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Riparian Songbird Monitoring at Hogback Creek, 1999-2003.

A report requested by and prepared for the
Inyo County Water Department



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STUDY AREA AND METHODS

Point Count Censuses

PRBO established one transect of 15 independent point count stations on lower Hogback Creek in 1999 (Appendix A). Where width of the riparian vegetation allowed, the 50 m census radius was placed entirely within riparian vegetation. In some cases, we established points on the edges of the narrow riparian strip, therefore including adjacent sagebrush or pasture habitats. We placed stations 250 m apart regardless of riparian habitat type.

We censused stations two times during the peak of the songbird breeding season (June 1 – June 29) in each of 5 years (1999-2003, Appendix A). We spaced each of two visits at least 7 days apart. From 1999 – 2001, we used the fixed-radius point count method following guidelines outlined in Ralph et al. (1993). In these years, we recorded all birds detected within a 50 m radius separately from those greater than 50 m and we noted whether detections were inside or outside of the riparian vegetation. We recorded type of detection, prioritizing song over visual or call. During and after 2002, we censused all points using the variable circular plot (VCP) point count method (Rosenstock et al. 2002) and followed general guidelines outlined in Ralph et al. (1993). In these years, we estimated the distance to each bird in 10m increments out to 50m, in 25m increments out to 100m, and lumped all detections beyond 100m. In all years, we conducted 5-minute counts. We recorded all birds detected and type of initial detection (visual, song or call).

To minimize observer bias, a different observer conducted each of the two censuses. Additionally, we conducted points in order from point 1 to 15 for one of the censuses and in the opposite direction (from point 15 to 1) for the other in order to minimize the effects of time of day on detection rates. We conducted censuses from within 30 minutes after local sunrise until approximately 4 hours later, and did not conduct counts in excessively windy or rainy conditions.

Observer Training

PRBO biologists trained in distance estimation and familiar with songs and calls of birds in the area conducted all point count censuses. Additionally, all biologists practiced distance estimation and local bird identification for two weeks prior to censuses. Throughout the season, observers calibrated distance estimations on a weekly basis, and starting in 2002, a Leica Range Finder™ was rotated through observers for use during the censuses.

Point Count Vegetation Assessment

We conducted vegetation assessments at each of the 15 point count stations in 2001. Using the Relevé method described by Ralph et al. (1993), we estimated percent cover by height category for every species of plant located within 50 m of point count stations. Height categories were “herb” (0 - .5 m), “shrub” (.5 - 5 m) and “tree” (> 5 m). We also estimated the width of the riparian zone at the point (riparian width), and the patchiness of riparian vegetation along the riparian width (riparian patchiness). We used our vegetation measurements and guidance provided by Sawyer and Keeler-Wolf (1995) to assign dominant habitat series (habitat types) to each point. See Appendix C for list of variables.

Statistical Analysis and Definitions

We summarized species diversity, species richness and total individuals for breeding species detected within 50 m during point counts at Hogback Creek. We excluded all non-breeding migrant or transient species. We further limited the species included in the summaries to those that we determined to be most reliably recorded with the point count protocol. Thus we also removed species whose territories are typically so large that we could not assure independence of individual observations among points (swallows [*Hirundinidae*], swifts [*Apodidae*], waterfowl [*Anatidae*], wading birds [*Ardeidae*], shorebirds [*Scolopacidae* and *Charadriidae*], vultures [*Cathartidae*], hawks [*Accipitridae*], falcons [*Falconidae*], Common Ravens [*Corvus corax*], and Chukar (*Alectoris chukar*). Nocturnal species were also excluded (owls [*Strigidae* and *Tytonidae*] and nightjars [*Caprimulgidae*]). Species used in this analysis are presented in Table 3.

Species diversity: We used Point Count 2.75 (Ballard 2002) to calculate breeding species diversity by transect in each of five years, using all detections within 50m summed over two visits. We used a transformation of Shannon's diversity index (or H' , Krebs 1989) denoted N_1 (MacArthur 1965). The transformation expresses the data in terms of number of species and thus is more easily interpreted. Expressed mathematically:

$$N_1 = e^{H'} \text{ and } H' = -\sum_{i=1}^{i=S} (p_i)(\ln p_i)$$

Where S = total species richness and p_i is the proportion of the total numbers of individuals for each species (Nur et al. 1999). High index scores indicate both high species richness and more equal distribution of individuals among species.

Species richness: We calculated the number of all breeding species by transect using all detections within 50m summed over two visits, using Point Count 2.75 (Ballard 2002).

Total individuals. We summed the number of all individuals of breeding species by transect using all detections within 50m summed over two visits, using Point Count 2.75 (Ballard 2002).

