys represent absolute counts of all Brown-headed Cowbirds detected per time spent in the field. As cowbirds express overlapping home ranges, some individuals may have been double counted – thus this is only an index of cowbird activity, not an absolute count. Cowbird surveys were conducted as long as cowbirds were present in the season at Rush Creek, and at all visits in June and July to June Lake and McGee Creek sites.

RESULTS AND DISCUSSION

RUSH CREEK NEST-SITE HABITAT ASSESSMENTS

Lower Rush Creek is now in its 22nd year of passive restoration. Its Willow Flycatcher population has demonstrated habitat characteristics that are unique to those reported elsewhere in California (McCreedy and Heath 2004). These included a predilection for Woods' Rose (*Rosa woodsii*) dominated sections of lower Rush Creek and a significantly greater nest distance to water (signaling a use of drier habitat) than observed at other sites in California.

In addition, McCreedy (2004b) identified several Rush Creek nest site characteristics that were significantly different from habitat characteristics at randomly selected non-nest sites on lower Rush Creek.

In 2005, the Willow Flycatcher population at Rush Creek exhibited habitat preferences similar to those reported in 2004. Nest distance to water averaged 87 m (n = 24, SD = 69m). All 24 nests were constructed in Woods' Rose, and to date, 100% of n = 66 nests found on lower Rush Creek (2001-2005) have been built in Woods' Rose.

Though the width of riparian habitat at nests was not significantly greater at nest sites than at non-nest sites in 2005, riparian width was again greater than 250 m. It is of key importance to recognize that only 218 of 610 riparian point count stations across the rest of the Eastern Sierra Nevada had riparian widths greater than 100 m (McCreedy 2004b). Heath and Ballard (2003) underscored the importance of riparian width when they found a positive correlation between riparian songbird diversity and riparian corridor width over 28 Eastern Sierra streams. Nearly all of the other significant differences between nest and non-nest sites found in McCreedy 2004b held in 2005 (Table 6).

Table 6. Nest and non-nest percent-absolute vegetation cover, species richness, percent-absolute ground cover, canopy measurements, and larger-scale distance means, with *t* and *P*-values for *n*=24 Willow Flycatcher nests and *n*=40 non-nest vegetation plots at lower Rush Creek, 2005). **All variables listed in bold type held significantly different (at *p*<0.05) means between nest and non-nest sites**. See Methods for variable descriptions.

	Nest		Non-Nest			
Variable	**Mean**	**SD**	**Mean**	**SD**	***t*-value**	***P*-value**
SHRUB COVER	**81.96**	***15.80***	**49.80**	***25.80***	**6.18**	**<0.0001**
Woods' Rose Cover	**41.10**	***26.04***	**13.58**	***19.81***	**4.46**	**0.0001**
Big Sagebrush Cover	**2.18**	***4.66***	**7.63**	***9.75***	**-3.01**	**0.004**
Rabbitbrush Cover	**.95**	***2.06***	**3.72**	***7.37***	**2.24**	**0.03**
All Willow Cover	**36.53**	***22.42***	**22.71**	***25.45***	**2.27**	**0.03**
NON-WOODY COVER	39.42	*30.30*	27.58	*29.06*	1.54	0.13
SPECIES RICHNESS						
Shrub Richness	**3.00**	***1.18***	**3.73**	***1.22***	**-2.37**	**0.02**
Non-woody Richness	**3.17**	***2.37***	**6.33**	***4.84***	**-3.49**	**0.009**
GROUND COVER						
Litter	**92.92**	***5.94***	**55.93**	***32.54***	**7.00**	**<0.0001**
Litter depth (mm)	**201**	***126***	**66**	***130***	**4.09**	**.0002**
Rock	**0.50**	***2.45***	**7.25**	***16.80***	**-2.50**	**0.02**
Bare Ground	**1.50**	***2.67***	**18.63**	***23.43***	**-4.57**	**<0.0001**
Water	**1.88**	***6.72***	**10.48**	***22.35***	**-2.27**	**0.0277**
CANOPY COVER	17.27	*23.37*	10.28	*14.93*	1.31	.20
Canopy Height	5.34	*1.35*	5.62	*3.15*	-0.49	0.62
Densiometer Cover	**83.16**	***12.32***	**20.25**	***28.63***	**12.15**	**<0.0001**
DISTANCE MEASURES						
Width Riparian (m)	260.17	*29.05*	228.85	*97.39*	1.90	0.06
Distance to Water (m)	**87.42**	***68.98***	**40.6**	***49.43***	**2.91**	**0.006**

