



Produced by The Institute for Bird Populations'
Sierra Nevada Bird Observatory

Using bird monitoring to inform meadow restoration at Hope Valley

December 3, 2012

Helen Loffland and Rodney Siegel

The Institute for Bird Populations
P.O. Box 1346
Point Reyes Station, CA 94956

www.birdpop.org



Above: White-crowned Sparrow nest in Lower Hope Valley

Table of Contents

Introduction.....	3
Methods.....	4
Willow Flycatcher Surveys.....	4
Multi-species Bird Monitoring	5
Vegetation Monitoring.....	5
Results.....	6
Willow Flycatcher Surveys.....	6
Multi-species Bird Monitoring	9
Vegetation Monitoring.....	17
Discussion.....	19
Recommendations.....	21
Acknowledgments.....	27
Literature Cited	27
Appendix A: Species list and total count of individuals detected during point count surveys in Upper and Lower Hope Valley during 2010 and 2012.....	29
Appendix B: Index of abundance (no. individuals/no. of stations) for bird species observed in Upper and Lower Hope Valley during surveys in 2010 and 2012.	32

Introduction

This report summarizes the results of multi-species bird monitoring in 2010 and 2012 at Upper and Lower Hope Valley and at reference sites at Red Lake Creek, Faith Valley, and Upper Charity Valley (Figure 1). Also included are the results of broadcast surveys for Willow Flycatcher at Upper and Lower Hope Valley in 2012. We use these survey results to provide specific recommendations to improve habitat conditions for Willow Flycatcher and other focal bird species.

During the summer of 2012 The Institute for Bird Populations (IBP) utilized two separate bird survey and monitoring protocols within the Hope Valley project area to assess which bird species are currently present at the site, and to provide pre-restoration baseline data for the area. These protocols included the Bombay et al (2003a) document entitled *A Willow Flycatcher Survey Protocol for California*, and the Loffland et al. (2011a) document entitled *Avian monitoring protocol for Sierra Nevada meadows: a tool for assessing the effects of meadow restoration on birds*. The first is a targeted single-species survey protocol used to determine the presence/absence of Willow Flycatchers and the approximate number of territories and their locations. The second protocol is used to assess and describe the larger bird community and to detect population level changes in meadow-associated bird species in response to restoration activities.

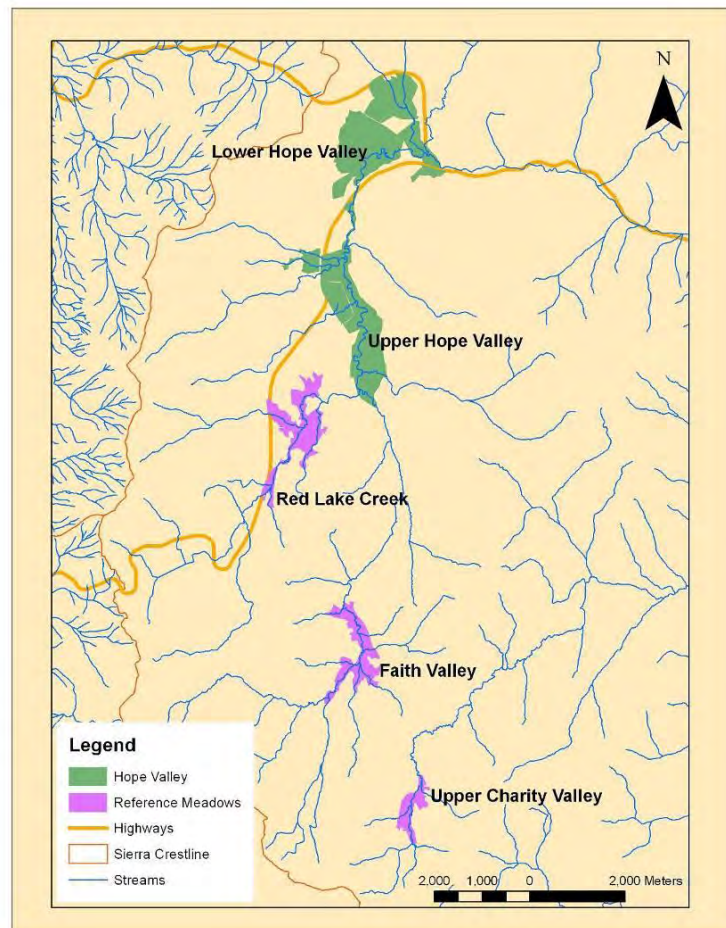


Figure 1. Upper and Lower Hope Valley and 3 reference meadows surveyed for birds in 2010 and 2012.

METHODS

Willow Flycatcher Surveys

To survey for the presence of Willow Flycatchers, Bombay et al. (2003) requires two survey visits be completed between June 1 and July 15, with one of the visits during the mandatory survey period 2 (June 15 to July 1) (Table 1). This mandatory period coincides with the time when Willow Flycatchers are most likely to be in the reproductive stage when singing rates, and therefore detection probabilities, are highest. The other visit can occur either before or after survey period 2 depending on the elevation and phenology of the site. Hope Valley occurs at an elevation on the east slope that makes either survey period 1 or 3 appropriate depending on the timing of snowmelt.

Table 1. Willow Flycatcher survey periods following Bombay et al. 2003a. Surveyors have the option of conducting one of the two visits in Survey Period 1 or in Survey Period 3.

Survey Period 1	Survey Period 2 Mandatory	Survey Period 3
June 1 – June 14	June 15 – June 25	June 26 – July 15th

Survey stations were delineated within the meadow along transects that parallel the stream channel or areas of shrubby riparian vegetation. Stations were placed 50m apart, and located only in the areas where riparian shrubs (usually willow) occur. Upper Hope Valley is very large, but with a few exceptions riparian shrubs occur primarily along stream channels, with vast areas outside of the stream corridor lacking shrubs. Almost all stations occur along 3 transects paralleling the West Fork of the Carson River and the associated tributaries. There are a few areas where willows are absent or very sparsely scattered. These areas did not receive Willow Flycatcher survey stations because the willow coverage was not adequate to provide habitat for Willow Flycatcher.

Lower Hope Valley has a similar survey station configuration as Upper Hope Valley, with most stations situated within the floodplain of the West Carson River. However this site has a substantial willow component that occurs in upland areas that are kept saturated by springs. Transects were also placed within each willow area occurring outside of the floodplain.

Survey activities at each station included a 6-minute period of broadcasting recordings of Willow Flycatcher vocalizations, and listening for a response (Figure 2). If Willow Flycatchers were detected at a survey station the location of the bird was documented, and nearby survey stations were eliminated during this visit to avoid excessive disturbance to individual birds. The same activities were repeated during the second survey visit.



Figure 2. IBP intern broadcasting Willow Flycatcher vocalizations during surveys in Lower Hope Valley.

Multi-Species Bird Monitoring

Multi-species monitoring (all bird species) in the meadows of Hope Valley followed Loffland et al. 2011a, and consisted of two primary methods: point counts and area searches. Point counts were conducted at survey stations spaced 250m apart, and all individuals of all species seen or heard were counted during a 7-minute period. Area searches consisted of slowly walking through the entire meadow tallying all birds by species. In addition to bird monitoring, basic vegetative assessments were completed at each station.

Surveys were completed twice in 2010 and twice in 2012 (Loffland et al 2011a, 2011b). By collecting data in multiple pre-restoration years we are improving our ability to detect and interpret any population changes that occur as a result of future restoration activities. This monitoring protocol uses a Before, After, Control, Impact (B.A.C.I.) design requiring that nearby reference sites not scheduled for restoration also be monitored. By collecting data at reference sites we hope to distinguish bird population changes that occur as a result of restoration, from those occurring across the local population due to other factors not related to restoration efforts. Therefore, the same multi-species monitoring protocol was applied at Red Lake Creek, Faith Valley and Upper Charity Valley as part of a larger IBP study funded by the National Fish and Wildlife Foundation. Only summary results for those reference sites will be reported here, but complete results for these additional reference sites can be found in Loffland et al (2011b) and Loffland et al (in preparation).

Vegetation Monitoring

We estimated vegetation, bare ground, water within 50m of all multi-species point count stations following Loffland et al. (2011a). Cover classes were averaged across four 50-m diameter quadrants at each point count station, and then averaged across all points within a meadow. These metrics are intended to serve as a point of reference for bird species counts and indices but are not intended to replace vegetation monitoring specific to meadow restoration. General habitat characteristics that are important to focal bird species were selected for ocular estimation and those variables of special importance are riparian shrub cover and water cover.

Similarly, measures of sagebrush and bare ground provide a rough index of the extent of severely disturbed area within a meadow.

RESULTS

Willow Flycatcher Surveys

In 2010 we incorporated a brief broadcast of the Willow Flycatcher song at every point count station following completion of multi-species point counts, however full protocol surveys following Bombay et al. (2003a) were not completed. No Willow Flycatchers were detected during multi-species surveys in 2010.

In 2012 we embarked on full protocol surveys following Bombay et al (2003a) and a total of 102 and 93 survey stations were originally delineated using GIS for the Willow Flycatcher surveys in Upper Hope Valley and Lower Hope Valley, respectively. Final station numbers and locations were adjusted slightly when field reconnaissance indicated that additional stations were needed, or previously identified stations were unnecessary or unsuitable. After field-based adjustments were made, both Lower and Upper Hope Valley had 98 survey stations each (Figures 3 and 4). The first visit to Upper Hope Valley occurred on June 15 and 16, 2012, and the second visit on July 10, 11, and 13, 2012 (Table 2). Lower Hope Valley was surveyed on June 17 and 18, and again on July 12 and 13, 2012. Despite using multiple observers these sites required more than one morning to survey. No Willow Flycatchers were detected in either Upper or Lower Hope Valley in 2012.

Table 2. Dates for Willow Flycatcher surveys in Upper and Lower Hope Valley in 2012.

Site	2012	
	First Visit	Second Visit
Upper Hope Valley	6/15/2012	7/10/2012
	6/16/2012	7/11/2012
		7/13/2012
Lower Hope Valley	6/17/2012	7/12/2012
	6/18/2012	7/13/2012

Knowledge about nearby breeding sites is relevant to the Hope Valley restoration project as it provides information on the relative likelihood that Willow Flycatchers will find and colonize newly created habitat post-restoration. On July 10, 11, and 12, 2010, we also visited nearby historic Willow Flycatcher breeding sites (Red Lake Peak, Red Lake 1, Red Lake 2, and Faith) in an attempt to determine if they are still occupied by Willow Flycatchers. These visits occurred between the hours of 11:00am and 3:00pm and did not have a 50-m survey station spacing. Instead, we used a wandering transect technique to meander through the meadows broadcasting vocalizations as we went. One Willow Flycatcher was detected at Red Lake Peak, and none were detected at the other sites.. The failure to detect Willow Flycatchers at Red lake 1 and Red Lake 2, and Faith Valley during an afternoon survey does not necessarily mean the species was absent. A single non-protocol visit, especially during the afternoon, is inadequate for establishing absence.