Breeding Status

We determined breeding status for all species encountered at Hogback Creek between May 1 and August 15, 1999-2003. We used observations recorded before, during, and after all censuses and during project set up and vegetation assessments. We ranked species by site, using the following four criteria of the Riparian Habitat Joint Venture breeding scale, modified from breeding bird atlas criteria (<http://www.prbo.org/CalPIF/criteria.html>):

0 No evidence of breeding: Species not detected during breeding season, or species known not to breed within the general study area.

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

3 Probable breeding: Singing individual encountered on 2 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); nesting material or fecal sack being carried by adult; independent juveniles with adults; active territory observed on at least three days (at least one week apart); active nest observed.

RESULTS AND DISCUSSION

We detected 66 species at Hogback Creek during the songbird breeding season, 1999-2003 (Table 1). Of 188 PRBO point count stations along 12 streams in the Owens Valley Alluvial Fan and of 173 PRBO point count stations along the Lower Owens River, the riparian bird community at Hogback Creek is anomalous (Heath and Gates 2002, Heath and Ballard 2003a). Hogback Creek was the only location where we documented breeding populations of Phainopeplas. And, with the exception of a few singing individuals detected at our Tinemaha Reservoir site, Hogback Creek is the only location among PRBO sites in which we have documented breeding Yellow-breasted Chats (State Species of Special Concern, CDFG and PRBO 2001). Additionally, Hogback Creek is the only location among PRBO sites where Wrentits have been documented, although the species has been found at other Owens Valley Alluvial Fan locations (T. & J. Heindel pers. coms.). The State Endangered Yellow-billed Cuckoo has been previously documented at Hogback Creek (Laymon and Williams 1994), and we did detect a calling individual in one of the 5 years of study, but breeding status remains unknown. We detected several other special status species at Hogback Creek, including Yellow Warbler (State Species of Special Concern), Swainson's Hawk (State Threatened), Northern Harrier (State Species of Special Concern), Loggerhead Shrike (State Species of Special Concern) and migrant populations of Willow Flycatcher (State Endangered or Federally Endangered depending on subspecies) and Olive-sided Flycatcher (State Species of Special Concern, CDFG and PRBO 2001, CDFG 2004). Several other riparian associated bird species utilize the riparian habitat provided by Hogback Creek, including Warbling Vireos, Black-headed and Blue Grosbeaks, Song Sparrows, and Black-chinned Hummingbirds.

Breeding bird species diversity, richness and abundance were among the highest at Hogback Creek compared to other Owens Valley Alluvial Fan sites (Table 2, Heath and Ballard 1999). Bird numbers and composition fluctuated among our five years of study at Hogback, with 2002 demonstrating the highest abundance, 1999 demonstrating the highest diversity and 2001 demonstrating lows in all cases. High numbers in 2002 may represent a northerly movement of desert-breeding species as a result of the record low rain levels in the desert regions of California in that year (Tinker 2002, Heath et al. 2002). Phainopeplas, for example, were present on Hogback Creek in record numbers in 2002 (Table 3). Yellow-breasted Chats, Black-headed Grosbeaks, Western Kingbirds, Lesser Goldfinches, and Western Wood-Pewees were at least twice as abundant in 1999 than in other years, and thus contributed to higher breeding diversity in that year. We retained Western Wood-Pewees in breeding bird diversity calculations because their localized breeding status is uncertain and sporadic (PRBO data). It is possible that Wood-Pewees bred in 1999, but it is also possible that they were migrants, therefore inflating the bird species diversity indices for that year. The most abundant species at Hogback Creek were Bewick's Wrens, Spotted Towhees, Song Sparrows, Phainopeplas, and Brown-headed Cowbirds (Table 3).

Table 1. Breeding status of all species detected at lower Hogback Creek, May 1 – August 15 1999-2003. 1 = Confirmed Breeder, 3 = Probable Breeder, 2 = Possible Breeder, 0 = Transient / Migrant / Disperser.

