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Mono Basin Willow Flycatcher Project
2003-2004 Habitat Characteristics Summary

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SUMMARY

In 2003, PRBO Conservation Science (PRBO) completed the first year of the Mono Basin Willow Flycatcher Project (MBWFP). The project is designed to study 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 California State Endangered (CDFG 1993) and a United States Forest Service Region V Sensitive Species. There are only approximately 500 known Willow Flycatcher territories remaining in California today (McCreedy and Heath, *in revision*).

Lower Rush Creek holds the only known active breeding population of Willow Flycatchers in the Inyo NF. The Inyo NF has requested a summary of territory and nest-site habitat characteristics found on Rush Creek, to guide its conservation efforts of this declining species. This report summarizes and discusses data gathered from 33 nest vegetation plots in 2003 and 2004, 41 non-nest vegetation plots in 2003 and 2004, and from transect sampling of 6 territories in 2003. While additional plot and transect data are recommended in order to minimize sample variances to produce stronger results, vegetation data gathered in 2003 and 2004 provides useful insight into Willow Flycatcher habitat characteristics found on lower Rush Creek.

Willow Flycatchers on Rush Creek display preferences for high Wood's Rose (*Rosa woodsii*) cover, lower (but still significant) willow cover, and low sagebrush scrub-associated species cover at the territory scale. Nest sites held significantly higher Wood's Rose cover than at randomly generated non-nest sites, and significantly less Big Sagebrush and Rabbitbrush cover than non-nest sites. From 2001-2004, all 42 detected nests (McCreedy and Heath *in revision* and PRBO data) were built in Wood's Rose – the only other records of Willow Flycatchers nesting in rose in California were collected in the Mono Basin as well, prior to 1941 water diversions to Los Angeles. While two territories held significant patches of wet meadow, nest sites together held significantly less graminaceous cover than non-nest sites. Finally, nest-sites held significantly less shrub species richness and non-woody species richness than non-nest sites. At the territory level, nearly two-thirds of vegetation did not exceed 3 m in height.

Width of the riparian corridor was significantly higher at nest sites than at non-nest sites, and the mean width of the riparian corridor at nest sites was 277 m. In contrast, 64% of PRBO riparian point count stations in the Eastern Sierra had a riparian width of less than 100m.

Contrary to other reports in California, Willow Flycatchers do not display any significant preference for the presence of surface water on lower Rush Creek. Breeding territories averaged 59 m from water from 2001-2004 (McCreedy and Heath *in revision* and PRBO data).

INTRODUCTION

From June through August 2003, PRBO documented 7 territorial males on lower Rush Creek, and six females. Thirteen territorial adults on lower Rush Creek represent the highest summer population since Willow Flycatchers were first documented on Rush by PRBO biologists in 2000.

Thirteen total nests were located on six territories. Of these 13 nests, eight nests held Willow Flycatcher eggs (thus termed "active nests"). Four of eight active nests fledged young. Five of the thirteen total nests were parasitized by the Brown-headed Cowbird (*Molothrus ater*), yet four of the five parasitized nests were abandoned by the host flycatcher female. The fifth nest was reconstructed to bury the cowbird egg (McCreedy 2004).

PRBO, in partnership with the Inyo NF, completed the second year of the MBWFP in August 2004. From June through August 2004, PRBO again documented 7 territorial males on lower Rush Creek. However, this season the Rush Creek population increased to eight mated females, over six in 2003. In addition, a second-year male (color-banded as a nestling in 2003) was sighted singing in multiple locations on 3 July, bringing the 2004 population total to eight males and females – the fourth straight year the Rush Creek Willow Flycatcher population has increased (McCreedy and Heath *in revision*, McCreedy 2004).

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.