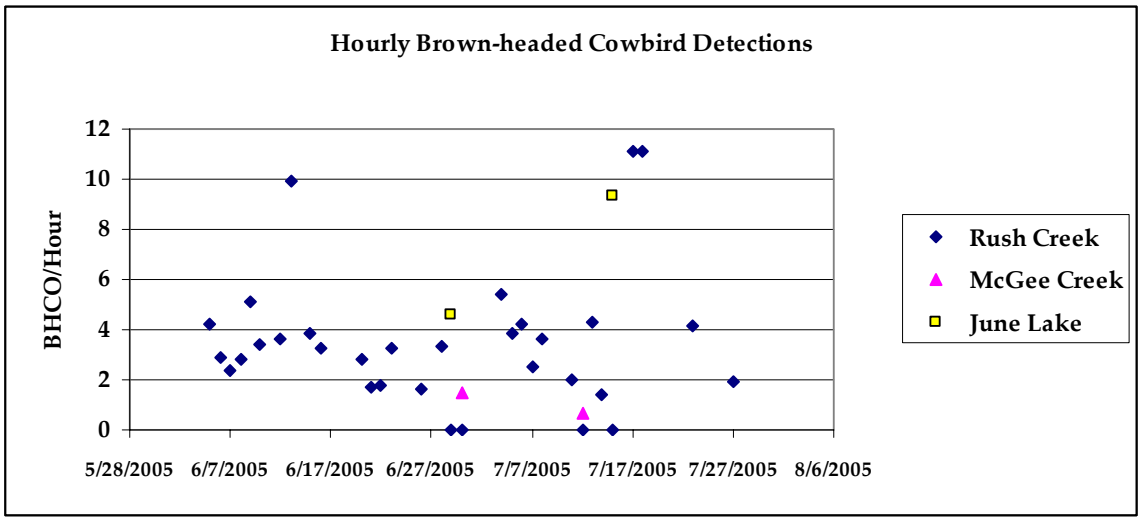
Nests in 2005 held significantly more non-woody cover, and significantly less Woods' Rose cover than in 2003-2004 (t = -3.32, P = 0.002; t = 2.80, P = 0.007, respectively). Nests in 2005 held close to significantly more Narrowleaf Willow cover than in 2003-2004 (t = -1.75, P = 0.09). These changes are primarily the result of a decrease in number of nesting attempts in monotypic Woods' Rose fields between 2003-2004 and 2005. Causes of this change include the loss of an old female which repeatedly nested in monotypic Woods' Rose for a third-year female that has never nested in monotypic Woods' Rose (Table 1, Territory 1). In addition, the Territory 2 female (GK/S) was intimidated into abandoning a repeatedly-used rose field by a pair of Northern Harriers (*Circus cyaneus*) which built their own nest in the middle of the rose field. After abandoning her first nest (which she built only eight meters from the harrier nest), GK/S eventually sought cover under Narrowleaf Willows that edge the rose field.

COMPARISON OF RUSH CREEK TO WIFL HABITAT POLYGONS AT JUNE LAKE AND MCGEE CREEK

Cowbird Surveys and Anthropogenic Threats

Willow Flycatchers were not detected at any of the June Lake nor McGee Creek polygons in 2005. An index of Brown-headed Cowbird activity at Rush Creek, June Lake Loop, and McGee Creek is presented in Figure 6.

Figure 6. Brown-headed Cowbird activity on Rush Creek and at Willow Flycatcher habitat polygons in June Lake Loop and at McGee Creek, Mono County, CA (2005).



Rush Creek hourly cowbird detections averaged 3.98 (SD = 2.60, min= 1.38, max = 11.13). Cowbird activity at June Lake polygons was higher than the Rush Creek average on both visits, while McGee Creek cowbird activity was lower than the Rush Creek average on both visits. An active Yellow Warbler nest was found parasitized at McGee Creek Polygon A on June 30, 2005, and two Yellow Warbler females were observed feeding Brown-headed Cowbird juveniles at June Lake Polygon C on July 15.

As shown, Brown-headed Cowbirds had a major impact at lower Rush Creek in 2005. Rothstein et al. (2003) reported that Brown-headed Cowbirds feed in the presence of domestic livestock, at campgrounds, suburban areas with lawns and bird feeders, and at golf courses. Anderson et al. (2005) used the Silver Lake Pack Station (Figure 5a) as a location to reliably catch and band large numbers of cowbirds for a regional, long-term color-banding study. In addition, PRBO biologists have observed color-banded cowbirds in riparian areas across the Mono Basin - birds that were originally banded in nearby residential areas (PRBO data).

