BIRD MONITORING AT BIG BEND RESTORATION AREA

2016 Project Report

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Cooper Farr
Conservation Science Program
Tracy Aviary
589 East 1300 South
Salt Lake City, UT, 84105

Executive Summary

Big Bend is an 80 acre restoration area situated along the Jordan River in the city of West Jordan. Especially in a highly modified and historically disturbed system, restoration activities can have varying impacts on birds, and it is important to assess the current ecological conditions and monitor the impacts of these activities on species of interest in order for habitat modification to successfully promote healthy bird communities. Since 2013, Tracy Aviary has conducted a citizen science bird monitoring project in Big Bend Restoration Area with the goals of 1) generating baseline information about the birds present in the Big Bend Restoration Area prior to restoration, 2) providing management recommendations with regard to practices favoring avian communities and contributing to the maintenance, integrity, and functionality of riparian ecosystems, and 3) improve the public's understanding of and involvement in urban riparian management issues by engaging volunteer citizen scientists.

We conducted breeding and non-breeding bird surveys at 8 sampling points in Big Bend during January through October of 2016. From April 28 to July 8, 2016, we had 1,091 bird observations and detected 51 species during the 6 breeding bird survey visits. During the monthly non-breeding surveys in January, February, March, April, August, September, and October of 2016, we detected 79 species. Of these species, 36 were detected exclusively during the non-breeding surveys, making the total 2016 species count 87 different bird species.

We also used data from breeding bird surveys at Big Bend as part of a larger analysis of riparian bird communities along the Jordan River, and found that size, canopy cover, and native understory cover were the best supported indicators of a healthy riparian bird community.

Big Bend supports a diverse bird community, and provides important habitat for migratory and resident bird species. Our monitoring efforts contribute to a holistic understanding of the ecological health of Big Bend, and provide insight to guide effective restoration and management activities.

Acknowledgements

We'd like to thank the extremely dedicated team of volunteers from Tracy Aviary's Citizen Science Program who braved the early mornings and long hours to collect this data. Thanks also to our project partners: the Jordan River Commission, U.S. Fish and Wildlife Service, West Jordan City, Utah Division of Wildlife Resources, Utah Division of Environmental Quality, National Park Service, Salt Lake County, and the Utah Reclamation Mitigation and Conservation commission.

Introduction

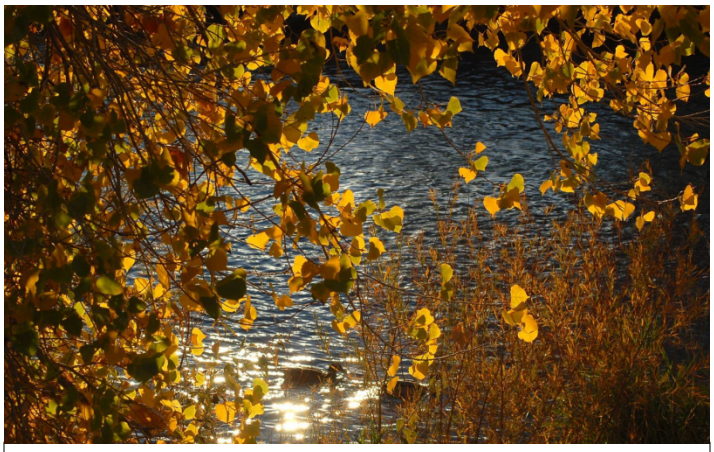

Figure 1. Many wildlife species occur in and along the Jordan River at the Big Bend Restoration Area.

Big Bend is an 80 acre restoration area in the city of West Jordan. The site is situated along the Jordan River, a waterway that flows over 50 miles through the Salt Lake valley between Utah Lake and the Great Salt Lake. As a riparian corridor in a highly urbanized matrix, the Jordan River provides recreation benefits to the 1.2 million residents of the area, and also contains vital remnant wildlife habitat for the region (Figure 1). This habitat is especially important for both resident and neotropical migratory birds of northern Utah; riparian areas are used by up to ¾ of all Utah bird species and can have up to fourteen times the density of birds as upland habitat (Knopf et al. 1988). Due to decades of channelization, development, urban and agricultural runoff, and the spread of exotic plants, the Jordan River has drastically changed from its historic condition. Many regions are undergoing restoration activities in order to restore the health of the river and riparian area, including Big Bend.

Plans for restoration of the Big Bend site include ambitious habitat restoration which will involve hydrologic restoration of the mile of river through the project area, removal of exotic vegetation, and re-vegetation with native trees and shrubs to create 40 acres of floodplain gallery forest, and various amenities for human use and recreation. Especially in a highly disturbed system, restoration activities can have varying impacts on birds, and it is important to assess the current ecological conditions and monitor the impacts of these activities on species of interest in order for habitat modification to successfully promote healthy bird communities (Block et al. 2001).