Willow Flycatcher nests were located and monitored at least once every four days, following protocols described in Martin and Geupel (1993) and Martin et al. (1997). On each visit to the nest, nest contents were recorded, and Brown-headed Cowbird parasitism noted. After nesting was complete, 5 m-radius vegetation plots centered on the nest were assessed also following Martin et al. (1997), and forty-one (thirty in 2003, and eleven in 2004) randomly-generated non-nest 5-m radius vegetation plots were completed to pair with nest vegetation assessments.

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. In addition, 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 be over 5 m in height and have a diameter at breast height (DBH) of at least 8 cm. Finally, width of the riparian corridor at nest and non-nest points was measured using color aerial photographs (provided by Ecosystem Sciences 2000) with ArcView GIS (ESRI 2000).

Means and standard errors for absolute covers, tree stem counts, and width of riparian measurements were calculated using STATA 8.0 (Stata Corp 1999) for n=33 nest plots and n=41 non-nest plots and compared for significant difference using the program CONTRAST (Hines and Sauer 1989).

To assess territory habitat characteristics, line intercept transects were completed for six of seven territories. Cover type (to species) and cover height extents along transects were recorded, and absolute cover type proportions and relative height class proportions were calculated by dividing cover type and cover height extents by total transect lengths across each territory. Transects were spaced 20 m apart, running north-south across each territory, irrespective of riparian corridor geography, and were set on UTM NAD83 coordinates (724000, 724020, 724040, etc.).

RESULTS AND DISCUSSION

Willow Flycatchers on lower Rush Creek express nest-site and territory habitat preferences that are anomalous to accounts reported in California (McCreedy and Heath, *in revision*). In particular, nests and territories are strongly correlated with the presence of Wood's Rose, and there is no apparent correlation between territory location and the presence of surface water. In California, over 87% (n= 670) of located Willow Flycatcher nests were built in willow (*Salix* spp.) (Greene et al. 2003, Williams and Craig 1998), yet on Rush Creek, 42 out of 42 nests located from 2001-2004 were constructed in Wood's Rose. Interestingly, only four other California Willow Flycatcher nesting records of Wood's Rose as substrate exist – and all are from the Mono Basin, collected prior to the beginning of municipal water diversions to the City of Los Angeles in 1941 (Western Foundation of Vertebrate Zoology records). In addition, a summary of California Willow Flycatcher data reported that water is always present on subspecies *brewsteri* territories, while subspecies *extimus* territories averaged a distance of 21 m to water (Williams and Craig 1998). Yet on lower Rush Creek, 18 breeding territories from 2001-2004 averaged 59 m from surface water (PRBO data).