Common name	Latin name	Breeding Status	Common name	Latin name	Breeding Status
American Kestrel	<i>Falco sparverius</i>	1	Lesser Goldfinch	<i>Carduelis psaltria</i>	3
American Magpie	<i>Pica hudsonia</i>	2	Lesser Nighthawk	<i>Chordeiles acutipennis</i>	0
American Robin	<i>Turdus migratorius</i>	1	Loggerhead Shrike	<i>Lanius ludovicianus</i>	0
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	3	Mountain Quail	<i>Oreortyx pictus</i>	0
Barn Swallow	<i>Hirundo rustica</i>	0	Mourning Dove	<i>Zenaida macroura</i>	1
Bewick's Wren	<i>Thryomanes bewickii</i>	3	Northern Harrier	<i>Circus cyaneus</i>	0
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	1	Northern Mockingbird	<i>Mimus polyglottos</i>	2
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	2	Nuttall's Woodpecker	<i>Picoides nuttallii</i>	3
Black-throated Sparrow	<i>Amphispiza bilineata</i>	2	Olive-sided Flycatcher	<i>Contopus cooperi</i>	0
Blue Grosbeak	<i>Guiraca caerulea</i>	2	Orange-crowned Warbler	<i>Vermivora celata</i>	2
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	1	Phainopepla	<i>Phainopepla nitens</i>	1
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	2	Red-shafted Flicker	<i>Colaptes auratus</i>	1
Brewer's Sparrow	<i>Spizella breweri</i>	0	Red-tailed Hawk	<i>Buteo jamaicensis</i>	0
Brown-headed Cowbird	<i>Molothrus ater</i>	3	Sage Sparrow	<i>Amphispiza belli</i>	2
Bullock's Oriole	<i>Icterus bullockii</i>	3	Say's Phoebe	<i>Sayornis saya</i>	2
Bushtit	<i>Psaltriparus minimus</i>	1	Solitary Vireo	<i>Vireo cassinii</i> or <i>plumbeus</i>	0
California Quail	<i>Callipepla californica</i>	1	Song Sparrow	<i>Melospiza melodia</i>	1
Cassin's Finch	<i>Carpodacus cassinii</i>	0	Spotted Towhee	<i>Pipilo maculatus</i>	1
Cedar Waxwing	<i>Bombycilla cedrorum</i>	0	Swainson's Hawk	<i>Buteo swainsoni</i>	0
Chipping Sparrow	<i>Spizella passerina</i>	1	Violet-green Swallow	<i>Tachycineta thalassina</i>	0
Chukar	<i>Alectoris chukar</i>	3	Warbling Vireo	<i>Vireo gilvus</i>	2
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	0	Western Flycatcher	<i>E. occidentalis</i> or <i>difficilis</i>	0
Common Nighthawk	<i>Chordeiles minor</i>	0	Western Kingbird	<i>Tyrannus verticalis</i>	0
Common Raven	<i>Corvus corax</i>	0	Western Scrub-Jay	<i>Aphelocoma californica</i>	0
Cooper's Hawk	<i>Accipiter cooperii</i>	0	Western Tanager	<i>Piranga ludoviciana</i>	2
Costa's Hummingbird	<i>Calypte costae</i>	0	Western Wood-pewee	<i>Contopus sordidulus</i>	2
Dusky Flycatcher	<i>Empidonax oberholseri</i>	0	White-throated Swift	<i>Aeronautes saxatalis</i>	0
European Starling	<i>Sturnus vulgaris</i>	0	Willow Flycatcher	<i>Empidonax traillii</i>	0
Great Horned Owl	<i>Bubo virginianus</i>	0	Wilson's Warbler	<i>Wilsonia pusilla</i>	0
Hammond's Flycatcher	<i>Empidonax hammondii</i>	0	Wrentit	<i>Chamaea fasciata</i>	3
House Finch	<i>Carpodacus mexicanus</i>	2	Yellow Warbler	<i>Dendroica petechia</i>	3
House Wren	<i>Troglodytes aedon</i>	1	Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	0
Lazuli Bunting	<i>Passerina amoena</i>	0	Yellow-breasted Chat	<i>Icteria virens</i>	1

Table 2. Species Diversity, Species Richness and Total Individuals detected within 50m for breeding species at Hogback Creek during five minute point counts, 1999-2003.

	1999	2000	2001	2002	2003
Species Diversity	18.15	11.51	11.58	14.53	14.57
Species Richness	30	22	21	26	27
Total Individuals	179	186	115	232	202

Table 3. Number of individuals per breeding species detected within 50m at Hogback Creek summed over two visits during five minute point counts, 1999-2003.

	1999	2000	2001	2002	2003
Ash-throated Flycatcher	6	9	2	8	4
Black-chinned Hummingbird	5	5	2	5	2
Bewick's Wren	21	30	30	27	34
Blue-gray Gnatcatcher	8	0	4	14	9
Brown-headed Cowbird	7	11	0	12	17
Black-headed Grosbeak	2	0	0	1	0
Blue Grosbeak	3	1	7	0	4
Brewer's Blackbird	1	0	0	1	1
Black-throated Sparrow	2	0	0	2	0
Bullock's Oriole	3	2	0	3	2
Bushtit	2	17	1	3	2
California Quail	2	4	3	13	10
Chipping Sparrow	0	0	1	0	0
Costa's Hummingbird	0	0	1	0	1
Common Yellowthroat	0	1	0	0	0
House Finch	0	1	0	1	2
House Wren	2	1	4	10	4
Lazuli Bunting	1	0	3	0	0
Lesser Goldfinch	9	3	2	3	4
Loggerhead Shrike	0	0	0	0	1
Mourning Dove	1	1	7	14	32
Northern Mockingbird	0	0	0	3	2
Nuttall's Woodpecker	3	0	0	0	1
Phainopepla	24	15	15	43	19
Northern Flicker	3	0	1	1	0
Sage Sparrow	1	0	7	0	0
Say's Phoebe	0	0	0	0	1
Song Sparrow	9	21	2	10	10
Spotted Towhee	30	46	19	40	26
Warbling Vireo	1	0	0	0	1
Western Kingbird	3	1	0	1	0
Western Scrub-Jay	1	5	0	2	0
Western Tanager	2	1	0	4	0
Western Wood-Pewee	5	0	0	0	0
Yellow-breasted Chat	11	4	1	4	5
Yellow-billed Cuckoo	0	0	0	0	1
Yellow Warbler	3	3	1	2	3