Brown-headed Cowbirds commute from riparian hosts' breeding grounds in the morning to feeding areas in the afternoon (Rothstein et al. 2003). Commuting distances can be over 14 km, but were typically less than 7 km in the Mono Basin and near Mammoth Lakes, CA (Anderson et al. 2005), and are most often 2-4 km (Rothstein et al. 2003). At Rush Creek, a

grazing moratorium has been in place for over ten years (McCreedy and Heath 2004), and there is only a handful of livestock that graze within 10 km of Rush Creek. Indeed, it is somewhat troubling that the Rush Creek Willow Flycatcher population experienced such high parasitism in 2005, for the only known anthropogenic subsidization of Rush Creek's Brown-headed Cowbirds occurs in the small town of Lee Vining, over 5 km from Rush Creek.

Table 7 summarizes possible anthropogenic threats to Willow Flycatcher nesting success. In addition to subsidizing cowbirds, human development subsidizes potential nest predators such as corvids, rodents, and domestic cats. Power lines present over riparian habitat provide hunting perches for corvids and cowbirds.

Table 7. Summary of potential anthropogenic threats at a known Willow Flycatcher breeding site (Rush Creek) and at potential Willow Flycatcher habitat at June Lake Loop and McGee Creek (see Figures 5a and 5b for location of polygons, Pack stations, and nearby development.

Site	Closest Urban Development (km)	Riparian Grazing?	Closest Pack Station (km)	Closest Campground (km)	Power lines Present?
Rush Creek	5.2	No	>15	8.5	No
June Lake Polygon A	1.0	Yes	3.7	0.1	No
June Lake Polygon B	0.1	Yes	3.3	0.8	Yes
June Lake Polygon C	0.4	No	1.4	2.1	Yes
June Lake Polygon D	2.4	No	1.3	0.4	No
McGee Creek Polygon A	7.0	Yes	0.1	0.1	No
McGee Creek Polygon B	7.3	No	1.4	0.8	No

Table 7 illustrates that all six Willow Flycatcher polygons lie amidst a mix of anthropogenic threats, many of which are not present in equal measure at Rush Creek. In particular, all polygons at June Lake Loop and McGee Creek lie within 5 km of large, actively operating pack stations.

June Lake and McGee Creek: Habitat Assessments

Nest sites at Rush Creek contain much higher overall shrub, riparian understory and Woods' Rose cover than at non-use or at Inyo NF polygons (Tables 8 and 9). Even with the addition of gooseberry in the understory at McGee and June Lake, riparian understory (complied from non-willow woody species such as Woods' Rose, gooseberry, and snowberry) and overall shrub cover are just a fraction of those covers found at Rush Creek. Absolute willow cover was not significantly different between June Lake and McGee polygons and Rush Creek nest sites, but there was no significant difference in absolute willow cover between nest and non-nest sites at Rush Creek as well.

Though riparian widths between June Lake and Rush Creek points were comparable, two of the June Lake polygons do not reach 100 m in width. The June Lake Loop polygons' wet,

open aspect is further reflected in Table 8 through high surface water cover, low shrub cover, high non-woody cover, and high non-woody species richness.

Table 8. Nest and non-nest percent-absolute vegetation cover, species richness, percent-absolute ground cover, canopy measurements, and larger-scale distance means, with *t* and *P*-values for *n*=24 Willow Flycatcher nests and *n*=40 non-nest vegetation plots at lower Rush Creek, and *n*=40 non-nest vegetation plots at June Lake (2005). See Methods for variable descriptions.

	Nest		Rush Creek Non-Nest		June Lake	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
SHRUB COVER	81.96	*15.80*	49.80	*25.80*	35.93	29.38
Woods' Rose Cover	41.10	*26.04*	13.58	*19.81*	0.53	1.54
Great Basin Sagebrush Scrub	3.13	*6.04*	12.95	*16.50*	5.63	22.07
Gooseberry Cover	0	*0*	0	*0*	0.811	1.91
Riparian Understory Cover	41.10	*26.04*	13.58	*19.81*	1.45	2.37
All Willow Cover	36.53	*22.42*	22.71	*25.45*	30.41	29.80
NON-WOODY COVER	39.42	*30.30*	27.58	*29.06*	71.53	31.12
SPECIES RICHNESS						
Shrub Richness	3.00	*1.18*	3.73	*1.22*	2.65	2.12
Non-woody Richness	3.17	*2.37*	6.33	*4.84*	8.85	5.48
GROUND COVER						
Litter	92.92	*5.94*	55.93	*32.54*	59.53	38.42
Litter depth (mm)	201	*126*	66	*130*	50	96.73
Water	1.88	*6.72*	10.48	*22.35*	30.35	40.30
CANOPY COVER	17.27	*23.37*	10.28	*14.93*	15.50	20.49
Canopy Height	5.34	*1.35*	5.62	*3.15*	8.57	6.83
Densiometer Cover	83.16	*12.32*	20.25	*28.63*	35.62	33.51
DISTANCE MEASURES						
Width Riparian (m)	260.17	*29.05*	228.85	*97.39*	214.78	203.76
Distance to Water (m)	87.42	*68.98*	40.6	*49.43*	11.78	16.63