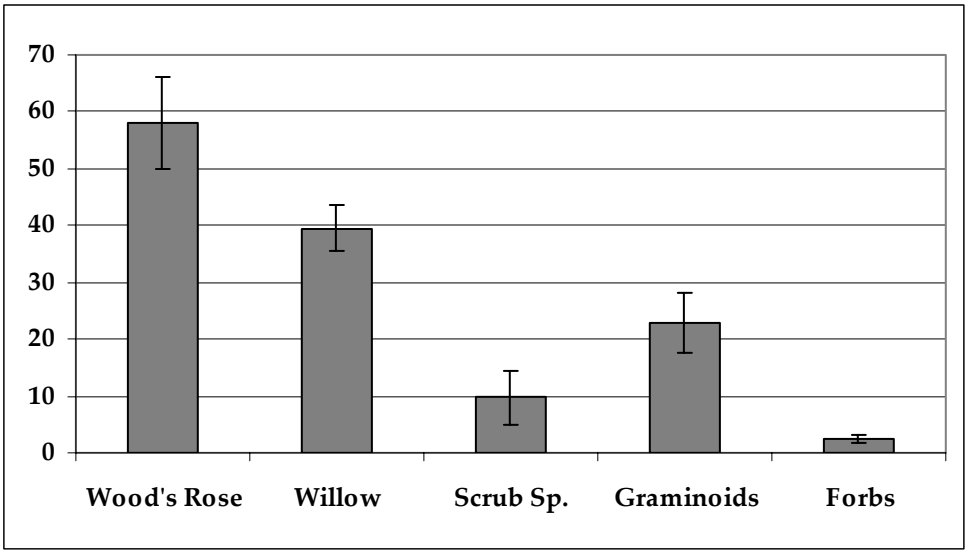
Territory Vegetation

Each lower Rush Creek Willow Flycatcher territory had a significant Wood's Rose component. On Rush Creek, Wood's Rose is most often found in the understory of Narrowleaf Willow (*Salix exigua*) stands, and as monotypic rosefields that can stretch up to 90 m across (CM pers. obs.). All save one Willow Flycatcher territory possessed at least one monotypic stand of Wood's Rose, the exception with absolute Wood's Rose coverage still comprising 42% of the territory, found in the understory of several stands of Narrowleaf Willow. Figure 1 presents mean absolute covers of major territory cover types.

Willow Flycatcher habitat on lower Rush Creek corresponds well with the "Narrowleaf Willow-Rose Patch Type" defined in McBain and Trush's *Monitoring Results and Analyses for Runoff Season 2002-2003. Mono Basin Tributaries: Lee Vining, Rush, Walker, and Parker Creeks* (2003:52). The report defines this patch type as: "Narrowleaf willow dominates the canopy and understory of this patch type. Wood's rose is a co-dominant plant species in the shrub and herb layers. Yellow willow and shiny willow are infrequent associates in the shrub layer. Over 80% of

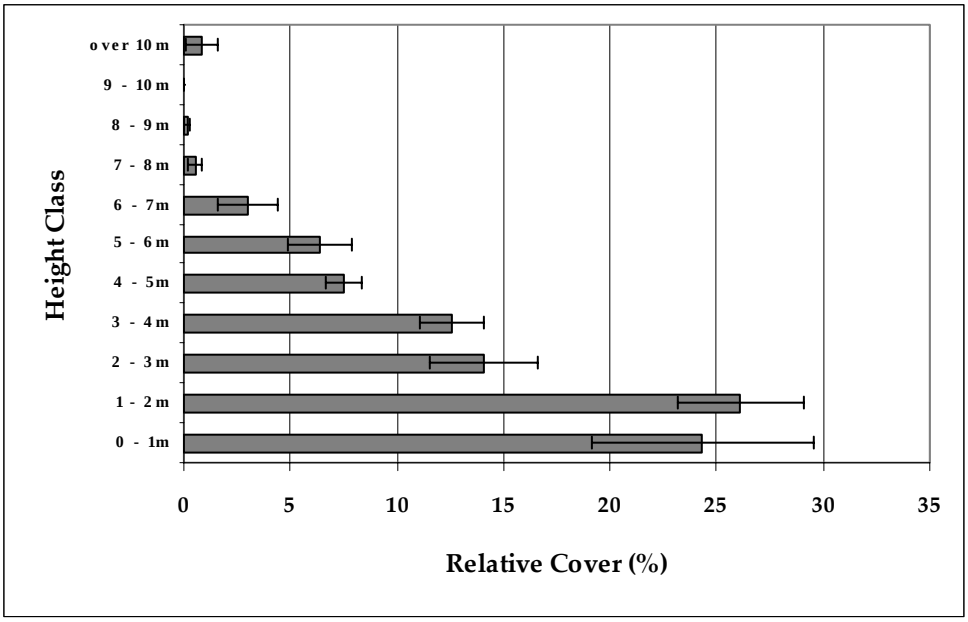
sampled transects identified as belonging to the Narrowleaf Willow – Wood's Rose patch type are currently found on Rush Creek. Narrowleaf Willow – Wood's Rose patches are correlated with contemporary low terraces up to Pre-1941 terraces. Narrowleaf Willow – Wood's Rose patches are likely to be found in drier sites where groundwater is slightly higher than that available through local precipitation alone or have been recharged through channel re-watering. Narrowleaf Willow – Wood's Rose patches are infrequently flooded, about every five years."