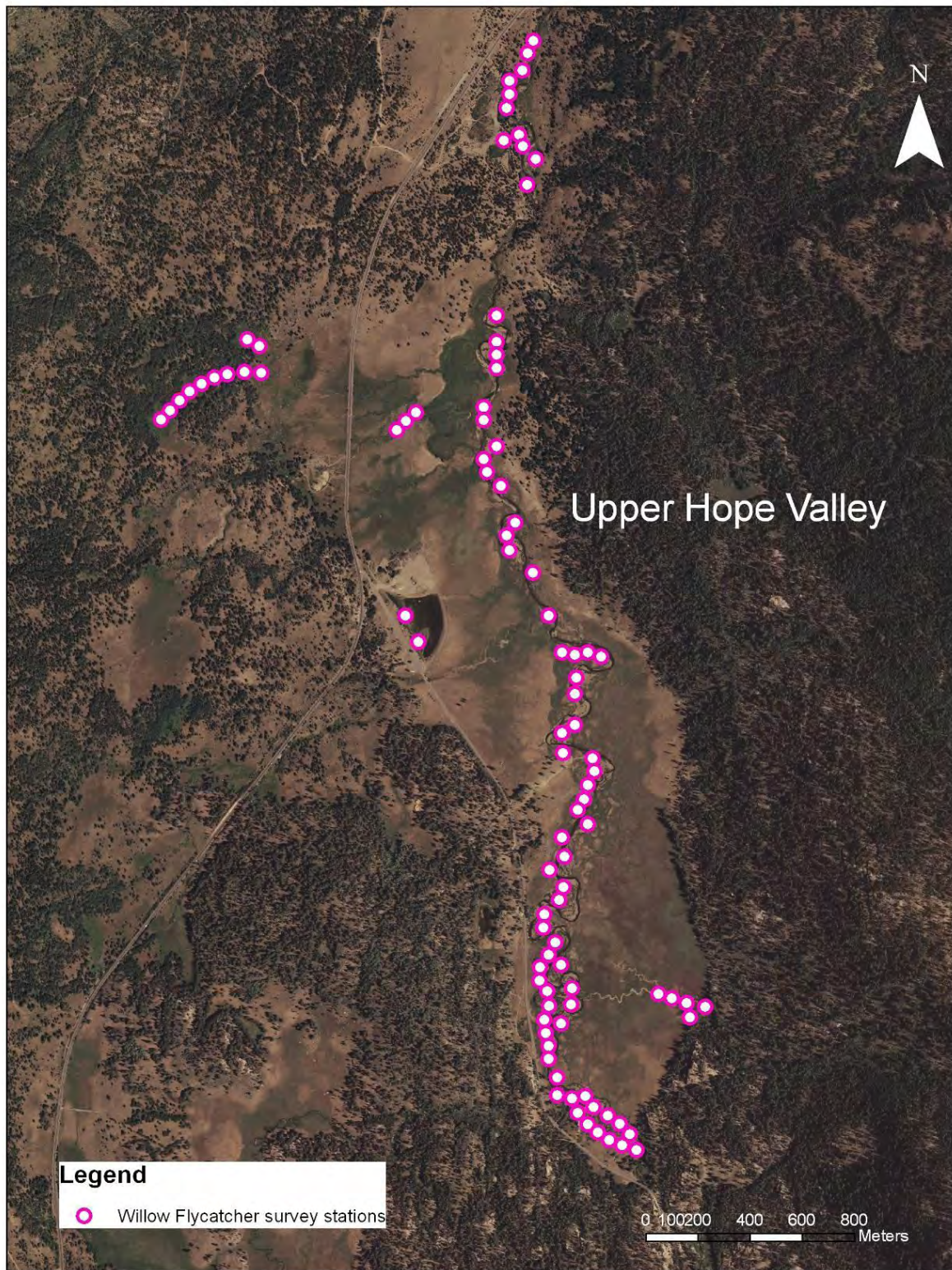


Figure 3. Willow Flycatcher survey station locations in Upper Hope Valley.

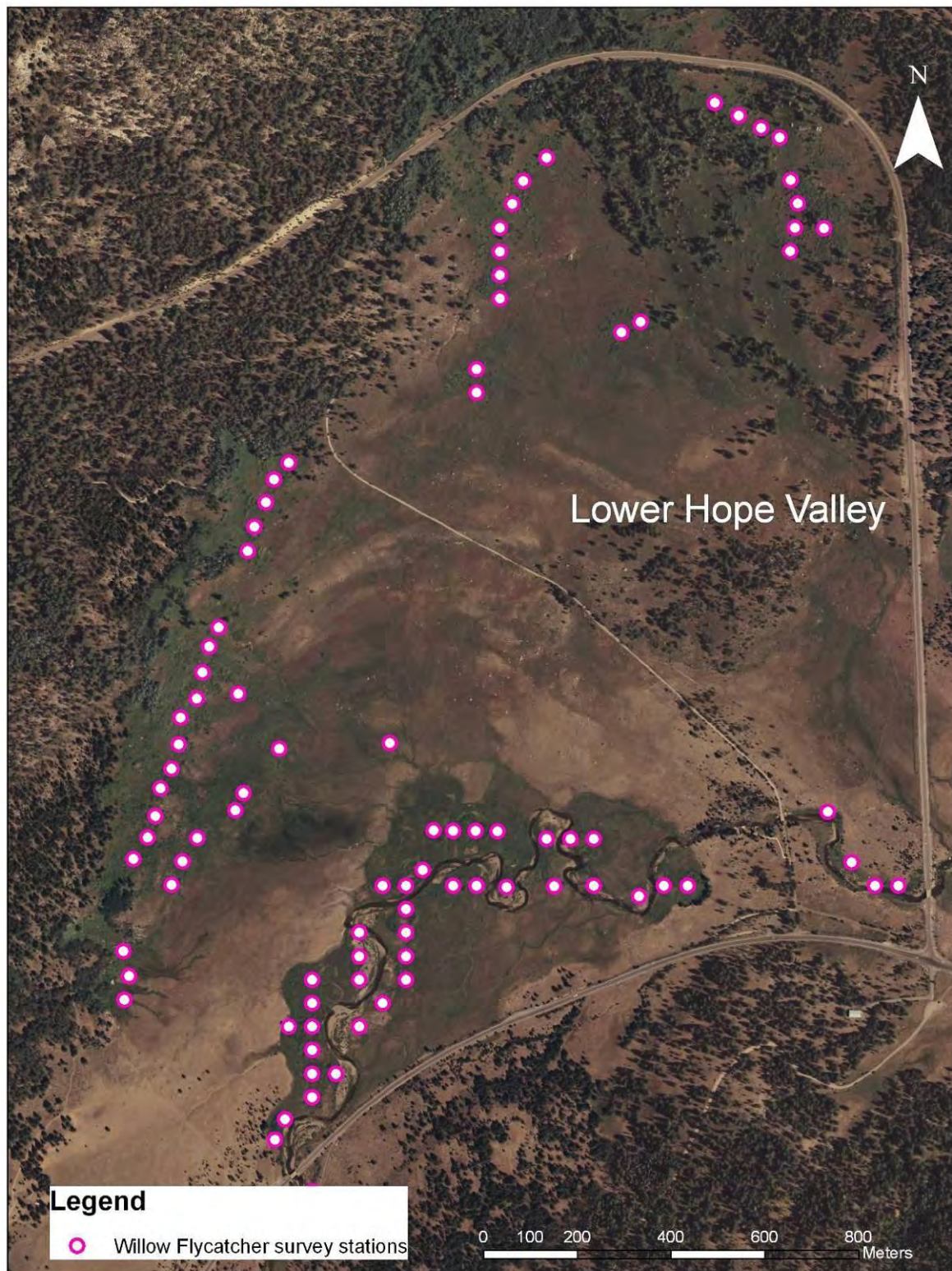


Figure 4. Willow Flycatcher survey station locations in Lower Hope Valley.

Multi-species Monitoring

In 2010 we surveyed 35 multi-species survey stations in Upper Hope Valley and 19 stations in Lower Hope Valley. At our reference sites at Red Lake Creek, Faith Valley and Upper Charity Valley, we surveyed 20, 14 and 8 multi-species survey stations, respectively. In 2012, we repeated these surveys at all five sites. However we added 8 new stations to the original 19 stations at Lower Hope Valley site to include willow habitat occurring near springs along the upland areas to the north of the floodplain (including Dangberg Camp) (Figures 5, 6 and 7). During 2010, stations at on the south side of Highway 88 at Burnside Lake Road and stations around the rest area near the intersection of Blue Lakes Road/Hwy 88 were reported as separate sites from the remainder of Hope Valley, but for the purpose of this report, we incorporated these sites and their stations into the Lower and Upper Hope Valley sites, respectively. The first visit to these five meadows occurred in late May or early June, and the second during mid-June or early July (Table 3).

Table 3. Dates for multi-species bird monitoring in the Hope Valley area in 2010 and 2012.

	2010		2012	
Site			First Visit	Second Visit
Upper Hope Valley	5/25/2010	6/16/2010	5/30/2012	7/4/2012
Lower Hope Valley	5/29/2010	6/17/2010	5/31/2012	7/3/2012
Faith Valley	6/6/2010	6/18/2010	6/10/2012	7/2/2012
Red Lake Creek	5/29/2010	6/11/2010	6/10/2012	7/2/2012
Upper Charity Valley	6/17/2010	6/30/2010	6/9/2012	7/4/2012