Table 9. Nest and non-nest percent-absolute vegetation cover, species richness, percent-absolute ground cover, canopy measurements, and larger-scale distance means, with *t* and *P*-values for *n*=24 Willow Flycatcher nests and *n*=40 non-nest vegetation plots at lower Rush Creek, and *n*=40 non-nest vegetation plots at McGee Creek (2005). See Methods for variable descriptions.

	Nest		Rush Creek Non-Nest		McGee Creek	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
SHRUB COVER	81.96	*15.80*	49.80	*25.80*	42.93	26.69
Woods' Rose Cover	41.10	*26.04*	13.58	*19.81*	3.54	5.10
Great Basin Sagebrush Scrub	3.13	*6.04*	12.95	*16.50*	0.75	0.47
Gooseberry Cover	0	*0*	0	*0*	1.77	3.27
Riparian Understory Cover	41.10	*26.04*	13.58	*19.81*	5.86	8.60
All Willow Cover	36.53	*22.42*	22.71	*25.45*	29.50	25.05
NON-WOODY COVER	39.42	*30.30*	27.58	*29.06*	70.88	27.81
SPECIES RICHNESS						
Shrub Richness	3.00	*1.18*	3.73	*1.22*	3.75	1.51
Non-woody Richness	3.17	*2.37*	6.33	*4.84*	14.95	3.96
GROUND COVER						
Litter	92.92	*5.94*	55.93	*32.54*	77.15	23.69
Litter depth (mm)	201	*126*	66	*130*	88	91.71
Water	1.88	*6.72*	10.48	*22.35*	14.83	22.90
CANOPY COVER	17.27	*23.37*	10.28	*14.93*	21.45	18.42
Canopy Height	5.34	*1.35*	5.62	*3.15*	8.82	4.43
Densiometer Cover	83.16	*12.32*	20.25	*28.63*	54.23	24.24
DISTANCE MEASURES						
Width Riparian (m)	260.17	*29.05*	228.85	*97.39*	185.63	56.45
Distance to Water (m)	87.42	*68.98*	40.6	*49.43*	10.80	13.48

Though average riparian width at McGee Creek was less than 200 m, it was still relatively high when compared to other alluvial fan creeks in the Eastern Sierra Nevada (McCreedy 2004b). Surface water coverage was not significantly different from non-nest points at Rush Creek, though distance to water (in part because of a narrower riparian corridor) is much lower than that at Rush Creek.

McGee Creek's polygons possessed remarkably high non-woody cover and diversity, yet held relatively high shrub and canopy (foliage over 5m in height) cover for their high non-woody diversity. McGee Creek's structural diversity – Black Cottonwood, Trembling Aspen, and Jeffrey Pine trees over 15 meters in height, Yellow Willow and Water Birch commonly six to nine meters in height, Geyer's, Booth's, Shiny, and Yellow Willow between two and six meters in height, well-developed Woods' Rose and gooseberry understory under the willows, and lush non-woody coverage was most reminiscent of Rush Creek nest sites among all polygons surveyed.

CONCLUSION

The Mono Basin Willow Flycatcher Project seeks to compile six years of demographic data (as suggested in Nur et al. 1999) to build an adequate investigation into the reoccupation of the Mono Basin by this California State Endangered Species and USFS Sensitive Species. Furthermore, the repopulation of Rush Creek, a riparian corridor under long-term restoration (McCreedy and Heath 2004), provides critical insight into what this declining species requires in riparian restoration projects in arid habitats.

In 2005, only three flycatcher young fledged, and only two of these fledglings likely made it to independence (McCreedy, personal observation). Low clutch sizes, heavy Brown-headed Cowbird parasitism, and low nest success combined to significantly decrease Willow Flycatcher productivity. Fecundity (fledglings produced per female) remained well below 1.00 for the second consecutive year, and compared to other Willow Flycatcher sites in California, Nevada, and Arizona, Rush Creek has one of the lowest productivities observed. If productivity remains at its current levels, there is some doubt that the Rush Creek population can continue to maintain itself, let alone act as a source population for other sites in the Eastern Sierra Nevada.

PRBO assessed potential Willow Flycatcher habitat in the June Lake loop and at McGee Creek. While these sites lack breeding Willow Flycatchers and face anthropogenic threats not present at lower Rush Creek, habitat quality appears to be generally high. Save Willow Flycatchers, nearly every other riparian songbird species that breeds at lower Rush Creek also breeds at polygons in the June Lake loop and at McGee Creek. The absence of breeding Willow Flycatchers at these sites may simply stem from the lack of a regional source population that can provide recruits to inhabit these unoccupied sites.