Since 2013, Tracy Aviary has conducted a citizen science bird monitoring project in Big Bend Restoration Area. Tracy Aviary's goal in working with the USFWS, West Jordan City, Utah Division of Wildlife Resources and others, was to design and implement a long-term monitoring process to create a baseline for the avian community composition present before any habitat improvement takes place at Big Bend. Our goals for this project are to:

1) Generate baseline information about the birds present in the Big Bend Restoration Area prior to restoration.

2) Provide management recommendations with regard to practices favoring avian communities and contributing to the maintenance, integrity, and functionality of riparian ecosystems.

3) Improve the public's understanding of and involvement in urban riparian management issues by engaging volunteer citizen scientists.

By collecting baseline data and monitoring birds over the long-term, this project will also provide important information on bird populations and communities as they face future changes in the climate and environment.

Methods

Study Design

Big Bend is an 80-acre property owned by the Utah Reclamation Mitigation and Conservation Commission and West Jordan City, and is one of the few open space properties that have not been developed along the Jordan River. The property has a small grove of native cottonwoods (*Populus* sp.) as well as coyote willow (*Salix exigua*) to the east. The dominant vegetation includes Russian olive (*Eleagnus* sp.) and some other introduced herbaceous and woody plants. Through the Five-Start restoration project, the Jordan River Commission created habitat patches with native species on the west side of West Jordan City's property. We conducted breeding and non-breeding bird surveys in Big Bend during January through November of 2016. These surveys were a continuation of long-term monitoring data collected in the same locations since 2013. In 2015, we adopted the point-transect method used by the Rocky Mountain Bird Observatory (Hanni et al. 2015).

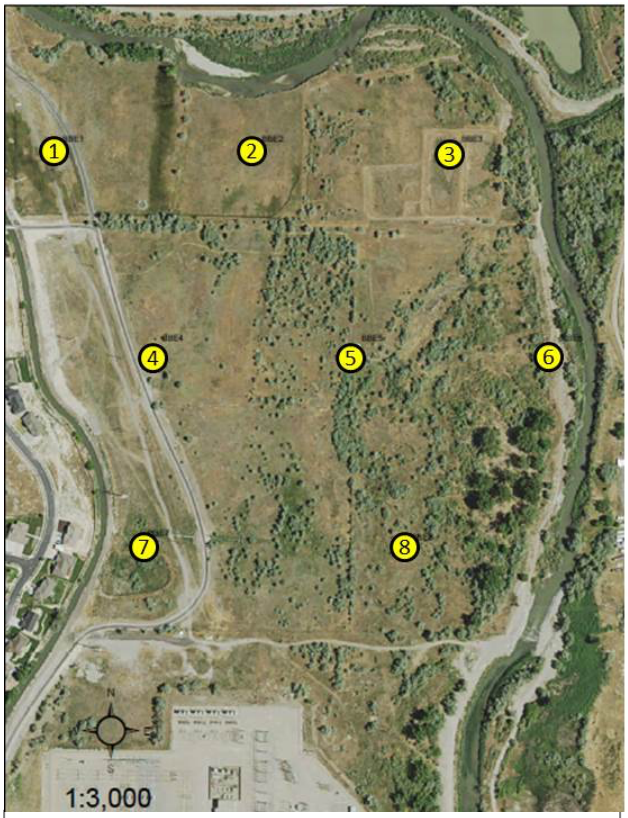

Figure 2. Map of bird survey point location in Big Bend Restoration Area

We used a systematic random sampling frame to generate eight sampling points throughout the Big Bend restoration area (Figure 2). To ensure independence between sampling areas, points were separated by a distance of at least 250m.

Citizen Scientist Participation and Training

We recruited a total of 8 participants to complete breeding bird surveys in Big Bend. These participants were trained as part of Tracy Aviary's Citizen Science Program, which is made up of 32 participants that conducted breeding bird surveys in 8 project locations throughout Salt Lake County. Training for the Citizen Science Program began in late February and continued through the survey season. We provided 6 indoor trainings (2-3 hours), 35 field trainings (2-5 hours), and we

required citizen scientists to attend at least one indoor training and 4-6 field trainings. Before citizen scientists conducted surveys, they were required to pass two tests: a bird identification by sound test, where they had to identify the calls and songs of 30 of the most common birds, and a field survey test, where they had to successfully complete a series of mock breeding bird surveys.