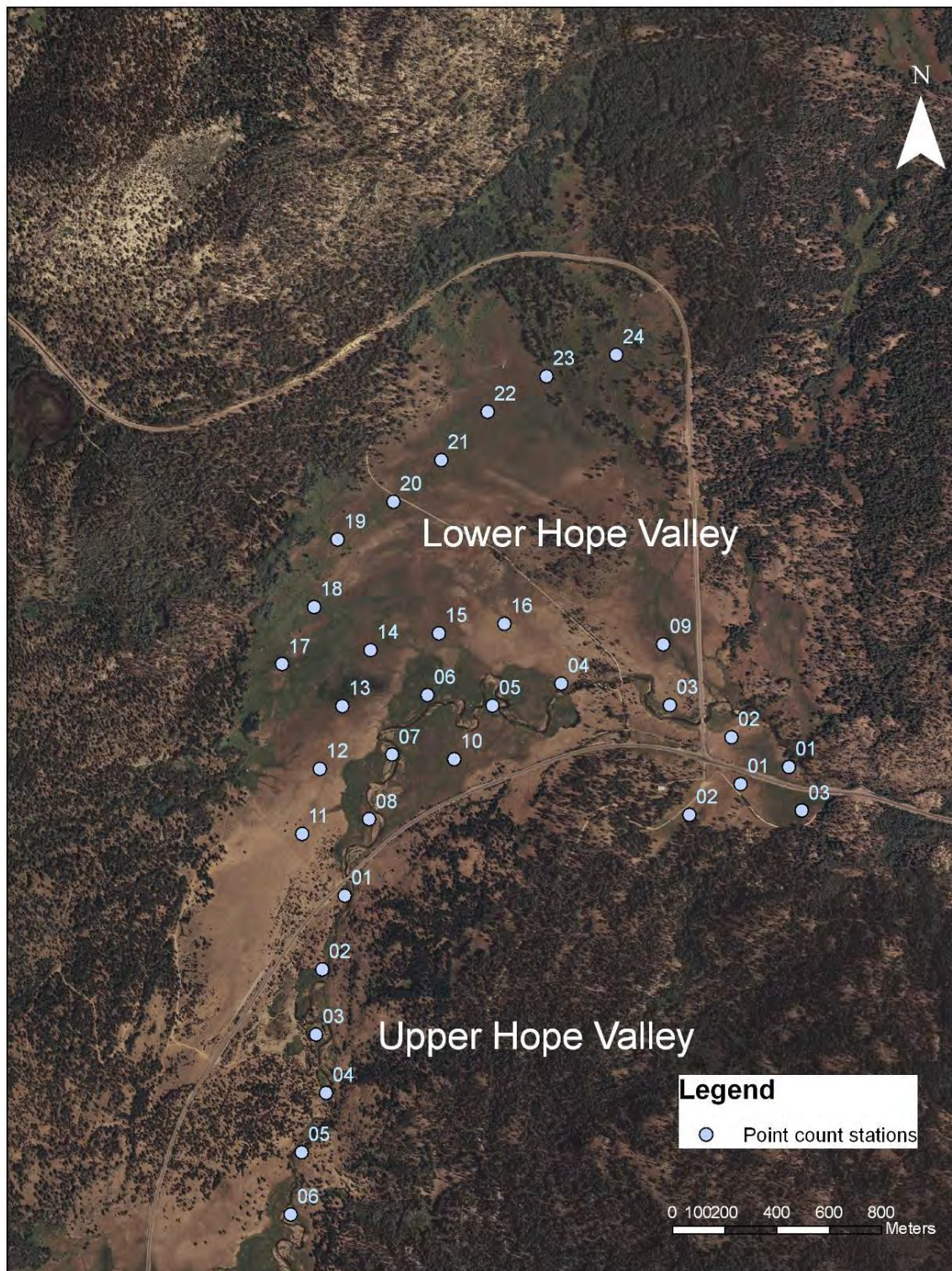


Figure 5. Multi-species point count station locations in Lower Hope Valley and northern Upper Hope Valley

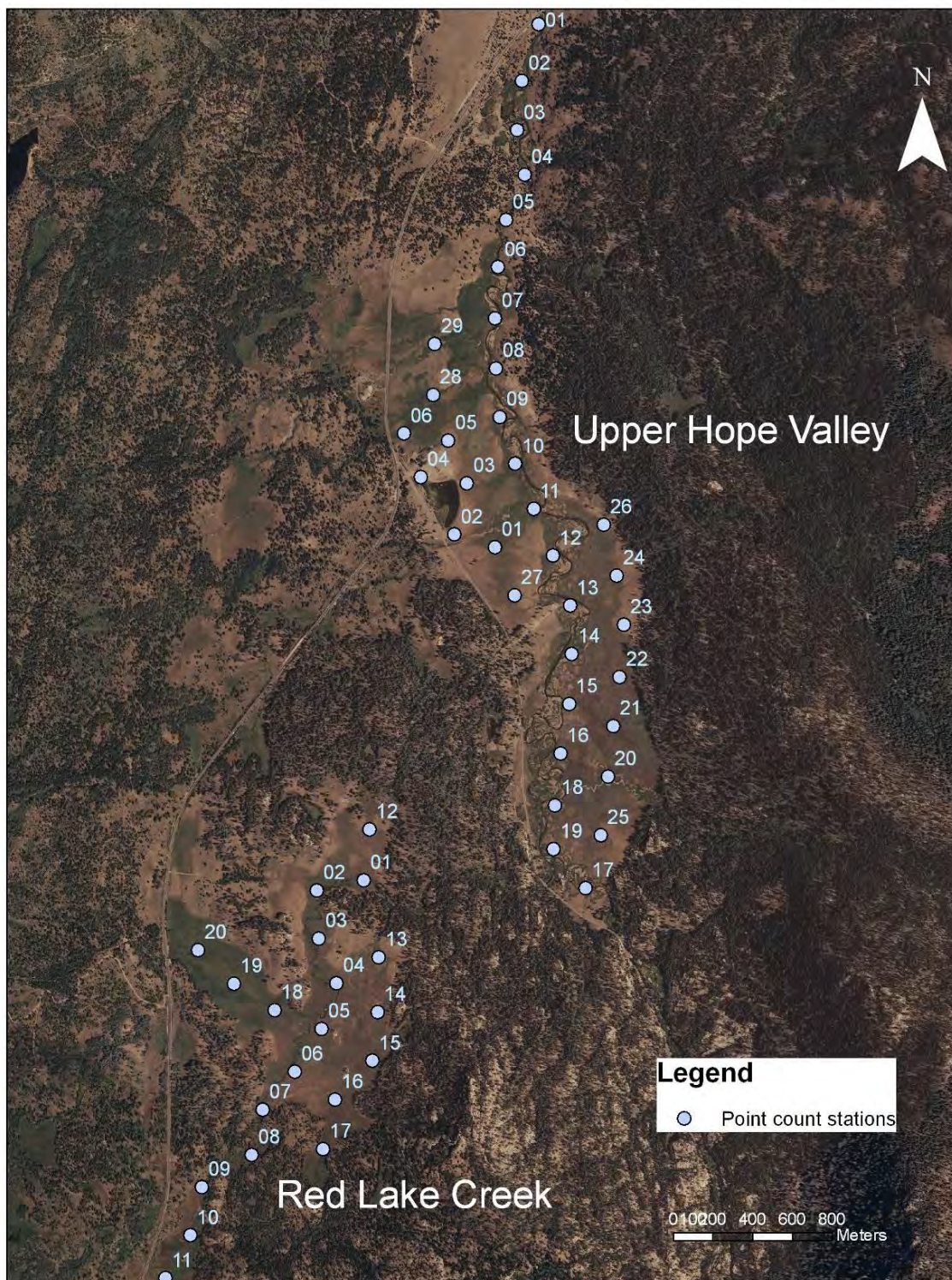


Figure 6. Multi-species point count station locations in Upper Hope Valley and Red Lake Creek.

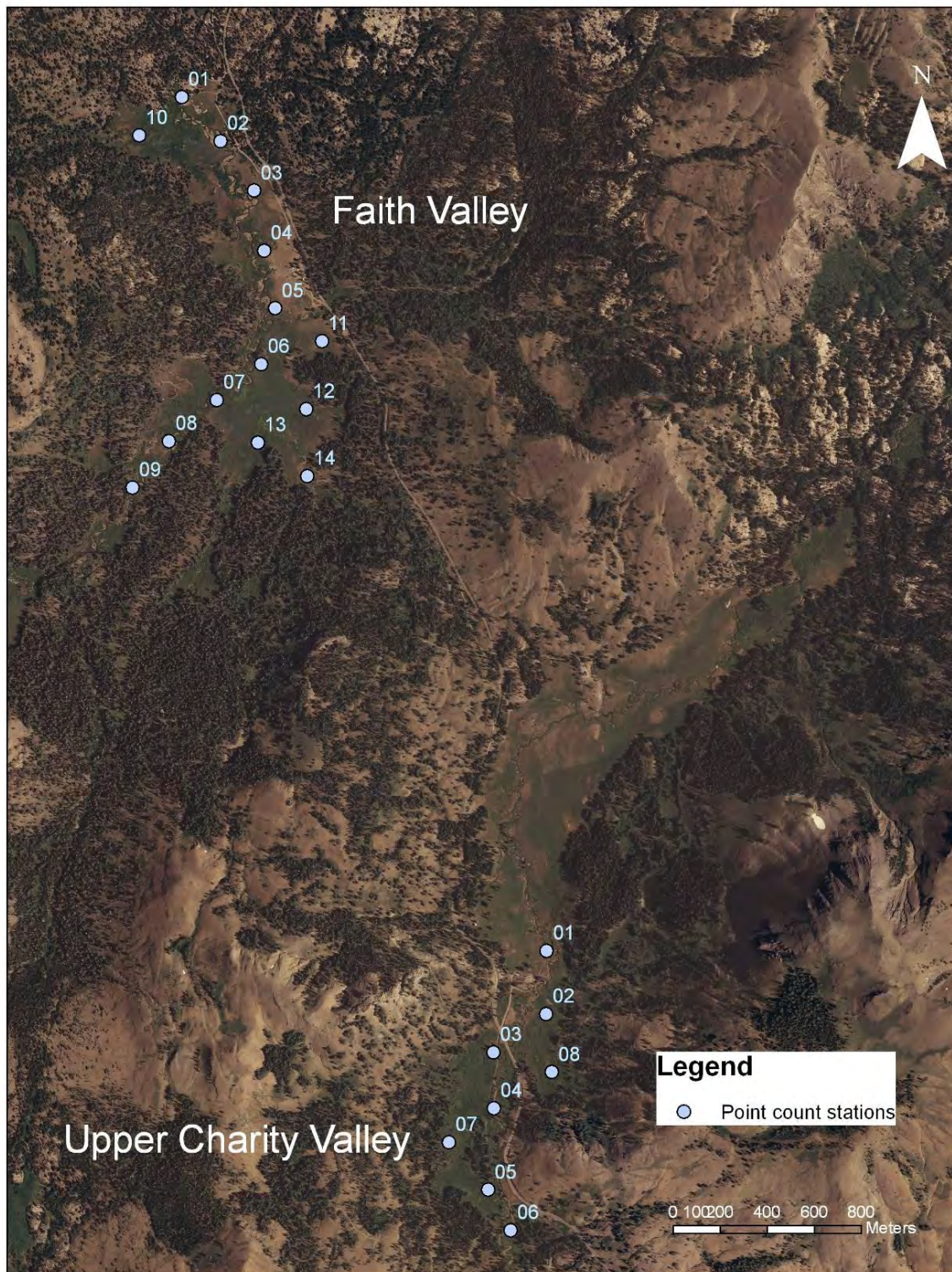


Figure 7. Multi-species point count station locations in Faith Valley and Upper Charity Valley.

Loffland et al (2011a) identifies 18 focal bird species that are expected to respond positively to meadow restoration, or in the case of Brown-headed Cowbird, have other conservation implications making them especially worthy targets of monitoring at project sites. These species and the percentage of stations at which they were detected in 2010 and 2012 are indicated in Table 4.

Table 4. Percentage of point count stations with focal bird species detected during surveys of Hope Valley in 2010 and 2012.