Nonetheless, habitat at June Lake loop and McGee Creek is somewhat different than nesting habitat found at lower Rush Creek. We have identified habitat differences between nest sites at Rush Creek and habitat polygons at June Lake and McGee Creek that are compelling. Yet Joseph Grinnell's observations of territorial Willow Flycatchers at Convict Creek in the early twentieth century are important here, for they demonstrate that Willow Flycatchers successfully overcame these habitat differences in the past.

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APPENDIX A

Appendix A. Breeding status of all species detected at June Lake and McGee Creek INF Willow Flycatcher habitat polygons, June-August, 2005. McGee Creek statuses supplemented with statuses reported by Heath et al. (2001) stemming from 1998-2000 surveys on the same portions of McGee Creek. Species with breeding confirmed in **bold type**. Species are ordered in accordance with the 2003 American Ornithological Union (AOU) 2003 checklist. (1) = Confirmed breeding. (3) = Probable breeding. (2) = Possible breeding. (0) = No evidence of breeding. (~) = Not detected. See methods for further explanation of codes.

SPECIES (Common Name)	SCIENTIFIC NAME	JUNE LAKE	McGEE CREEK
Mallard	***Anas platyrhnchos***	**1**	**1**
Northern Pintail	*Anas acuta*	~	0
Green-winged Teal	*Anas crecca*	0	~
Blue Grouse	*Dendragapus obscurus*	~	2
California Quail	*Callipepla californica*	~	0
Great Blue Heron	*Ardea herodias*	0	~
Black-crowned Night Heron	*Nycticorax nycticorax*	0	~
Turkey Vulture	*Cathartes aura*	~	0
Osprey	*Pandion haliaetus*	0	~
Cooper's Hawk	*Accipiter cooperii*	0	~
Northern Goshawk	*Accipiter gentilis*	~	0
Red-tailed Hawk	***Buteo jamaicensis***	~	**1**
Golden Eagle	*Aquila chrysaetos*	~	0
American Kestrel	***Falco sparverius***	**~**	**1**
American Coot	*Fulica americana*	3	**~**
Killdeer	***Charadrius vociferus***	**~**	**1**
Willet	*Catoptrophorus semipalmatus*	**~**	0
Wilson's Snipe	*Gallinago delicata*	0	2
California Gull	*Larus californicus*	0	**~**
Mourning Dove	*Zenaida macroura*	**~**	0
Common Nighthawk	*Chordeiles minor*	**~**	0
White-throated Swift	*Aeronautes saxatalis*	**~**	0
Black-chinned Hummingbird	*Archilochus alexandri*	**~**	2
Costa's Hummingbird	*Calypte costae*	**~**	2
Calliope Hummingbird	***Stellula calliope***	**2**	**1**
Rufous Hummingbird	*Selasphorus rufus*	**~**	0
Belted Kingfisher	*Ceryle alcyon*	0	**~**
Lewis' Woodpecker	***Melanerpes lewis***	**~**	**1**
Williamson's Sapsucker	*Syphirapicus thyroideus*	**~**	0
Red-breasted Sapsucker	***Syphirapicus ruber***	**1**	**3**
Downy Woodpecker	***Picoides pubescens***	**~**	**1**
Hairy Woodpecker	***Picoides villosus***	**0**	**1**