Figure 1. Absolute cover (with standard errors) of major territory cover types for *n*=6 Willow Flycatcher territories on lower Rush Creek, 2003. "Willow" groups three willow species: Narrowleaf Willow (*Salix exigua*), Yellow Willow,(*Salix lutea*), and Shiny Willow (*Salix lucida*). "Scrub Sp." groups sagebrush scrub - associated species: Big Sagebrush (*Artmesia tridentata*), Rabbitbrush (*Chrysothamnus* spp.), and Bitterbrush (*Purshia tridentata*). "Forbs" groups several non-woody, non-grassy species such as Star-flowered Solomon's Seal (*Smilacina stellata*), Lupine (*Lupinus lepidus*), and Wooley Mullein (*Verbascum thapsus*).



While accruing 125 hours of Willow Flycatcher activity budget data in 2003 (McCreedy 2003), males were frequently observed singing from snags standing over monotypic Wood's Rose stands, or from taller willows surrounding monotypic rosefields (CM pers. obs.). Both males and females were frequently observed flycatching from perches above or adjacent monotypic rosefields, and several nests from 2001-2004 have been constructed within or on the periphery of these same stands of Wood's Rose.

Figure 2. Mean relative territory cover by height class for *n*=6 Willow Flycatcher territories on lower Rush Creek, 2003. Figure 2 presents relative territory cover by height class. A plant whose maximum height is less than 1 m would fall in the "0 – 1m" class, a large willow whose maximum height is 6.2 m would fall in the "6 – 7m" class. Thus, 26% of the mean territory vegetative cover stood at 1 – 2m in height.



Though lower Rush Creek is in the twenty-first year of passive restoration following over forty years of municipal water diversions, its riparian habitat is best described as "early succesional". Unlike nearby Lee Vining Creek, the majority of lower Rush Creek's Black Cottonwoods (*Populus trichocarpa*) are resprouts from diversion survivors, and not seedling regeneration (McBain and Trush 2003). The tallest willows on lower Rush Creek rarely exceed 7 m in height (CM pers. obs.). Figure 2 illustrates that nearly two-thirds of the vegetation on six Willow Flycatcher territories did not exceed 3 m in height. Wood's Rose generally stands at 0.5 – 3 m (Hickman 1993), and comprises the majority of this crucial understory. Willows make up the majority of vegetation over 3 m in height, with the exception of Black Cottonwood trees (found on two territories) standing over 10 m in height. Though graminoids and forbs cover roughly 25% of Willow Flycatcher territories (Figure 1), only two territories held significant meadow patches of *Juncus, Carex*, and Poaceous grasses – these meadows accounting for roughly 35% of total mean territory graminoid cover and 48 % of 0-1 m cover. The majority of graminoids found on Willow Flycatcher territories are represented by Wooly Sedge (*Carex languinosa*), *Juncus mexicanus*, and Squirrel tail (*Elymus elymoides ssp. elymoides*) existing in the understories and on the margins of willow and rose stands.

Surface water was found on only two territories, comprising less than one percent of total mean relative territory cover.

Nest Vegetation

Table 1. Nest and non-nest plot means, with χ^2 and *P*-values for *n*=33 Willow Flycatcher nests and *n*=41 non-nest vegetation plots at lower Rush Creek, 2003-2004. **Bold** type denotes variables with nest and non-nest means significantly different at $p<0.05$. Degrees of freedom = 1 for each variable. See Methods for variable descriptions.