Common Name	Latin Name	Usual Habitat within Meadows ¹	Percent of Stations with Detections			
			Upper Hope Valley 2010	Upper Hope Valley 2012	Lower Hope Valley 2010	Lower Hope Valley 2012
Sandhill Crane	<i>Grus canadensis</i>	M, E	--	--	--	--
Virginia Rail	<i>Rallus limicola</i>	E	--	--	--	--
Sora	<i>Porzana carolina</i>	E	--	--	16%	--
Spotted Sandpiper	<i>Actitis macularius</i>	G	86%	83%	47%	30%
Wilson's Snipe	<i>Gallinago gallinago</i>	E	52%	29%	53%	41%
Great Gray Owl	<i>Strix nebulosa</i>	M	--	--	--	--
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	S,A	9%	12%	--	--
Willow Flycatcher	<i>Empidonax traillii</i>	S,E	--	--	--	--
Swainson's Thrush	<i>Catharus ustulatus</i>	S,A	--	--	--	--
Warbling Vireo	<i>Vireo gilvus</i>	S,A	31%	34%	16%	37%
Yellow Warbler	<i>Dendroica petechia</i>	S	26%	29%	16%	41%
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	S,A	11%	<1%	16%	<1%
Common Yellowthroat	<i>Geothlypis trichas</i>	S,E	--	--	--	--
Wilson's Warbler	<i>Wilsonia pusilla</i>	S,A	6%	14%	16%	<1%
Yellow-breasted Chat	<i>Icteria virens</i>	S	--	--	--	--
Song Sparrow	<i>Melospiza melodia</i>	M	83%	86%	79%	89%
Lincoln's Sparrow	<i>Melospiza lincolni</i>	M	40%	17%	32%	26%
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	S,M	85%	83%	84%	74%
Brown-headed cowbird	<i>Molothrus ater</i>	all	51%	43%	74%	48%

¹ = Aspen; E = emergent vegetation and surface water; G = gravel bars and streamside zone; M = open meadow; S = riparian deciduous shrubs

In 2012, 74 bird species were detected during point counts and area searching at Upper and Lower Hope Valley, and 87 species were detected when results from 2010 and 2012 were combined (Appendix A). Species' relative abundance was indexed by the number of individuals detected divided by the number of survey stations (Appendix B). Those species with values approaching or exceeding one individual per station included generalist species such as Mountain Chickadee, American Robin, and Brewer's Blackbird, as well as riparian or grassland associates including Vesper's Sparrow, Savannah Sparrow, Red-winged Blackbird, Spotted Sandpiper, Song Sparrow, and White-crowned Sparrow (Figure 8). Of particular interest are the latter three species which are meadow focal species (Loffland et al. 2011a). These three species

are meadow or riparian associates and are typically found in open areas with herbaceous vegetation, or gravel bars in the case of Spotted Sandpiper.



Figure 8. Upper Hope Valley and Song Sparrow, a species we encountered frequently there.

The remaining focal species (Table 5) identified by Loffland et al. (2011a) were detected less frequently within Hope Valley, probably because they are typically associated with conditions that occur only in relatively small portions of Hope Valley. These conditions include: saturated or flooded conditions (Sora, Wilson's Snipe, Lincoln's Sparrow), with dense riparian shrub cover (Yellow Warbler) or dense riparian shrub cover mixed with riparian deciduous tree cover (MacGillivray's Warbler, Wilson's Warbler, Red-breasted Sapsucker, Warbling Vireo)(Ray 1903, Grinnell and Miller 1944, Orr and Moffit 1971, Stewart et al. 1977, Heath and Ballard 2003). Those meadow focal species not detected at all are either associated with marsh or continuously flooded meadow habitat (Sandhill Crane, Virginia Rail) or flooded meadow/riparian habitat in combination with dense shrub cover (Willow Flycatcher, Swainson's Thrush, Common Yellowthroat, Yellow-breasted Chat). Both Sandhill Crane and Swainson's Thrush are only rarely (or historically) found at latitudes as far south as Hope Valley, and Yellow-breasted Chat and Common Yellowthroat are typically found at somewhat lower elevations (Grinnell and Miller 1944, Gaines 1992, Ivey and Herzinger 2001). Great Gray Owl is associated with large meadows such as Hope Valley, but is only rarely found on the east side of the Sierra Crest. The most proximal confirmed observation to Hope Valley was a Great Gray Owl detected at Carson Pass over 50 years ago. During our second Willow Flycatcher survey visit, one observer heard what may have been a Great Gray Owl at the southern end of Upper Hope Valley during the late night/early morning hours of July 12, 2012, but the vocalization was brief and could not be confirmed.

Table 5. Number of individuals and index of relative abundance for each focal species detected at Upper and Lower Hope Valley and three reference meadows in 2012

Meadow Focal Species	Upper Hope Valley		Lower Hope Valley		Red Lake Creek		Faith Valley		Upper Charity Valley	
	Count ¹	Index ² (35 stations)	Count ¹	Index ² (29 stations)	Count ¹	Index ² (20 stations)	Count ¹	Index ² (14 stations)	Count ¹	Index ² (8 stations)
Spotted Sandpiper	34.5	0.99	10.5	0.39	13.5	0.68	9	0.64	2	0.25
Wilson's Snipe	6	0.17	9.5	0.35	3.5	0.18	4.5	0.32	1.5	0.19
Red-breasted Sapsucker	2.5	0.07	0	0.00	1.5	0.08	0	0.00	0	0.00
Warbling Vireo	6	0.17	10.5	0.39	4.5	0.23	2	0.14	5.5	0.69
Yellow Warbler	11	0.31	14.5	0.54	8	0.40	12	0.86	0.5	0.06
MacGillivray's Warbler	1.5	0.04	1	0.04	1	0.05	0	0.00	0	0.00
Wilson's Warbler	4	0.11	2	0.07	1.5	0.08	0.5	0.04	5	0.63
Song Sparrow	50.5	1.44	52.5	1.94	25.5	1.28	22	1.57	1.5	0.19
Lincoln's Sparrow	6.5	0.19	15	0.56	13.5	0.68	5.5	0.39	10	1.25
White-crowned Sparrow	45.5	1.30	48.5	1.80	18	0.90	34	2.43	27.5	3.44
Brown-headed Cowbird	10	0.29	11	0.41	9	0.45	8.5	0.61	0.5	0.06

¹Count: number of individuals detected at an unlimited radius from all point count stations average across 2 visits in 2012.

²Index: count divided by the number of point count stations per meadow

Spotted Sandpiper and Wilson's Snipe both nest on the ground and probe the soil for invertebrates (Figure 9). Spotted Sandpiper thrives where there are open gravel bars (both actively forming, or abandoned by the stream on upper terraces). As a result, Spotted Sandpipers were relatively common at the proposed restoration site in Upper Hope Valley with 0.99 birds/station (Table 5). This value was at least 1/3 greater than values for the other sites.



Figure 9. Spotted Sandpiper nest in Upper Hope Valley

This is likely the result of more active stream migration and the resultant gravel bars in Upper Hope Valley. Wilson's Snipe have quite different habitat requirements and nest and forage in spring-fed or otherwise water-covered areas with mud or peat and dense sedge cover. For this reason they were found primarily near springs or beaver ponds/oxbows and were most abundant in Lower Hope Valley and Faith Valley, and least abundant in Upper Hope Valley (Table 5).

White-crowned Sparrows had a relatively high index of abundance at all five sites monitored but despite their presence at most stations, the index at the restoration site at Upper Hope Valley was the second lowest of the meadows monitored, and only half that of Upper Charity Valley and Faith Valley, where shrub cover is greater (Figure 10). Song Sparrows were consistently common with an index of more than 1 individual per station at all sites (with the exception of Upper Charity Valley which is somewhat high in elevation for Song Sparrow). Lincoln's Sparrows prefer dense herbaceous cover with saturated conditions and therefore were detected at a rate of only 0.19 birds/station at Upper Hope Valley. This is compared with values ranging from 0.56 to 1.25 Lincoln's Sparrow/station at the other 4 survey sites which tend to be wetter overall. Yellow Warblers are the most commonly found focal warbler species in the area, with an index as high as 0.86 birds/station in Faith Valley. At the proposed restoration site in Upper Hope Valley, they were detected at a modest rate for a meadow of this size, with only 0.31 birds/station. Wilson's Warblers and MacGillivray's Warblers are often found in mature willow stands that have a component of aspen, alder, or lodgepole pine, in typically more shady settings. These two species occurred at rates < 0.15 birds/station at all meadows. Warbling Vireos have similar habitat needs but will utilize more coniferous areas along meadows and creeks, and therefore, while not particularly abundant, were found more frequently (0.17 to 0.69 birds/station) than Wilson's Warbler or MacGillivray's Warbler.



Figure 10. White-crowned Sparrow nest in Lower Hope Valley

Other notable wetland-related species that occur in the vicinity of Hope Valley are Wilson's Phalarope, and Green-winged Teal. These species nest in flooded oxbows along the West Carson River, and/or beaver ponds along tributaries to the river, specifically in Upper Hope Valley where Maxwell Creek enters the West Carson, and along the main flood plain where springs enter Lower Hope Valley. Bald Eagles hunt and loaf in snags along both meadows, and there are large nesting colonies of Cliff Swallows under the Highway 89 bridge in Lower Hope Valley and within a very large cracked boulder/rock outcrop along the east bank of the river in Upper Hope Valley (near the confluence with Maxwell Creek).

Vegetation Monitoring

Summary results for vegetation plots are presented in Table 6. This table includes results from 2012 at Upper and Lower Hope Valley and the three reference sites. Riparian shrub (primarily willow) cover was lowest at Lower Hope Valley at 8.3%, and highest at Upper Charity Valley at 56%. Snag cover was lowest at Lower and Upper Hope Valley (0.01 and 0.06 respectively) and highest at Red lake Creek at 0.48%. Non-woody herbaceous cover was lowest at Upper Hope Valley (74%) and highest at Red Lake Creek (92%). Cover from flowing water and standing water was highest at Upper Charity Valley and Faith Valley, respectively. Although these metrics assess only a small sample of each meadow, the Upper Hope Valley site does indicate some need for restoration, with <10% willow cover, the lowest herbaceous vegetation cover, the greatest amount of bare ground and the second greatest value for sagebrush cover.

Table 6. Ocular estimates of percent cover of vegetation, water, and exposed ground within 50m of point count stations at Upper and Lower Hope Valley and three reference sites in 2012.