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SPECIES (Common Name)	SCIENTIFIC NAME	JUNE LAKE	McGEE CREEK
Northern Flicker	***Colaptes auratus***	**3**	**1**
Olive-sided Flycatcher	*Contopus cooperii*	~	0
Western Wood-pewee	***Contopus sordidulus***	**1**	**1**
Willow Flycatcher	*Empidonax traillii*	~	0
Hammond's Flycatcher	*Empidonax hammondii*	~	0
Dusky Flycatcher	***Empidonax oberholseri***	~	**1**
Western Flycatcher	*Empidonax difficilis*	~	2
Black Phoebe	*Sayornis nigricans*	~	0
Cassin's Vireo	*Vireo cassinii*	0	2
Warbling Vireo	*Vireo gilvus*	3	3
Philadelphia Vireo	*Vireo philadelphicus*	~	2
Steller's Jay	*Cyanocitta stelleri*	3	0
Clark's Nutcracker	*Nucifraga columbiana*	2	0
Common Raven	***Corvus corax***	**2**	**1**
Tree Swallow	*Tachycineta bicolor*	2	0
Violet-green Swallow	***Tachycineta thalassina***	**2**	**1**
Cliff Swallow	*Petrochelidon pyrrhonata*	~	0
Mountain Chickadee	*Poecile gambeli*	3	2
White-breasted Nuthatch	*Sitta carolinensis*	2	~
Pygmy Nuthatch	*Sitta pygmaea*	0	~
Brown Creeper	***Certhia americana***	~	**1**
Bewick's Wren	*Thryomanes bewickii*	~	2
House Wren	***Troglodytes aedon***	**3**	**1**
Marsh Wren	*Cistothorus palustris*	0	~
American Dipper	*Cinclus mexicanus*	~	2
Ruby-crowned Kinglet	*Regulus calendula*	0	~
Mountain Bluebird	***Sialia currucoides***	~	**1**
Townsend's Solitaire	*Myadestes townsendi*	~	0
Swainson's Thrush	*Catharus ustulatus*	~	0
Hermit Thrush	*Catharus guttatus*	~	3
American Robin	***Turdus migratorius***	**1**	**1**
Sage Thrasher	*Oreoscoptes montanus*	0	~
European Staling	***Sturnus vulgaris***	**2**	**1**
Orange-crowned Warbler	***Vermivora celata***	**2**	**1**
Nashville Warbler	*Vermivora ruficapilla*	0	~
Yellow Warbler	***Dendroica petechia***	**1**	**1**

Appendix A. Breeding status of all species detected at June Lake and McGee Creek Willow Flycatcher habitat polygons, June-August, 2005. McGee Creek statuses supplemented with statuses reported by Heath et al. (2001) stemming from 1998-2000 surveys on the same portions of McGee Creek. Species with breeding confirmed in **bold type**. Species are ordered in accordance with the 2003 American Ornithological Union (AOU) 2003 checklist. (1) = Confirmed breeding. (3) = Probable breeding. (2) = Possible breeding. (0) = No evidence of breeding. (~) = Not detected. See methods for further explanation of codes.

SPECIES (Common Name)	SCIENTIFIC NAME	JUNE LAKE	McGEE CREEK
Yellow-rumped Warbler	*Dendroica coronata*	1	2
Townsend's Warbler	*Dendroica townsedii*	~	0
American Redstart	*Setophaga ruticilla*	~	0
MacGillivray's Warbler	***Oporornis tolmiei***	**1**	**3**
Common Yellowthroat	*Geothlypis trichas*	0	~
Wilson's Warbler	*Wilsonia pusilla*	0	2
Yellow-breasted Chat	***Icteria virens***	~	2
Western Tanager	*Piranga ludoviciana*	2	0
Green-tailed Towhee	***Pipilo chlorurus***	**3**	**1**
Spotted Towhee	*Pipilo maculatus*	0	3
Chipping Sparrow	*Spizella passerina*	0	~
Brewer's Sparrow	***Spizella breweri***	**3**	**1**
Sage Sparrow	*Amphispiza belli*	~	2
Fox Sparrow	***Passerella iliaca***	**3**	**1**
Song Sparrow	***Melospiza melodia***	**1**	**1**
Lincoln's Sparrow	*Melospiza lincolnii*	~	0
Dark-eyed Junco	*Junco hyemalis*	0	~
White-crowned Sparrow	*Zonotrichia leucophrys*	0	~
Black-headed Grosbeak	*Pheucticus melanocephalus*	3	2
Lazuli Bunting	*Passerina amoena*	~	3
Red-winged Blackbird	*Agelaius phoeniceus*	3	3
Brewer's Blackbird	***Euphagus cyanocephalus***	**2**	**1**
Brown-headed Cowbird	***Molothrus ater***	**1**	**1**
Bullock's Oriole	*Icterus bullockii*	~	3
Cassin's Finch	***Carpodacus cassinii***	3	2
Pine Siskin	*Carduelis pinus*	2	~
Lesser Goldfinch	***Carduelis psaltria***	~	**1**

APPENDIX B

Appendix B. Plant species encountered during habitat assessments.