	Nest		Non-Nest			
Variable	**Mean**	**SE**	**Mean**	**SE**	**X^2-value**	***P*-value**
Shrub Cover	**90.21**	***1.94***	**58.49**	***4.12***	**48.50**	**<0.001**
Wood's Rose Cover	**61.44**	***4.96***	**17.33**	***4.07***	**47.31**	**<0.001**
Big Sagebrush Cover	**0.28**	***0.14***	**10.53**	***2.45***	**17.42**	**<0.001**
Rabbitbrush Cover	**0.71**	***0.36***	**3.65**	***0.98***	**7.94**	**0.005**
All Willow Cover	25.53	*4.30*	26.11	*3.39*	0.01	0.916
Non-Woody Cover	**14.67**	***4.17***	**34.87**	***5.09***	**9.42**	**0.002**
Grass Cover	**1.63**	***0.84***	**8.26**	***1.71***	**12.14**	**0.0005**
Carex Cover	6.04	*1.89*	12.85	*2.98*	3.74	0.053
Juncus Cover	3.63	*2.34*	9.70	*2.18*	3.60	0.058
All Graminoid Cover	**11.30**	***3.45***	**30.82**	***4.92***	**10.54**	**0.001**
Forb Cover	3.37	*1.21*	4.04	*1.18*	0.16	0.691
Shrub Richness	**2.45**	***0.18***	**3.59**	***0.19***	**18.89**	**<0.001**
Non-woody Richness	**1.58**	***0.34***	**3.80**	***0.46***	**15.29**	**<0.001**
Cottonwood Trees	0	*0*	0.46	*0.30*	2.35	0.128
Buffaloberry Trees	**0.36**	***0.16***	**0**	***0***	**5.05**	**0.025**
All Willow Trees	5.73	*2.48*	4.61	*1.45*	0.15	0.698
Litter	**95.09**	***1.55***	**72.41**	***4.15***	**26.15**	**<0.001**
Rock	**0.48**	***0.33***	**8.05**	***2.43***	**9.54**	**0.002**
Bare Ground	**1.09**	***0.62***	**7.93**	***2.30***	**8.21**	**0.004**
Water	**0.91**	***0.91***	**5.98**	***2.34***	**4.07**	**0.044**
Width Riparian	**276.55**	***6.68***	**221.89**	***12.74***	**14.43**	**<0.001**

Table 1 illustrates the critical importance of high Wood's Rose cover in Willow Flycatcher nest-site selection on lower Rush Creek – which is reflected in high total shrub cover as well. Equally striking is the lack of difference in willow cover between nest and non-nest plots. While Willow Flycatchers have been repeatedly correlated to willows on their breeding grounds in California, it is Wood's Rose - and not willows – that Rush Creek's Willow Flycatchers are keying into at the nest-site level. However, it is important not to underestimate the importance of large stands of Narrowleaf, Yellow, and Shiny Willow to Willow Flycatcher presence on Rush Creek. Average width of the riparian corridor at the nest is 278 m, and willows covered nearly 40% of six territories in 2003. As willow territory cover is greater than willow nest cover at a difference that is nearly significant (p=0.019, χ^2=5.55, d.f.=1), it may be that while Wood's Rose provides crucial nest protection in the understory, the combination of willows standing over and adjacent to Wood's Rose stands provide song perches, flycatching perches, and microclimate for additional foraging opportunities. These results compare well with a Colorado study (Sedgwick and Knopf

1992), in which females selected areas of high (willow) density and more uniform patch size and height, while males selected areas with large song perches amidst shrubs of variable size.

Table 1 also illustrates Willow Flycatcher predilection for nest sites lacking Big Sagebrush and Rabbitbrush cover. As lower Rush Creek is still in restoration after decades of water diversion, significant sagebrush and associated scrub patches still exist within the riparian corridor. McBain and Trush (2003) found Big Sagebrush to be the most frequently sampled plant on Lee Vining, Rush, Parker, and Walker Creeks (Wood's Rose was second). Yet Willow Flycatcher nest plots possessed less than 1% absolute cover of both Big Sagebrush and Rabbitbrush – and nearly all of this was dead scrub, drowned by the increasing water table and shaded out by competing Wood's Rose and willow (PRBO data).