Cover Class ¹	Upper Hope Valley (35 stations)		Lower Hope Valley (29 stations)		Red Lake Creek (20 stations)		Faith Valley (14 stations)		Upper Charity Valley (8 stations)		All sites combined	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
tree	3.1	5.9	2.3	3.4	3.3	6.7	4.5	7.5	5.6	6.4	3.4	5.8
snag	0.06	0.2	0.01	0.05	0.48	1.26	0.29	0.61	0.25	0.48	0.2	0.64
downed log	0.1	0.3	0.03	0.1	0.8	1.7	0.2	0.66	0.2	0.3	0.3	0.8
riparian shrub	9.1	13.7	8.3	10.0	9.0	13.7	29.6	19.2	56.2	15.3	15.3	19.4
sagebrush	6.2	11.8	7.2	10.0	3.1	4.9	2.8	5.4	0.8	2.4	5.0	9.2
Herbaceous veg.	74.0	25.8	82.6	14.7	92.1	10.0	81.1	15.4	79.6	4.7	81.1	19.1
bare soil	5.9	5.9	4.5	6.6	2.7	2.7	5.1	4.4	4.0	3.2	4.7	5.3
leaf litter	0.4	2.3	0.1	0.4	0.2	0.5	0	0	0	0	0.2	1.4
gravel	1.9	3.2	0.8	2.1	0.2	0.5	4.3	8.1	2.0	2.6	1.6	3.8
flowing water	3.7	4.6	2.6	3.8	4.7	3.9	3.3	3.0	30.6	2.3	3.5	3.9
standing water	0.6	1.5	1.1	2.8	0.5	1.2	2.5	3.0	5.0	5.8	1.3	2.8

¹Cover may sum to more than 100% due to multiple overstory and understory layers.

Discussion

Specific habitat needs of individual meadow-associated bird species are diverse. We believe effective restoration efforts are best informed by considering the needs of the particular species that are being targeted with the restoration efforts. The following discussion is therefore organized around individual meadow focal species or groups of focal species that we detected in Hope Valley, or that have the potential to be detected in Hope Valley subsequent to restoration activities.

Willow Flycatcher

The California-endangered Willow Flycatcher is the bird species in the region that is most strictly linked to wet meadows dominated by mature stands of willow. Most Willow Flycatcher breeding sites are found in meadows or riparian areas with season-long saturated soils and surface water (Harris et al 1987, Bombay 1999, Bombay et al. 2003a, b, Mathewson et al., in press). These conditions may occur in association with oxbows and ponds within a floodplain meadow community or in areas where perennial springs spread water across a variable-gradient meadow surface (Weixelman et al. 2011). Deciduous riparian shrubs, particularly willows, are a critical habitat component for Willow Flycatcher. Most Willow Flycatcher territories contain 50% or more willow cover (across a 1- 3 acre area)(Bombay 1999). Although Willow Flycatchers are not currently found in Hope Valley, their historic documentation in 1998 at Maxwell Creek in Upper Hope Valley, and their continued persistence (at least on an occasional basis) at nearby meadows, especially Red Lake Peak and Red Lake, make future colonization of restored habitat in Upper Hope Valley a distinct possibility (Mathewson et al. 2011).

Conspecific attraction is the practice of attracting a bird species to settle in a meadow by broadcasting territorial vocalizations during the period of northward migration in the spring and extending into early breeding season to encourage continued residency. This practice is not warranted in Upper Hope Valley at this time (see below), but could be implemented if restoration activities create more extensive high quality habitat. It may also be warranted in nearby areas of Lower Hope Valley where natural regeneration and the willow planting efforts of the “Friends of Hope Valley” have improved conditions over the last 25 years. This method could also be used in nearby Red Lake and Faith Valley to insure that the species continues to settle there as habitat in Upper Hope Valley improves.

Yellow Warbler

Yellow Warbler, a California Species of Special Concern is, like Willow Flycatcher, strongly linked to dense willow stands. However it is not as limited to extremely wet conditions (Heath 2008). Yellow Warblers do, however, occur in their greatest densities at sites with these characteristics. While not extremely abundant in Hope Valley, Yellow Warblers are present in adequate numbers to quickly colonize newly created habitat when new willow stands reach maturity. Because of the elevation of the site, creating new willow stands could take some time (as many as 10 to 15 years). Nonetheless, this species is an excellent indicator of the quality of willow habitat in the absence of Willow Flycatchers.

Song Sparrow, White-crowned Sparrow

Although already common in Hope Valley these two sparrow species should respond positively and quickly to restoration as willow communities expand. Although not strictly necessary, willow is a preferred component of White-crowned and Song Sparrow habitat.

Lincoln Sparrow

Like the more abundant Song Sparrow and White-crowned Sparrow, Lincoln Sparrow requires open meadow habitat with dense herbaceous cover and, ideally, some scattered shrubs. This species, however, is linked to sites that are wetter and have more continuous sedge cover than other sparrow species. They also sometimes utilize stands of corn lily for nesting. They appear to be less tolerant of disturbance and grazing pressure than many other bird species inhabiting meadows (Cicero 1997). Lincoln's Sparrow occurs in numbers that will allow it to increase and occupy newly created habitat, if areas of Upper Hope Valley become wetter and herbaceous cover more continuous through restoration activities.

Red-breasted Sapsucker, Warbling Vireo, Wilson's Warbler, MacGillivray's Warbler

This suite of species, while not extremely abundant at Hope Valley, should respond relatively quickly to increases in willow cover, and especially willow increases in proximity to areas with active aspen regeneration. Aspen is absent or rare along most of Upper Hope Valley. Release of existing stands through timber or fire management, or the establishment or planting of new stands along the eastern edge of the meadow, could result in dramatic increases in these species.

Sora, Virginia Rail, Wilson's Snipe

In the Sierra Nevada, these three species are found only in marshy emergent vegetation in large meadows (or other wetlands) with flooded oxbows, beaver ponds, or other impoundments. Wilson's Snipe are relatively easy to detect and are therefore excellent for monitoring improvements in this habitat type with restoration. Although more secretive, the two rail species are still common enough in the Sierra to respond if adequate wetlands are created during restoration.

Great Gray Owl

Foraging habitat for Great Gray Owl is abundant along the eastern boundary of Upper Hope Valley, where the species could take advantage of the pocket gopher and vole populations found in the dry and wet portions of the meadow, respectively. One limiting factor however is a scarcity of downed trees and snags that extend into the meadow. This species forages by sitting and waiting on low perches over meadow vegetation. It frequently perches on the large branches that extend up from fallen trees that along the meadow edge. These conditions can be created by falling or pushing a few trees over with heavy equipment into the meadow. It is currently unknown whether adequate numbers of large broken top trees exist within 200 feet of the

meadow for nesting. If not, other regions of the Sierra have been successful in creating occupied nests by topping and excavating a bowl in suitable trees in proximity to large meadows. It should be noted, however, that Hope Valley is well outside the core range of Great Gray Owl in the Sierra Nevada (which is centered to the south, in the Yosemite area)(Beck and Winter 2000, Hull et al. 2010). Even if measures are taken to improve conditions for Great Gray Owl at this site, this species still may be unlikely to regularly occupy the meadow, though the possible Great Gray Owl detection at Hope Valley in 2012 provides some degree of hope that the species may indeed occur within the area.

Recommendations

Hydrology is a primary factor restricting habitat quantity and quality for Willow Flycatcher and other focal bird species associated with meadows. All rely on lush herbaceous and woody vegetation, and the insect food resources (Erman 1984, 1996) associated with saturated wet meadows. Flooded conditions also may provide some degree of protection from nest predation, as some mammalian predators avoid open water (Cain et al 2003, Borgmann 2010). Similarly, many of these focal species require dense riparian shrubs or trees (aspen, alder, dogwood) that will only germinate and grow with consistent deep water. Although willow requires consistent moisture for germination, mature willow will often persist at a site after meadow hydrology is altered when roots are deep enough to remain in contact with the water table, despite its lowered elevation. In general, it is easier to add willow to a suitably wet meadow system, whereas restoring disturbed hydrologic systems in areas with remnant willow may require significant effort and heavy equipment (except in very small stream settings).

Upper Hope Valley

In 2012 project leaders made the decision that the restoration project at Hope Valley would not attempt to raise the stream base level for the West Carson River in Hope Valley, but rather to explore other lower-risk options for restoration within the Upper Meadow. With this in mind, we describe below four basic scenarios to improve habitat for Willow Flycatcher (and other meadow birds) in Upper Hope Valley:

1. Planting willow in areas where hydrology already provides necessary flooding and/or soil saturation levels.
2. Altering small tributaries (filling, ponding, etc) to increase soil saturation and standing water (with subsequent willow planting as feasible).
3. Lowering oxbow base levels or creating artificial oxbows to match the water table in existing primary stream channels (with subsequent willow planting as feasible).
4. Mechanical shaping of existing stream banks to alter flow patterns (with subsequent willow planting as feasible).

The following discussion breaks down Upper Hope Valley into areas defined as Willow Flycatcher priority areas based on habitat components, or the likelihood that suitable habitat components could be restored (Figure 11). In general, these same areas can be considered priority areas for the other focal species listed above.