SCIENTIFIC NAME	COMMON NAME	FAMILY
Abies concolor (Gord. & Glend.) Lindl. ex Hildebr.	white fir	Pinaceae
Achillea millefolium L.	common yarrow	Asteraceae
Achnatherum Beauv.		Poaceae
Achnatherum hymenoides (Roemer & J.A. Schultes) Ba	Indian rice grass	Poaceae
Aconitum columbianum Nutt.	Columbian monkshood	Ranunculaceae
Agrostis idahoensis Nash	Idaho bentgrass	Poaceae
Allium L.	wild onion	Liliaceae
Allium nevadense S. Wats.	Nevada onion	Liliaceae
Amelanchier utahensis Koehne	Utah serviceberry	Rosaceae
Aquilegia formosa Fisch. ex DC.	western columbine	Ranunculaceae
Arabis L.	rockcress	Brassicaceae
Arnica L.	arnica	Asteraceae
Artemisia douglasiana Bess.	Douglas' sagewort	Asteraceae
Artemisia ludoviciana Nutt.	Louisiana sagewort	Asteraceae
Artemisia tridentata Nutt.	big sagebrush	Asteraceae
Astragalus L.	milkvetch	Fabaceae
Betula occidentalis Hook.	water birch	Betulaceae
Bromus tectorum L.	cheatgrass	Poaceae
Carex douglasii Boott	Douglas' sedge	Cyperaceae
Carex lanuginosa Michx.	woolly sedge	Cyperaceae
Carex nebrascensis Dewey	Nebraska sedge	Cyperaceae
Castilleja Mutis ex L. f.	Indian paintbrush	Scrophulariaceae
Cercocarpus ledifolius var. intermontanus N. Holmg	curlleaf mountain mahogany	Rosaceae
Chenopodium L.	goosefoot	Chenopodiaceae
Chenopodium nevadense Standl.	Nevada goosefoot	Chenopodiaceae
Chrysothamnus Nutt.	rabbitbrush	Asteraceae
Cicuta douglasii (DC.) Coult. & Rose	western water hemlock	Apiaceae
Cirsium scariosum Nutt.	meadow thistle	Asteraceae
Cirsium vulgare (Savi) Ten.	bull thistle	Asteraceae
Cryptantha Lehm. ex G. Don	cryptantha	Boraginaceae
Eleocharis R. Br.	spikerush	Cyperaceae
Elymus elymoides ssp. elymoides (Raf.) Swezey		Poaceae
Elymus glaucus ssp. glaucus Buckl.	blue wildrye	Poaceae
Epilobium angustifolium L.	fireweed	Onagraceae
Epilobium ciliatum Raf.	hairy willowherb	Onagraceae
Epilobium L.	willowweed	Onagraceae
Equisetum arvense L.	field horsetail	Equisetaceae
Equisetum laevigatum A. Braun	smooth horsetail	Equisetaceae
Eriastrum sparsiflorum (Eastw.) Mason	Great Basin woolstar	Polemoniaceae
Erigeron aphanactis var. aphanactis (Gray) Greene	rayless shaggy fleabane	Asteraceae
Erigeron L.	fleabane	Asteraceae
Eriogonum ampullaceum J.T. Howell	Mono buckwheat	Polygonaceae
Eriogonum saxatile S. Wats.	hoary buckwheat	Polygonaceae
Eriogonum umbellatum Torr.	sulphur wild buckwheat	Polygonaceae
Festuca L.	fescue	Poaceae
Fragaria L.	strawberry	Rosaceae
Gayophytum ramosissimum Torr. & Gray	pinyon groundsmoke	Onagraceae

Appendix B. Plant species encountered during habitat assessments.