Willow Flycatcher nest sites have significantly less non-woody cover than random non-nest sites for all graminoids, forbs, and grass (Poaceae) cover. This difference is likely related to high shrub cover at the nest-site, which results in sparse non-woody ground cover and thick litter layers. Indeed, absolute litter cover was also significantly higher at nest over non-nest sites. This is also reflected in significantly *lower* shrub and forb species richness at the nest-site versus non-nest points (Table 1).

Though Willow Flycatcher nest plots held slightly higher tree stem counts than non-nest plots, this difference was not significant. It does not appear that Willow Flycatchers are preferentially selecting nest sites in taller, and perhaps older, vegetation on Rush Creek.

Willow Flycatcher nests are found in significantly wider stretches of the lower Rush Creek riparian corridor than at non-nest points. Of equal importance may be the great width of the lower Rush Creek corridor in general, in respect to other drainages in the Inyo National Forest. PRBO's Eastern Sierra Riparian Songbird Conservation Project found 392 of 610 (64.3%) riparian point count stations in the Eastern Sierra to have riparian width of less than 100 m (PRBO data). Average riparian width at Willow Flycatcher nests at lower Rush Creek was 276.55 m, and average riparian width at non-nest sites was 221.89 m. Heath and Ballard (2003) also found positive correlation between riparian songbird diversity and riparian width over 28 Eastern Sierra streams.

CONCLUSION

The Rush Creek Willow Flycatcher population represents an apparent reoccupation of a high desert riparian corridor under passive restoration (McCreedy and Heath *in revision*). Restoration activities have included a grazing moratorium in place for over ten years, a return to constant streamflow, opening of historic side channels, and occasional planting of coarse debris in the streambed (McCreedy and Heath *in revision*, Ridenhour 1997). While it is difficult to quantify the effect each of these activities has had on the success of Willow Flycatchers on lower Rush, they have combined to create riparian habitat that currently supports the only known breeding population of Willow Flycatchers in the Inyo NF.

Together, these data provide important insight into Willow Flycatcher habitat on lower Rush Creek. Territories are generally comprised of vegetation less than 3 m in height, with a mix of Wood's Rose and willow (most often Narrowleaf Willow). Territories nearly always hold significant, monotypic stands of Wood's Rose. A smaller component of taller vegetation, nearly all of it willow, makes up much of the remainder of the territories' vegetative cover. Territories may hold patches of wet meadow, but the majority of them do not. Surface water covered only an average of 1% total mean territory cover, and was only found on 2 of 6 territories.

Up to present, nests are always located in Wood's Rose, generally around 1.1 m in height (n=42). Rose generally makes up the majority of vegetative cover around the nest, though many nests are constructed in rose under an additional canopy of willows.

Willow Flycatcher habitat on lower Rush Creek is well-described by the "Narrowleaf Willow – Wood's Rose" patch type, in which Narrowleaf Willow and Wood's Rose are co-dominants with infrequent Yellow Willow and Shiny Willow mixed in (McBain and Trush 2003). The patch type is not especially wet in comparison to other types found on lower Rush Creek, yet is supported by a slightly higher groundwater table that has been recharged by returned flow to Rush Creek and through infrequent flooding (*ibid*). Its expansion and complexity is likely maintained by the absence of livestock grazing in the Mono Basin National Forest Scenic Area.

While this report is presented to give beginning insight into Willow Flycatcher habitat characteristics on lower Rush Creek, population sample sizes are still small. Increased sample sizes will present the Inyo NF with a clearer picture of the Willow Flycatcher recovery on Rush Creek. Additional unoccupied Willow Flycatcher habitat exists on Rush Creek, as well as in other riparian areas of the Mono Basin. Once the Rush Creek Willow Flycatcher population becomes firmly established, and assuming other demographic factors including productivity and survivorship remain high enough to support population expansion, lower Rush Creek can provide a source population for the reoccupation of similar habitats in the Eastern Sierra.

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