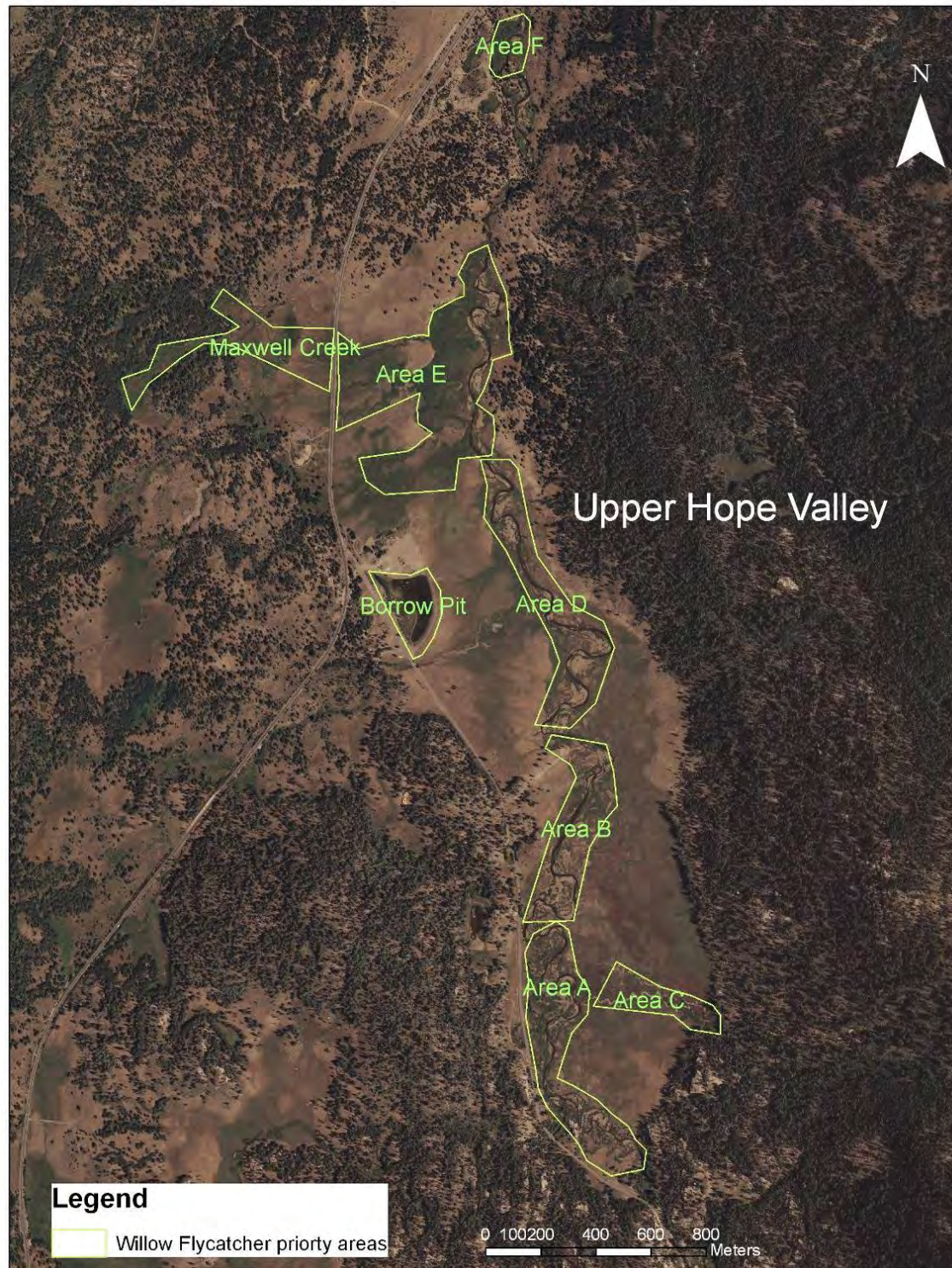


Figure 11. Priority areas for Willow Flycatchers and other focal bird species in Upper Hope Valley.

AREA A

Oxbows in the northern end of area “A” hold water even during low water years such as 2012. This area also has relatively mature and dense willow stands (*Salix lemmonii* and *Salix geyeriana*), but outside of the oxbows themselves the vegetation and meadow surface are very disturbed and plant communities are more xeric, with sagebrush and lodgepole pine incursion. Area A contains the majority of Yellow Warbler detections in Upper Hope Valley. This area would benefit greatly from activities to increase the amount and duration of standing water in the oxbows (including some not currently supporting wetland conditions), even if lowering of the base level elevation within the primary channel is not possible. The habitat would be excellent if understory vegetation were more sedge-dominated and standing water persisted into July or August.

Presence of surface water in the southern half of area A is rare, but because of the persistence of a mature shrub component (predominantly *Salix lemmonii*), there is potential to create good quality habitat if water can be diverted from the main channel, or otherwise captured, into existing oxbows. Because this part of the meadow is close to the location where the stream enters the meadow and there is a large bedrock formation controlling the stream bed, the depth of stream incision is not extreme in this southern-most area. It is possible that by manually deepening existing oxbows, or creating new artificial oxbows, the existing water table could be captured and surface water in oxbows could persist longer into the summer.

Red Lake Creek enters Area “A” just north of the large granite outcropping. If some of this flow could be captured or slowed as it enters the West Carson River, overall meadow wetness in area “A” might be increased.

AREA B

Area B has relatively little willow and oxbows are few, but willow planting and manipulation of oxbows may result in modest habitat improvements over time.

AREA C

The unnamed tributary that enters the meadow in area C is incised from the point where it enters the meadow on the east to the location where it drains into the West Carson River. Nonetheless, because of the persistence of a mature shrub component in the eastern half of Area C, there is potential to create good quality habitat for focal species if the water within this tributary can be reverted to a surface flow, or is captured in a series of ponds. A nearby meadow on the Upper Truckee River supports Willow Flycatcher despite the incision of the primary channel because beaver have “plugged” the small head cut tributaries, resulting in ponded areas and surface flow.

AREA D

Area D is an extremely incised section of meadow with relatively little willow and few oxbows. Most willow is *Salix exigua* and restricted to the gravel bar habitat directly adjacent to

the active channel. Although this willow is commonly the first to colonize new gravel bars, Willow Flycatcher typically do not utilize *Salix exigua* for nesting. Planting *Salix lemmonii* in association with manipulation of oxbows and bank shaping could result in habitat improvements along the streamside zone.

MAXWELL CREEK

Maxwell creek enters Hope Valley on the west side, and flows under highway 88 via culverts where it enters the West Carson River in area “E”. Within the last 5 years, Maxwell Creek directly west of highway 88 has become incised. If this headcut continues to travel upstream it could threaten the historic Willow Flycatcher nesting area approximately 500m to the west where the stream enters the aspen stands. Potential Willow Flycatcher habitat in proximity to the aspen stands and nearby springs is still of high quality. The fence line running north/south along the aspen and meadow interface appears to limit grazing to the west. Some grazing still occurs in the area between this fence and Highway 88.

AREA E

The portion of Area E that sits within the West Carson River floodplain currently supports the best hydrologic conditions for Willow Flycatcher and its habitat. Surface water from springs and ponded tributaries result in season-long saturated conditions (as evidenced by the abundance of other meadow focal or wetland bird species, especially Wilson’s Snipe, Lincoln’s Sparrow, Wilson’s Phalarope and Green-winged Teal. Willow cover is relatively sparse but since the removal of livestock in the 1990s is slowly returning (despite some heavy hedging by beaver). This area would benefit primarily from willow plantings especially if they can be protected from beaver.

Salix geyeriana is the predominant willow species here and appears to germinate and successfully compete with relatively dense cover from *Carex* spp (Figure 12). As a result *Salix geyeriana* is likely the best choice for planting within this area, particularly if willow cuttings are used instead of rooted plants. Extensive and easily accessible stands of mature *Salix geyeriana* are

available as a source for cuttings in the Dangberg Camp area along Highway 89 in the northeast corner of Lower Hope Valley.



Figure 12. *Salix geyeriana* colonizing a spring fed area in Hope Valley.

Locations and conditions of culverts under Highway 88 at the west edge of area “E” warrant assessment to determine if they are significantly altering how water is entering Upper Hope Valley, and whether this flow pattern is contributing to erosion in the main channel. It appears that the flow is being captured before it meets the West Carson in area “E”, but culvert improvements or stream stabilization could result in more surface flow and increased meadow saturation across the western edge of the meadow in area “E”.

BORROW PIT

The Borrow Pit area, near the Blue Lakes Road intersection with Highway 88, has standing water and willow, but it currently of limited value to Willow Flycatchers and other focal species because of the steep sides and artificial shoreline. Habitat quality could be improved with bank shaping to create a more gradual gradient and more shallow emergent vegetation conditions along the shoreline. Culverts under Blue Lakes road south of the Borrow Pit may warrant evaluation to determine if they are contributing to the incised condition of tributaries within western Upper Hope Valley.

AREA F

Area F is in a section of stream that is relatively confined by surrounding geology. The meadows in this section support some tall, dense willow and relatively deep oxbows, however habitat patches are probably too restricted to support more than one Willow Flycatcher territory. No recommendations are suggested for this area.

Lower Hope Valley

Although no restoration plans for Lower Hope Valley (Figure 13) are currently being prepared, the “Friends of Hope Valley” have ongoing activities in this meadow to improve willow cover and bank stability using “willow waddles” and the planting of willow slips. Given that any efforts likely to occur here are relatively small in scale, we have only a few recommendations for the site.

AREA J & K

These two spring-fed areas along the sloping northern and western half of Lower Hope Valley are regenerating beautifully with the release from livestock grazing pressure in the 1990’s. Willow (primarily *Salix geyeriana*) is expanding across these slopes slowly. In the southern regions of J and K where the slope flattens the willow is less abundant. Planting of slips of *Salix geyeriana* could help expand and speed the colonization by willows of this area.

AREA G, H, & I

The floodplain within Lower Hope Valley has been recovering nicely over time, but overbank flows are rare, and oxbows do not hold water as long into the summer as would be ideal for many focal species, especially Willow Flycatcher. Due to the scarcity of overbank

flows, flood related disturbance and seed deposition in older oxbows away from the active stream channel is uncommon. These oxbows, without a willow component, could benefit from willow plantings along the lower margins of the oxbows where soil remains moist. Similarly, deepening oxbows using hand tools may bring the bottom of the oxbow into contact with the current water table level, and provide summer-long standing water and the associated plant, insect, and bird communities.

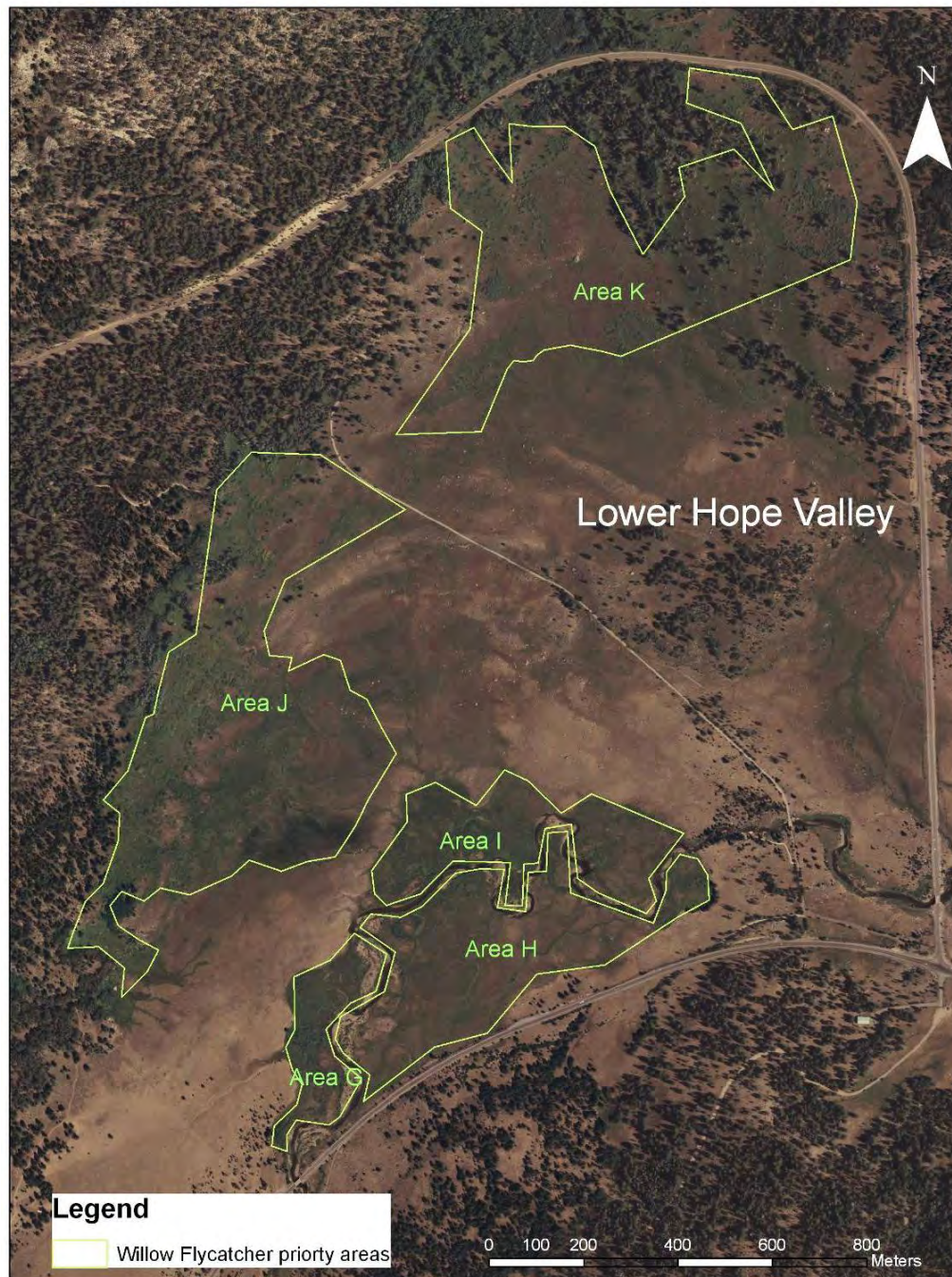


Figure 13. Priority areas for Willow Flycatchers and other focal bird species in Upper Hope Valley.