Heath and Ballard (2003b) investigated bird and habitat relationships over a 250 km latitudinal stretch of the eastern Sierra Nevada, including Hogback Creek. They found that Mature Black Willow habitat types harbored significantly higher breeding bird diversity than any other riparian types in the region. In particular, breeding bird species diversity was positively correlated with Black Willow tree cover, willow shrub cover, riparian width and the percent of the study area covered by riparian vegetation. In Mixed Willow habitats, herbaceous cover and percent of riparian vegetation were positively correlated with breeding bird species diversity (Heath and Ballard 2003b).

Hogback Creek harbored wide patches of multi-storied riparian vegetation, demonstrated by high percentages of tree, shrub and herb cover and high riparian widths (Table 4). About half of our Hogback Creek stations had riparian widths of over 100m, and with the exception of sites on the Lower Owens River, Hogback Creek was the only site characterized predominantly as Black Willow or Fremont Cottonwood habitat types (Table 4 and Table 5, Heath and Ballard 2003b). Average Black Willow and Fremont Cottonwood cover at other PRBO Alluvial Fan study sites was 0% and < 1% respectively, and herbaceous cover averaged 6% (PRBO data).

Table 4. Select vegetation data at lower Hogback Creek points, 2001. See Appendix C for definitions of vegetation variables and habitat codes.

Point	hab1	hab1 perc	hab2	hab2 perc	hab3	hab3 perc	tree cov	shrub cov1	shrub cov2	herb cov1	total woody	stand wat	run wat	litter	road trail	rock	bare grnd	herb rich	shrub rich	tree rich	rip width	rip patch
1	BLWI	50	SALT	50	--	0	20	45	50	10	75	0	0	45	10	2	35	2	6	1	70	80
2	BLWI	35	SALT	25	--	0	15	35	60	30	80	0	0	5	5	0	10	2	9	1	>100	50
3	BLWI	10	RABR	45	--	0	5	15	40	60	75	0	0	3	0	0	0	2	10	1	>100	30
4	BLWI	50	RABR	50	--	0	5	25	60	40	75	0	0	5	0	0	5	3	10	1	>100	60
5	BLWI	35	RIBES	65	--	0	15	95	25	20	98	0	0	100	0	0	0	3	3	1	>100	90
6	MIWI	60	RABR	20	--	0	0	20	60	50	75	0	0	5	0	0	20	2	9	0	80	90
7	BLWI	50	SALT	30	--	0	10	20	50	40	75	0	0	3	0	0	15	3	12	1	>100	60
8	FRCO	25	RABR	50	--	0	15	25	40	40	65	0	0	15	0	0	25	3	8	2	50	40
9	BLWI	40	FRCO	15	RABR	45	50	37	50	60	60	0	0	60	2	0	20	5	11	3	80	100
10	BLWI	75	FRCO	15	RABR	10	45	48	50	60	60	0	0	80	2	1	2	4	10	2	>100	45
11	BLWI	55	FRCO	45	--	0	55	35	47	90	65	0	0	90	0	0	2	6	11	2	80	80
12	BLWI	65	FRCO	15	--	0	40	20	40	90	50	0	0	90	0	0	1	5	11	2	>100	30
13	BLWI	100	--	--	--	0	43	35	40	90	42	0	4	90	2	0	0	4	9	2	80	30
14	BLWI	80	BISA	20	--	0	20	58	40	40	68	0	8	55	13	5	15	4	9	3	40	50
15	BLWI	30	BISA	65	--	0	35	15	75	15	70	0	5	65	12	12	5	6	10	2	50	60

Hogback Creek is unique among PRBO's other Owens Valley Alluvial Fan riparian sites in that its riparian tree canopy is complemented by a high percentage of shrub willow cover. Other Alluvial Fan sites had an average of 6% shrub willow cover, while Hogback Creek shrub willow ranged from 20% to 80% cover (Table 5). Also anomalous to Hogback Creek, was the large patches of *Prunus*, *Ribes* and Wild Rose,

and it was in these patches that we observed several Yellow-breasted Chat territories (S. Heath pers. obs., Table 5). The herbaceous layer was characterized predominantly by Yerba Mansa and American Licorice, and Grass or *Juncus* species (Table 5).