SCIENTIFIC NAME	COMMON NAME	FAMILY
Gentianopsis holopetala (Gray) Iltis	Sierran fringed gentian	Gentianaceae
Helenium L.	sneezeweed	Asteraceae
Heracleum lanatum Michx.	= Heracleum maximum	Apiaceae
Hesperostipa comata ssp. comata (Trin. & Rupr.) Ba		Poaceae
Holodiscus microphyllus Rydb.	= Holodiscus discolor	Rosaceae
Hordeum L.	barley	Poaceae
Iris missouriensis Nutt.	Rocky Mountain iris	Iridaceae
Juncus mexicanus Willd. ex J.A. & J.H. Schultes	Mexican rush	Juncaceae
Juncus nevadensis S. Wats.	Nevada rush	Juncaceae
Juncus phaeocephalus Engelm.	brownhead rush	Juncaceae
Juniperus occidentalis var. australis (Vasek) A.&	western juniper	Cupressaceae
Lepidium L.	pepperweed	Brassicaceae
Leptodactylon pungens (Torr.) Torr. ex Nutt.	granite pricklygilia	Polemoniaceae
Leymus triticoides (Buckl.) Pilger	beardless wildrye	Poaceae
Lilium kelleyanum J.G. Lemmon	Kelley's lily	Liliaceae
Linum lewisii var. lewisii Pursh	Lewis' flax	Linaceae
Lupinus lepidus Dougl. ex Lindl.	Pacific lupine	Fabaceae
Lupinus polyphyllus var. burkei (S. Wats.) C.L. Hi	= Lupinus burkei ssp. burkei	Fabaceae
Machaeranthera canescens ssp. canescens var. canes	cutleaf goldenweed	Asteraceae
Mentha L.	mint	Lamiaceae
Mimulus guttatus DC.	seep monkeyflower	Scrophulariaceae
Mimulus primuloides Benth.	primrose monkeyflower	Scrophulariaceae
Muhlenbergia filiformis (Thurb. ex S. Wats.) Rydb.	pullup muhly	Poaceae
Oenothera elata ssp. hirsutissima (Gray ex S. Wats	Hooker's evening primrose	Onagraceae
Penstemon Schmidel	penstemon	Scrophulariaceae
Pinus contorta Dougl. ex Loud.	lodgepole pine	Pinaceae
Pinus jeffreyi Grev. & Balf.	Jeffrey pine	Pinaceae
Platanthera leucostachys Lindl.	bog orchid	Orchidaceae
Poa pratensis L.	Kentucky bluegrass	Poaceae
Polemonium occidentale Greene	western polemonium	Polemoniaceae
Populus balsamifera ssp. trichocarpa (Torr. & Gray	black cottonwood	Salicaceae
Populus tremuloides Michx.	quaking aspen	Salicaceae
Populus trichocarpa Torr. & Gray ex Hook.	= Populus balsamifera ssp. trichocarpa	Salicaceae
Potentilla glandulosa ssp. nevadensis (S. Wats.) K	Nevada cinquefoil	Rosaceae
Potentilla gracilis var. fastigiata (Nutt.) S. Wat		Rosaceae
Prunus andersonii Gray	desert peach	Rosaceae
Purshia tridentata (Pursh) DC.	antelope bitterbrush	Rosaceae
Ribes cereum var. cereum Dougl.	wax currant	Grossulariaceae
Rosa woodsii Lindl.	Woods' rose	Rosaceae
Rumex crispus L.	curly dock	Polygonaceae
Salix boothii Dorn	Booth's willow	Salicaceae
Salix exigua Nutt.	sandbar willow	Salicaceae
Salix geyeriana Anderss.	Geyer's willow	Salicaceae
Salix laevigata Bebb	willow	Salicaceae
Salix lucida ssp. lasiandra (Benth.) E. Murr.	Pacific willow	Salicaceae
Salix lutea Nutt.	yellow willow	Salicaceae
Salsola tragus L.	= Salsola kali ssp. tragus	Chenopodiaceae
Scirpus microcarpus J.& K. Presl	panicled bulrush	Cyperaceae

Appendix B. Plant species encountered during habitat assessments.

SCIENTIFIC NAME	COMMON NAME	FAMILY
Senecio hydrophilus Nutt.	water groundsel	Asteraceae
Senecio triangularis Hook.	arrowleaf groundsel	Asteraceae
Shepherdia argentea (Pursh) Nutt.	silver buffaloberry	Elaeagnaceae
Sidalcea oregana (Nutt. ex Torr. & Gray) Gray	Oregon checkermallow	Malvaceae
Sisymbrium irio L.	Londonrocket	Brassicaceae
Sisyrinchium idahoense Bickn.	Idaho blue-eyed grass	Iridaceae
Smilacina stellata (L.) Desf.	= Maianthemum stellatum	Liliaceae
Solidago californica Nutt.	California goldenrod	Asteraceae
Solidago canadensis ssp. elongata (Nutt.) Keck	= Solidago canadensis var. salebrosa	Asteraceae
Sphenosciadium capitellatum Gray	woolly head parsnip	Apiaceae
Stellaria longipes var. longipes Goldie	longstalk starwort	Caryophyllaceae
Stephanomeria spinosa (Nutt.) S. Tomb	thorn skeletonweed	Asteraceae
Symphoricarpos rotundifolius var. rotundifolius Gr	roundleaf snowberry	Caprifoliaceae
Taraxacum G.H. Weber ex Wiggers	dandelion	Asteraceae
Thalictrum fendleri var. fendleri Engelm. ex Gray	Fendler's meadow rue	Ranunculaceae
Tiquilia nuttallii (Hook.) A. Richards.	Nuttall's coldenia	Boraginaceae
Tragopogon dubius Scop.	yellow salsify	Asteraceae
Trifolium L.	clover	Fabaceae
Trifolium longipes Nutt.	longstalk clover	Fabaceae
Trifolium variegatum Nutt.	whitetip clover	Fabaceae
Triglochin concinnum Burtt-Davy	Utah arrowgrass	Juncaginaceae
Typha L.	cattail	Typhaceae
Urtica dioica ssp. holosericea (Nutt.) Thorne	stinging nettle	Urticaceae
Verbascum thapsus L.	common mullein	Scrophulariaceae
Vicia americana ssp. americana Muhl. ex Willd.	American vetch	Fabaceae