Acknowledgments

We wish to thank our partners at American Rivers, The National Fish and Wildlife Foundation, The Humboldt-Toiyabe National Forest, and The Friends of Hope Valley for funding, input and historic context for our work. Special thanks to our field crew for their dedicated efforts: Adam Baz, Rob Frye, Katie Hood, Claire Johnson, Cedar Mathers-Winn, Christina Varians, and Bob Wilkerson for training and database management. This project was conducted by The Institute for Bird Populations' Sierra Nevada Bird Observatory. This is Contribution No. 452 of The Institute for Bird Populations.

Literature Cited

- Beck, T. W., and J. Winter. 2000. Survey protocol for Great Gray Owl in the Sierra Nevada of California. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.
- Bombay, H. L. 1999. Scale perspectives in habitat selection and reproductive success for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. Thesis, California State University, Sacramento, California.
- Bombay, H. L., T. M. Benson, B. E. Valentine, and R. A. Stefani. 2003a. *A willow flycatcher survey protocol for California*. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.
- Bombay, H. L., M. L. Morrison, and L. S. Hall. 2003b. Scale perspectives in habitat selection and animal performance for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. *Studies in Avian Biology* 26:60-72.
- Borgmann, K. L. 2010. *Mechanisms underlying intra-seasonal variation in the risk of avian nest predation: implications for breeding phenology*. Ph.D. Dissertation. University of Arizona, Tucson, AZ.
- Cain, J. W., III, Morrison, M. L., and Bombay, H. L. 2003. Predator activity and nest success of Willow Flycatchers and Yellow Warblers. *Journal of Wildlife Management* 67:600-610.
- Cicero, C. 1997. Boggy meadows, livestock grazing, and interspecific interactions: influences on the insular distribution of montane Lincoln's Sparrows (*Melospiza lincolnii alticola*). *Great Basin Naturalist* 57(2):104-115.
- Erman, N. 1984. The use of riparian systems by aquatic insects. Pp. 177-1982 in R. E. Warner and K. Hendrix (eds.), *California riparian systems: ecology, conservation, and productive management*. University of California Press, Berkeley, CA.
- Erman, N. A. 1996. Status of aquatic invertebrates. Chapter 35, pp. 987-1008 in, D. C. Erman (ed.), *Sierra Nevada Ecosystem Project: final report to Congress, vol. II, assessments and scientific basis for management options*. Centers for Water and Wildland Resources. University of California, Davis.
- Gaines, D. 1992. Birds of the Yosemite Sierra. Artemisia Press. Lee Vining, CA.
- Grinnell, J. and A. H. Miller. 1944. The distribution of the birds of California. *Pacific Coast Avifauna* 27:1-617.
- Harris, J. H., S. D. Sanders, and M. A. Flett. 1987. Willow Flycatcher surveys in the Sierra Nevada. *Western Birds* 18:27-36.

- Heath, S. 2008. Yellow Warbler (*Dendroica petechia*). in California Bird Species of Special Concern: a ranked assesement of species, subspecies, and distrinct populations of birds of immediate conservation concern in California (W. D. Shuford, and Gardali, T., eds) Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento. Pgs 332-339.
- Heath, S. K., and G. Ballard. 2003. Patterns of breeding songbird diversity and occurrence in riparian habitats of the eastern Sierra Nevada. Pp. 21-34 in P. M. Faber (ed.), *California riparian systems: processes and floodplain management, ecology and restoration*. Riparian Habitat and Floodplains Conference Proceedings, Riparian Habitat Joint Venture, Sacramento, CA.
- Hull, J. M., J. J. Keane, W. K. Savage, S. A. Godwin, J. A. Shafer, E. P. Jepsen, R. Gerhardt, C. Stermer, and H. B. Ernest. 2010. Range-wide genetic differentiation among North American Great Gray Owls (*Strix nebulosa*) reveals a distinct lineage restricted to the Sierra Nevada, California. *Molecular Phylogenetics and Evolution* 56:212-221.
- Ivey, G. L. and C. P. Herziger. 2001. Distribution of Greater Sandhill Crane Pairs in California 2000. California Department of Fish and Game, Sacramento.
- Loffland, H. L., R. B. Siegel, and R. L. Wilkerson. 2011a. Avian Monitoring Protocol for Sierra Nevada Meadows: A tool for assessing the effects of meadow restoration on birds. Version 1.0. The Institute for Bird Populations, Point Reyes Station, CA.
- Loffland, H. L., R. B. Siegel, and R. L. Wilkerson. 2011b. Pre-restoration bird surveys at meadows on the Eldorado and Humboldt-Toiyabe national Forests and nearby lands managed by the State of California. The Institute for Bird Populations, Point Reyes Station, CA.
- Mathewson, H. A., H. L. Loffland, M. L. Morrison. 2011. *Demographic Analysis for Willow Flycatcher Monitoring in the Central Sierra Nevada, 1997–2010: Final Report*. Texas A & M University.
- Mathewson H. A, M. L. Morrison, H. L. Loffland, P. Brussard. In press. Ecology of Willow Flycatchers in the Sierra Nevada, California: the role of meadow characteristics and weather on demographics. *Ornithological Monographs*.
- Orr, R. T., and J. Moffitt. 1971. *Birds of the Lake Tahoe Region*. California Academy of Sciences, San Francisco, CA.
- Ray, S. M. 1903. Land birds of Lake Valley, CA. *Auk* 20:185.
- Stewart, R. M., R. P. Henderson, and K. Darling. 1977. Breeding ecology of Wilson's Warbler in the High Sierra Nevada, California. *Living Bird* 16:83-102.
- Weixelman, D.A., B. Hill, D. J. Cooper, E. L. Berlow, J. H. Viers, S. E. Purdy, A. G. Merrill, S. E. Gross. 2011. A Field Key to Meadow Hydrogeomorphic Types for the Sierra Nevada and Southern Cascade Ranges in California. Gen. Tech. Rep. R5-TP-034. Vallejo, CA. U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, 34pp.

Appendix A. Species list and total count of individuals detected during point count surveys in Upper and Lower Hope Valley during 2010 and 2012¹

Bird Species	Upper Hope Valley				Lower Hope Valley			
	2010		2012		2010		2012	
	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius
Canada Goose	8.5	30.5	0	0	0	0	0	0
Mallard	2.75	14	0	5.5	0.75	2	0	1
Green-winged Teal	0	2	1.5	1.5	*	*	*	*
Ring-necked Duck	0	0	1	5	0	0	0	0
Bufflehead	0.25	1	0	3	0	0	0	0
Common Merganser	0.5	2.5	0	0	*	*	0	0
Sooty Grouse	0	0	0	0	0	0	0	0
Mountain Quail	0	10.5	0.5	13	0	2.5	0	5
California Quail	0	0	0	2	0	0.5	1	4
Great Blue Heron	0	0	0	0	0	0.5	0	0
Turkey Vulture	0	0	*	*	0	0	0	0
Bald Eagle	*	*	0	0	0	0.5	0	0
Red-tailed Hawk	*	*	0	1	*	*	0	2
American Kestrel	*	*	0	0	0	0	0	0
Sora	0	0	0	0	0	2.5	0	0
Killdeer	1.25	14	2.5	18.5	0.75	6.5	0	2
Spotted Sandpiper	6.25	40.5	8	34.5	0.5	12	0	10.5
Wilson's Snipe	0.75	16	0	6	0.25	8	1	9.5
Wilson's Phalarope	0	0.5	0	0	0	0	0	0
Mourning Dove	0	0	0	1	0	0	0	0
Calliope Hummingbird	*	*	0	0	0	0	0	0
Belted Kingfisher	0	0	1	1.5	0	0	0	0.5
Williamson's Sapsucker	0	1	0.5	0.5	0	0	0	0
Red-breasted Sapsucker	0	1.5	0.5	2.5	0	0	*	*
Hairy Woodpecker	0	0.5	*	*	*	*	0	0.5
Northern Flicker	0.5	8	1.5	12	0	5.5	1	11
Olive-sided Flycatcher	0	0	0	0	0	0.5	0	0
Western Wood-Pewee	0	9	0	22.5	0.25	5.5	0.5	16.5
Hammond's Flycatcher	0.25	1	0	0	0.25	1.5	0	0
Gray Flycatcher	*	*	0	0	0	0	0	0
Dusky Flycatcher	2.25	9.5	4.5	27.5	0.75	5.5	5.5	21.5
Cassin's Vireo	0.25	1.5	0	1	0	1.5	0.5	1
Hutton's Vireo	0	0.5	0	0	0	0	0	0
Warbling Vireo	0.75	6.5	0	6	0	2.5	1	10.5
Steller's Jay	0	10	0	5.5	0.25	2.5	0	7
Clark's Nutcracker	0.25	7	0	23	0	1	1.5	21.5
Common Raven	0	0	0	1.5	0.5	2	0	1.5
Tree Swallow	5.75	13	0.5	0.5	0	0	0	0
Violet-green Swallow	*	*	0	0	0	0	0	0.5