Table 5. Percent cover of 50 m radius point count circle occupied by select plant species at Hogback Creek, 2001. Latin names provided in Appendix B.

site	<u>Herbaceous cover</u>				<u>Riparian woody plant cover</u>				<u>Non-riparian woody plant cover</u>				<u>Tree Species</u>		
	Yerba Mansa Cover	American Licorice Cover	Grass Cover	Juncus Cover	Prunus Cover	Ribes Cover	Wild Rose Cover	Willow Cover	Horse-brush Cover	Big Sage-brush Cover	Salt-bush Cover	Rabbit-brush Cover	Freemont Cottonwood Cover	Black Locust Cover	Black Willow Cover
1	3	0	0	0	0	0	0	70	0	5	20	5	0	0	20
2	26	1	2	0	0	0	5	60	0	0	20	15	0	0	15
3	59	4	2	0	20	10	0	20	0	0	0	50	0	0	5
4	18	3	19	0	10	20	10	30	0	0	0	30	0	0	5
5	2	0	0	0	0	80	0	20	0	0	0	0	0	0	15
6	45	3	4	0	0	0	0	80	0	0	0	20	0	0	0
7	34	3	1	0	0	5	0	80	2	0	10	5	0	0	10
8	30	1	8	0	23	0	5	23	0	0	0	23	23	0	6
9	30	11	21	0	0	3	0	65	0	0	0	2	25	0	40
10	42	3	9	0	8	0	0	57	0	0	0	3	27	0	36
11	59	1	11	0	1	10	0	45	0	0	0	2	40	0	30
12	54	0	26	9	1	0	0	60	0	0	2	2	34	0	32
13	45	26	20	14	10	1	0	50	0	0	0	4	35	0	37
14	10	0	20	2	25	0	0	65	0	0	1	2	6	0	13
15	0	0	2	0	5	0	0	35	0	15	3	0	0	40	14

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APPENDIX A. HOGBACK CREEK POINT COUNT VISITS, LOCATIONS, DESCRIPTION AND MAP

Appendix A - Table 1. Point Count census dates (1999-2003) at Hogback Creek.

Year	Visit 1	Visit 2
1999	June 8	June 20
2000	June 8	June 25
2001	June 3	June 17
2002	June 1	June 15
2003	June 8	June 30

Appendix A – Table 2. GPS locations of Hogback Creek point count stations, in decimal degrees, NAD83.

Point	LAT	LON
1	36.64770	-118.14544
2	36.65030	-118.14613
3	36.65122	-118.14508
4	36.65321	-118.14567
5	36.65467	-118.14842
6	36.65638	-118.14753
7	36.65801	-118.14607
8	36.65954	-118.14431
9	36.65908	-118.14264
10	36.66118	-118.14236
11	36.66262	-118.14228
12	36.66455	-118.14093
13	36.66596	-118.13991
14	36.66685	-118.13799
15	36.66830	-118.13666

HOGBACK CREEK POINT COUNT TRANSECT DESCRIPTION

STATION: Lower Hogback Creek = HOGL

FLAG MARKING POINT: Blue

INTERVALS BETWEEN POINTS: 250m

TOTAL # POINTS: 15

NOTES: Wear sturdy clothing, as there are a few thrashes through the vegetation. Bring a compass. All bearings are magnetic. Points are more or less numbered downstream.

ACCESS: From 395 take Moffatt Ranch Rd. west. Cross la aqueduct and make an immediate left. Follow this road until it intersects with Hogback Rd. Turn right on Hogback. Approx. 0.1 miles past this intersection (with Movie Rd.) a thin riparian corridor should be on your right (north) side with a spur road adjacent on its west side. Take it and follow it a very short distance past a small pinkish boulder on your right and park.

Point #1: Go back to the pinkish boulder that you passed. Flag is on willow to the east of the boulder, but do the count from the boulder.

APPENDIX A. POINT COUNT TRANSECT DESCRIPTION – CONTINUED-

Point #2: Continue in from Hogback Rd. along spur road until you pass a gate in a barbed-wire fence, after which, turn right and follow cow-path just off the edge of the riparian. It should rejoin the road. The point is a willow just beyond and east of the road's terminus.

Point #3: Follow the main cow-path from the end of the road. It will go through a large section of little white flowers and curve gently right, entering a small grassy area bordered by willows where it peters out. At the small grassy area, hug the willows as they curve to your right. Pass two consecutive orange flags on your left and head towards conspicuous 7m willow that the flags point towards. There's a small patch of bare earth banking the "creek" below this willow. Flag is on a rabbit brush next to the willow.

Point #4: From point #3, head directly towards the White Mountains to the NNW. They should appear framed by a large willow on the right and a lower clump of willows on the left. Go to the clump on the left. From this clump, look NW and see the large clump of trees and snags now framed by the Sierras on the left and the Whites on the right. Go there. The point is on the central willow.

Point #5: Head WNW through a clearing in the rose/currant following cow paths. From the other side of this short patch continue along a bearing of 290 degrees to the riparian on the other side of the drier rabbit brush field. You should pass directly over some old boards. The willows here appear impassable. Look downhill for a small boulder and a blue flag in a rabbit brush. From this boulder you should be able to look across the thick tangle of willows towards a relatively prominent patch of taller willows with an even canopy and lots of blue flagging draped from on high. This is your objective. Make sure your shoelaces are tied and your data is secure in the clipboard and head in from the boulder. Watch for the deep creek about a third of the way through. The crux is the very end when you have to balance your way over live currant stems. Try not to crush the wood rat hutch when you do get there.

Point #6: Escape at a bearing of approx. 320 degrees through a maze of willows the sage on the other side. Don't worry about which path you choose. You'll pop out to an area with big boulders and torn-down old structures. Turn right, and head approx. 20 degrees along a cow path, through a patch of willows, to a sandy bare spot. Turn right and look for the flag on a small willow in line with yourself and a 3m willow snag beyond.

Point #7: Continue along the edge of the riparian and sage. Approx. 30m past the "split" boulder, continue straight into riparian and towards the right-hand edge of some large willows. A cow path will veer right into the willows, and the flag is at this entry spot.

Point #8: Follow the cow path through the willows to a grassy field beyond. Turn left and head down. At the bottom of this small field a cow path cuts through the rose/currant/cherry. Follow the path of least resistance until two big cottonwoods appear to your right. A large willow will be on your left, bordering sage, and a large patch of rose will sit isolated before you. From this point, look beyond the left edge of the rose to the large cottonwood with the dead willow branches on the right-hand side. The flag is on that cottonwood.

Point # 9: Head down about 20m and turn right through the veg. Cast off up and across sage angling back slightly at a bearing of 115. Cross the "road" and look for the flag in a low-angled willow snag on the edge of the riparian.

Point # 10: Head downhill again, keeping edge of riparian on your right until it swings around in front of you. Beyond a thin strip of willows you'll find yourself on a very small "ridge" peppered with rabbit brush and surrounded by willow. The point is on a rabbit brush near the terminus of the ridge and two partially exposed rocks in the ground.

Point #11: Head at a bearing of 345 degrees downhill and towards a large cottonwood in the distance. Cross fallen snags and jog right a few meters for easier travel. A short thrash through the tule/cattails the previous bearing leads you to a gallery of 2-3m willows surrounded by taller trees. There is a cow path entering the willows on the left-hand side that quickly dissolves. A short, but somewhat blind thrash through the willows should bring you to the other side and the point. Try to keep your eyes on that tall cottonwood, and avoid getting swept away to the right. Sage will be visible from the point. The point is on a very young cottonwood, and three small saw-cut stumps are a few meters away.