Bird Species	Upper Hope Valley				Lower Hope Valley			
	2010		2012		2010		2012	
	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius
Northern Rough-winged Swallow	0	2	*	*	0	0	0	0
Cliff Swallow	4.75	14	9	20.5	10.5	56	20	136.5
Mountain Chickadee	2.5	22	2	36	0.5	8.5	1	11.5
Red-breasted Nuthatch	0	6.5	0	5.5	0	0.5	0	1
White-breasted Nuthatch	0	1	*	*	0	0	0	0
Pygmy Nuthatch	0	0	0	0.5	0	0	0	0
Brown Creeper	0	0.5	0	0.5	0	0.5	0	0
Bewick's Wren	0	0	0	0	0	0	1	1.5
House Wren	0.25	4	0	2.5	0	2	0	1
Golden-crowned Kinglet	*	*	0	0	0	0	0	0.5
Blue-gray Gnatcatcher	0	0	0	0	0	0.5	0	0
Western Bluebird	0	0	0	0	0	0.5	0	0
Mountain Bluebird	1	2	0	1	0.25	2	0.5	1
Townsend's Solitaire	0	2	0.5	1.5	0	0	0	3
Hermit Thrush	0	0	0	0	0	0	0	0
American Robin	9.25	50.5	11	58.5	4	29	5.5	44.5
European Starling	0	0	0	0	0.5	1	0	1.5
Orange-crowned Warbler	*	*	0	0	0	1	0	0
Nashville Warbler	0	0	0.5	1	0	0	0	0
Yellow Warbler	1	5	1.5	11	0.75	3	2.5	14.5
Yellow-rumped Warbler	0.75	3	1.5	10.5	0	1	1	6
Hermit Warbler	0	0.5	0	0.5	0	1	0	0.5
MacGillivray's Warbler	0.5	2.5	0	1.5	0	1.5	0	1
Wilson's Warbler	0.25	1.5	0	4	0	1.5	1	2
Western Tanager	0	2	0	6	0	2.5	0	1.5
Green-tailed Towhee	0.5	5.5	0.5	10.5	0.5	5	4.5	17.5
Spotted Towhee	0	0	0	*	*	0.5	0	0
Chipping Sparrow	0.75	7	0.5	5.5	0.5	1.5	0.5	3
Brewer's Sparrow	0.25	1	0	1.5	0.5	3.5	1	8.5
Vesper Sparrow	2.75	21	1.5	7.5	0.5	6.5	1	5
Savannah Sparrow	3.25	29	15.5	50	3	12.5	14	37.5
Fox Sparrow	*	*	0	2.5	0	0	0	0
Song Sparrow	5.25	28	14	50.5	4	23.5	10	52.5
Lincoln's Sparrow	1.25	8	0	6.5	1.5	5.5	4	15
White-crowned Sparrow	3.5	38	7.5	45.5	1.75	12.5	6.5	48.5
Dark-eyed Junco	0	5	10	23.5	1.25	5	0.5	15.5
Black-headed Grosbeak	0	0.5	0	1.5	0	1	0	1

Bird Species	Upper Hope Valley				Lower Hope Valley			
	2010		2012		2010		2012	
	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius
Lazuli Bunting	0	0.5	0	0	0	0	0	0
Red-winged Blackbird	5.5	54.5	9	60	6.75	48.5	8.5	69.5
Western Meadowlark	0	0	*	*	0	0	0.5	6
Brewer's Blackbird	10.75	54	19	37	3.25	28.5	7.5	23.5
Brown-headed Cowbird	3	13.5	1	10	1.75	13	1	11
Purple Finch	0	1.5	0.5	0.5	0	1.5	0	0
Cassin's Finch	1.75	16	0	7	0.5	5	2	5
Red Crossbill	0	0	*	*	0	0	0	0
Pine Siskin	0	0	0	2	0	0	1	2
Lesser Goldfinch	0	0	0	0.5	0	0	0	0.5
Evening Grosbeak	0	0	0	0.5	*	*	2.5	2.5

¹Total count of individuals is averaged between 2 visits.

* Species detected during area search surveys, but not documented during more time-restricted point count surveys.

Appendix B. Index of abundance (no. individuals/no. of stations) for bird species observed in Upper and Lower Hope Valley during surveys in 2010 and 2012.

Bird Species	Upper Hope Valley				Lower Hope Valley			
	2010		2012		2010		2012	
	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius
Canada Goose	0.447	0.871	0	0	0	0	0	0
Mallard	0.145	0.400	0	0.157	0.021	0.105	0	0.037
Green-winged Teal	0	0.057	0.043	0.043	0	0	0	0
Ring-necked Duck	0	0	0.029	0.143	0	0	0	0
Bufflehead	0.013	0.029	0	0.086	0	0	0	0
Common Merganser	0.026	0.071	0	0	0	0	0	0
Unidentified Duck	0	0	0	0.014	0	0	0	0.019
Sooty Grouse	0	0	0	0	0	0	0	0
Mountain Quail	0	0.300	0.014	0.371	0	0.132	0	0.185
California Quail	0	0	0	0.057	0	0.026	0.053	0.148
Great Blue Heron	0	0	0	0	0	0.026	0	0
Bald Eagle	0	0	0	0	0	0.026	0	0
Red-tailed Hawk	0	0	0	0.029	0	0	0	0.074
Sora	0	0	0	0	0	0.132	0	0
Killdeer	0.066	0.400	0.071	0.529	0.021	0.342	0	0.074
Spotted Sandpiper	0.329	1.157	0.229	0.986	0.014	0.632	0	0.389
Wilson's Snipe	0.039	0.457	0	0.171	0.007	0.421	0.053	0.352
Wilson's Phalarope	0	0.014	0	0	0	0	0	0
Mourning Dove	0	0	0	0.029	0	0	0	0
Belted Kingfisher	0	0	0.029	0.043	0	0	0	0.019
Williamson's Sapsucker	0	0.029	0.014	0.014	0	0	0	0
Red-breasted Sapsucker	0	0.043	0.014	0.071	0	0	0	0
Hairy Woodpecker	0	0.014	0	0	0	0	0	0.019
Northern Flicker	0.026	0.229	0.043	0.343	0	0.289	0.053	0.407
Olive-sided Flycatcher	0	0	0	0	0	0.026	0	0
Western Wood-Pewee	0	0.257	0	0.643	0.007	0.289	0.026	0.611
Hammond's Flycatcher	0.013	0.029	0	0	0.007	0.079	0	0
Dusky Flycatcher	0.118	0.271	0.129	0.786	0.021	0.289	0.289	0.796
Cassin's Vireo	0.013	0.043	0	0.029	0	0.079	0.026	0.037
Hutton's Vireo	0	0.014	0	0	0	0	0	0
Warbling Vireo	0.039	0.186	0	0.171	0	0.132	0.053	0.389
Steller's Jay	0	0.286	0	0.157	0.007	0.132	0	0.259
Clark's Nutcracker	0.013	0.200	0	0.657	0	0.053	0.079	0.796
Common Raven	0	0	0	0.043	0.014	0.105	0	0.056
Tree Swallow	0.303	0.371	0.014	0.014	0	0	0	0
Violet-green Swallow	0	0	0	0	0	0	0	0.019
Northern Rough-winged Swallow	0	0.057	0	0	0	0	0	0
Cliff Swallow	0.250	0.400	0.257	0.586	0.300	2.947	1.053	5.056
Mountain Chickadee	0.132	0.629	0.057	1.029	0.014	0.447	0.053	0.426

Bird Species	Upper Hope Valley				Lower Hope Valley			
	2010		2012		2010		2012	
	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius
Red-breasted Nuthatch	0	0.186	0	0.157	0	0.026	0	0.037
White-breasted Nuthatch	0	0.029	0	0	0	0	0	0
Pygmy Nuthatch	0	0	0	0.014	0	0	0	0
Brown Creeper	0	0.014	0	0.014	0	0.026	0	0
Bewick's Wren	0	0	0	0	0	0	0.053	0.056
House Wren	0.013	0.114	0	0.071	0	0.105	0	0.037
Golden-crowned Kinglet	0	0	0	0	0	0	0	0.019
Ruby-crowned Kinglet	0	0	0	0	0	0	0	0
Blue-gray Gnatcatcher	0	0	0	0	0	0.026	0	0
Western Bluebird	0	0	0	0	0	0.026	0	0
Mountain Bluebird	0.053	0.057	0	0.029	0.007	0.105	0.026	0.037
Townsend's Solitaire	0	0.057	0.014	0.043	0	0	0	0.111
Hermit Thrush	0	0	0	0	0	0	0	0
American Robin	0.487	1.443	0.314	1.671	0.114	1.526	0.289	1.648
European Starling	0	0	0	0	0.014	0.053	0	0.056
Orange-crowned Warbler	0	0	0	0	0	0.053	0	0
Nashville Warbler	0	0	0.014	0.029	0	0	0	0
Yellow Warbler	0.053	0.143	0.043	0.314	0.021	0.158	0.132	0.537
Yellow-rumped Warbler	0.039	0.086	0.043	0.300	0	0.053	0.053	0.222
Hermit Warbler	0	0.014	0	0.014	0	0.053	0	0.019
MacGillivray's Warbler	0.026	0.071	0	0.043	0	0.079	0	0.037
Wilson's Warbler	0.013	0.043	0	0.114	0	0.079	0.053	0.074
Unidentified Warbler	0	0	0	0.029	0	0	0	0.037
Western Tanager	0	0.057	0	0.171	0	0.132	0	0.056
Green-tailed Towhee	0.026	0.157	0.014	0.300	0.014	0.263	0.237	0.648
Spotted Towhee	0	0	0	0	0	0.026	0	0
Chipping Sparrow	0.039	0.200	0.014	0.157	0.014	0.079	0.026	0.111
Brewer's Sparrow	0.013	0.029	0	0.043	0.014	0.184	0.053	0.315
Vesper Sparrow	0.145	0.600	0.043	0.214	0.014	0.342	0.053	0.185
Savannah Sparrow	0.171	0.829	0.443	1.429	0.086	0.658	0.737	1.389
Fox Sparrow	0	0	0	0.071	0	0	0	0
Song Sparrow	0.276	0.800	0.400	1.443	0.114	1.237	0.526	1.944
Lincoln's Sparrow	0.066	0.229	0	0.186	0.043	0.289	0.211	0.556
White-crowned Sparrow	0.184	1.086	0.214	1.300	0.050	0.658	0.342	1.796
Dark-eyed Junco	0	0.143	0.286	0.671	0.036	0.263	0.026	0.574
Black-headed Grosbeak	0	0.014	0	0.043	0	0.053	0	0.037
Lazuli Bunting	0	0.014	0	0	0	0	0	0
Red-winged Blackbird	0.289	1.557	0.257	1.714	0.193	2.553	0.447	2.574

Bird Species	Upper Hope Valley				Lower Hope Valley			
	2010		2012		2010		2012	
	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius	<50m	unlim. radius
Western Meadowlark	0	0	0	0	0	0	0.026	0.222
Brewer's Blackbird	0.566	1.543	0.543	1.057	0.093	1.500	0.395	0.870
Brown-headed Cowbird	0.158	0.386	0.029	0.286	0.050	0.684	0.053	0.407
Purple Finch	0	0.043	0.014	0.014	0	0.079	0	0
Cassin's Finch	0.092	0.457	0	0.200	0.014	0.263	0.105	0.185
Pine Siskin	0	0	0	0.057	0	0	0.053	0.074
Lesser Goldfinch	0	0	0	0.014	0	0	0	0.019
Evening Grosbeak	0	0	0	0.014	0	0	0.132	0.093