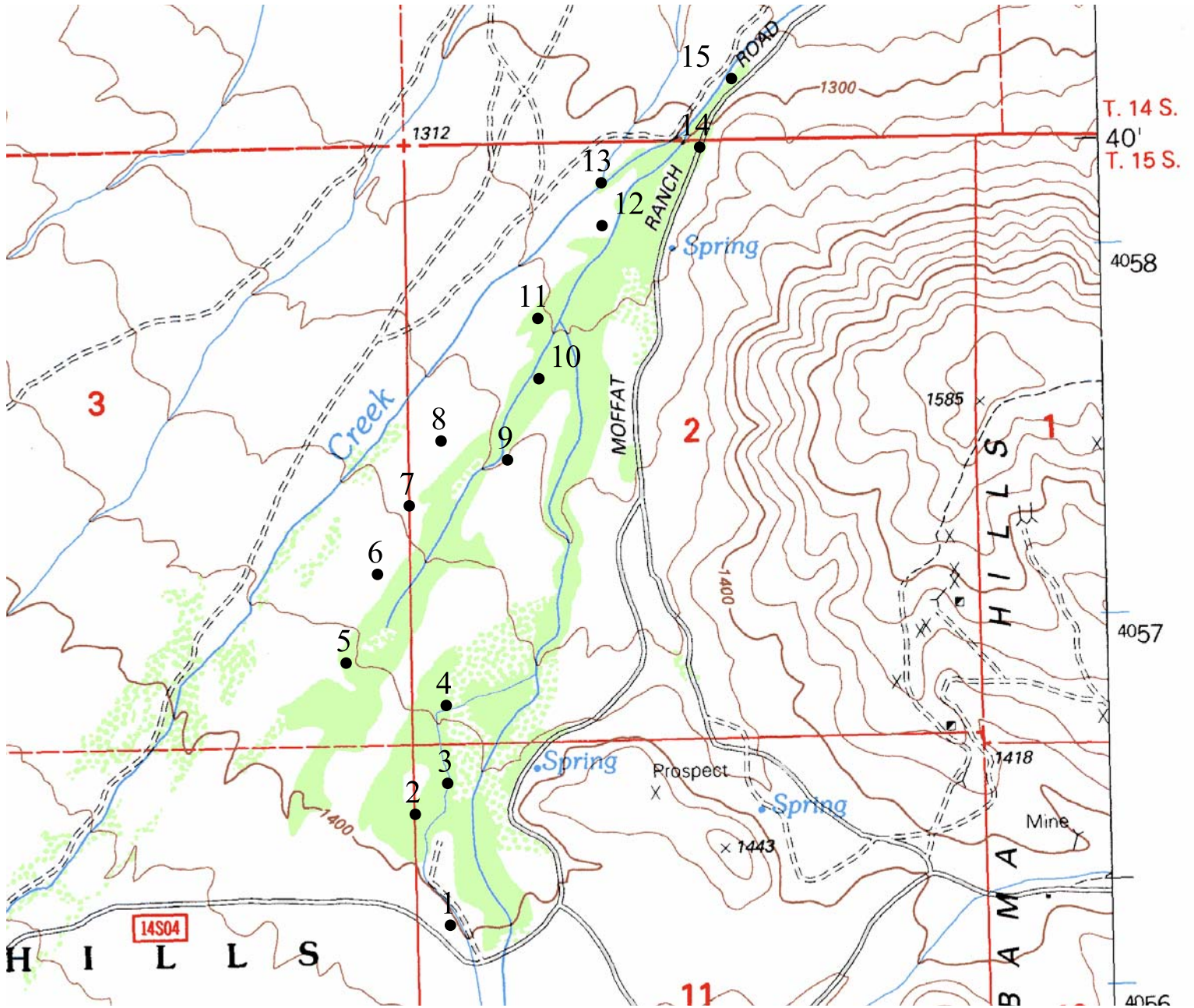
Point #12: Cross through a gap in the vegetation by keeping the stumps on your left, and continue downhill. After approx. 95m bear left around the thick, dense stand of willow. Keep this wall of vegetation on your right, and you'll eventually see a lone, white 1.5m cottonwood "snag" that looks essentially like a stick in the mud. Flag is on the snag.

Point # 13: Head off at 345 degrees to hook up with a cow path which will hook around willows. Immediately afterwards, it will fork. Bear left. Either way you go, head down towards a small patch of willows near the bottom of the open field. Flagging is on the left-hand side of the willows. The creek should be audible off to your left.

Point # 14: At the very bottom of the clearing, a cow path breaks through the willows. It will take you to the creek. Cross both the creek and the barbed-wire fence and follow the road to where it crosses the creek. There is a footbridge on the upstream side of the crossing. The point is on a willow in the center of the "Y" on the south side of the creek at this crossing.

Point # 15: Continue down the road towards a patch of large locust trees. A short walk through the sage takes you to a large willow on the south side of the stream, just upstream from the bulk of the taller locusts. The point is here.

APPENDIX A: PRBO POINT COUNT LOCATIONS AT LOWER HOGBACK CREEK.



500 0 500 1000 1500 Meters



HOGL - Lower Hogback Creek
USGS 7.5' Quad: Manzanar

**APPENDIX B. HOGBACK CREEK PLANT LIST AND SAWYER AND KEELER-WOLF
HABITAT CODES**

Code	Latin Name	Common Name	Sawyer and Keeler-Wolf riparian habitat types	CODE
ANCA10	<i>Anemopsis californica</i>	Yerba Mansa	Mature Black Willow	BLWI
ARLU	<i>Artemesia ludoviciana</i>	Mugwort	Fremont Cottonwood	FRCO
ARTR2	<i>Artemesia tridentata</i>	Big Sagebrush	Saltbush	SALT
ASCLE	<i>Asclepias spp</i>	Milkweed	Rabbitbrush	RABR
ASTER	<i>Aster spp</i>	Aster forb species	<i>Ribes spp.</i>	RIBES
ATRIP	<i>Atriplex spp</i>	Saltbush	Big Sagebrush	BISA
CASTI	<i>Castilleja spp</i>	Paintbrush		
CHRY9	<i>Chrysothamnus spp</i>	Rabbitbrush species		
CICUT	<i>Cicuta spp</i>	water hemlock		
CIRSI	<i>Cirsium spp</i>	Thistle		
CLAMA	<i>Clematis spp</i>	clematis		
DEAD	--	Unknown Dead plant		
ELYMU	<i>Elymus spp</i>	Wild Rye		
EPHED	<i>Ephedra spp</i>	Mormon Tea species		
EPHEDD	--	Dead Mormon Tea		
ERFA2	<i>Eriogonum fasciculatum</i>	Eastern Mojave buckwheat		
ERICA2	<i>Ericameria spp</i>	heathgoldenrod		
GLLE3	<i>Glycyrrhiza lepidota</i>	American licorice		
GRASS	--	Grass species		
GRASSD	--	Dead Grass		
JUNCU	<i>Juncus spp</i>	Rush		
PHCO15	<i>Phragmites communis</i>	Common Reed		
POTEN	<i>Potentilla spp</i>	Cinquefoil		
PRUNU	<i>Prunus spp</i>	Prunus		
RIBES	<i>Ribes spp</i>	Currant species		
ROPS	<i>Robinia pseudoacacia</i>	Black Locust		
ROWO	<i>Rosa woodsii</i>	Rose (wild)		
SAEX	<i>Salix exigua</i>	Coyote / Sandbar Willow		
SAGO	<i>Salix gooddingii</i>	Goodding's willow		
SALA6	<i>Salix lasiolepis</i>	Arroyo Willow		
SALIX	<i>Salix spp</i>	Willow species		
SAVE4	<i>Sarcobatus vermiculatus</i>	Big Greasewood		
SMST	<i>Smilacina stellata</i>	False Solomon's Seal		
TETRA3	<i>Tetradymia spp</i>	Horsebrush		
TYPHA	<i>Typha spp</i>	Cattail		
TRIFOL	<i>Tripholium spp</i>	Clover		
URDI	<i>Urtica dioica</i>	Stinging Nettle		
VINE	--	Unknown vine		

APPENDIX C. LIST AND DEFINITIONS OF VEGETATION VARIABLES

DEFINITIONS

Cover: The percent of ground (within the 50m radius circle) obscured from above, absolute values. Used for all vegetation layers, and standing water, running water, road/trail, rock and bare ground covers.

Tree: Vegetation > 5m tall, regardless of species

Shrub: Vegetation > 50cm < 5m, regardless of species

Herb: Vegetation ≤ 50cm, regardless of species

VARIABLES

HAB1, HAB2, HAB3: Defines the habitat types according to Sawyer/Keeler-Wolf series (Sawyer and Keeler Wolf 1995) present within the 50m radius circle. Two to three habitats are typically defined.

HAB1PERC, HAB2PERC, HAB3PERC: Percent of the 50m radius plot that corresponds to the defined habitat(s).

TREECOV: Absolute cover (%) of **tree** layer(s)

SHRUBCOV: Absolute cover (%) of **shrub** layer(s)

HERBCOV: Absolute cover (%) of **herb**

TOTALWOODY: Absolute cover (%) of **total woody** - All woody vegetation combined regardless of height categories – as viewed from above.

STANDWAT: Absolute cover (%) of **standing water** (includes ponds, shallow floodwater etc.)

RUNWAT: Absolute cover (%) of **running water** (creeks, aqueducts, rivers)

LITTER: Absolute cover (%) of **litter**

ROADTRAIL: Absolute cover (%) of **road** (including paved, dirt, gravel, human trails or campground, parking lots etc.)

ROCK: Absolute cover (%) of **rocks** (i.e. large boulders, cliffs, river rocks, lava flows)

BAREGRND: Absolute cover (%) of **bare ground** that is not road or rock (sandbar, gravel bar, decomposed granite, soil)

HERBRICH: Number of species in the herb layer

SHRUBRICH: Number of species in the shrub layer.

TREERICH: Number of species in the tree layer.

RIPWIDTH: Width of riparian. The estimated width of the riparian vegetation from one edge of the riparian vegetation to another, perpendicular to the stream (if > 100m, use GIS). Riparian vegetation is defined as willow, cottonwood, wetland species and not saltbush, grass/meadow, etc. River not included in estimate unless it falls between two riparian edges.

RIPPATCH: Riparian Patchiness. The percent of the riparian width “line” that is taken up by riparian vegetation, as viewed from above. If the riparian is wide, but very patchy (ie willows interspersed with pasture) the riparian patchiness may be low. If the riparian strip is narrow, but solid riparian veg, riparian patchiness = 100%.

SPECIES COVER VARIABLES

% absolute cover of each species listed (see Appendix B for species names that correspond with Table 5).