Surveys

We conducted 6 breeding bird surveys during the 2016 breeding season, between April 29th and July 8th. Pairs of citizen scientists conducted unlimited radius point count surveys at these locations between sunrise and approximately 10am. The 'observer' of the team identified all birds seen and heard at the point during a six minute point count, and noted the exact distance using a laser rangefinder, direction, detection type (visual, singing, calling, other), and any other information they could determine about the bird (age, sex, etc.). The 'recorder' of the team wrote all of the observations on the datasheet, noted the minute during the survey (1-6) when the observation was made, and also noted weather and site variables, such as wind speed, cloud cover, ambient noise levels, and presence of water/snow.

In addition to the breeding bird surveys conducted in the spring and summer, we also completed monthly non-breeding surveys to better understand the birds that use the area year-round. These surveys were conducted once a month in January, February, March, April, August, September, October, and November (and they will continue throughout the winter). During the non-breeding surveys, at least one trained Tracy Aviary staff person lead groups of participants on a walk through the sampling area, and noted any birds seen and heard during that time. Participants were allowed to point out and identify birds, but they survey leader made the final decision for identification of the bird species and the number of individuals present. The survey leader also noted weather variables, the total amount of time, and the total distance traveled during the survey.

We used point count data to calculate species richness and the relative abundance, or total number of observations, for each species. We compared species richness and relative abundance during the breeding season of 2016 to 2015, 2014, and 2013.

Results

Breeding Bird Surveys

From April 28 to July 8, 2016, we had 1,091 bird observations and detected 51 species (Table 1) during the 6 breeding bird survey visits. These numbers are comparable to our past efforts; in 2015, we had 4 visits with 1049 detections of 53 species, in 2014 we had 9 visits with 2,276 observations of 61 species, and in 2013 we had 5 visits with 780 observations of 41 species.

Table 1: Complete list of species and the total number of observations for each species during breeding season surveys in 2013, 2014, 2015, and 2016. Years where there were no observations of the species are highlighted in gray. *Note: there were a different number of survey visits during each year, so the total observations are not directly comparable and they do not represent the abundance of these species in the area.*

Species	**Number of Observations***			
	2013	**2014**	**2015**	**2016**
Black-billed Magpie	143	449	229	120
Bullock's Oriole	23	52	20	43
Northern Rough-winged Swallow	46	82	46	43
Red-winged Blackbird	18	104	27	40
European Starling	107	120	52	36
Western Kingbird	16	39	15	32
American Robin	5	96	19	27
Mallard	13	60	62	27
Song Sparrow	26	50	40	27
California Quail	18	108	38	25
Mourning Dove	77	184	19	24
Ring-necked Pheasant	1	24	19	23
Brown-headed Cowbird	10	16	19	21
American Kestrel	2	18	8	19
Bank Swallow	30	23	28	17
Barn Swallow	14	39	5	14
Double-crested Cormorant	4	53	21	14
House Finch	38	38	10	12
Lesser Goldfinch	14	15	5	12
Rock Pigeon	2	26	126	12
Killdeer	1	7	9	11
Western Meadowlark	0	13	6	11
Black-capped Chickadee	7	13	6	9
Black-chinned Hummingbird	6	7	10	9
Red-tailed Hawk	8	11	6	9
American Goldfinch	0	14	2	8
American White Pelican	7	23	24	8
Canada Goose	36	94	29	8
Lazuli Bunting	0	0	6	8
California Gull	6	35	7	6
Eurasian Collared-dove	0	5	5	6
House Sparrow	5	9	11	6
Spotted Sandpiper	0	4	0	5
Belted Kingfisher	1	9	3	4

Caspian Tern	0	7	4	4
Downy Woodpecker	0	2	0	3
Black-headed Grosbeak	2	1	1	2
Cliff Swallow	2	56	0	2
Great Blue Heron	4	3	1	2
Say's Phoebe	0	0	1	2
Western Tanager	0	5	4	2
White-faced Ibis	1	231	14	2
Willow Flycatcher	0	0	0	2
Yellow-rumped Warbler	0	6	0	2
American Avocet	1	0	0	1
Blue-gray Gnatcatcher	0	2	4	1
Cooper's Hawk	0	0	0	1
Franklin's Gull	6	10	50	1
Northern Flicker	0	1	0	1
Yellow Warbler	0	1	3	1
Yellow-headed Blackbird	1	5	4	1
Tree Swallow	0	3	4	0
Common Yellowthroat	1	1	2	0
Forster's Tern	0	4	2	0
MacGillivray's Warbler	0	0	2	0
Blue Grosbeak	0	0	1	0
Brewer's Blackbird	0	61	1	0
Dark-eyed Junco	0	0	1	0
Great Horned Owl	0	0	1	0
Olive-sided Flycatcher	0	0	1	0
Savannah Sparrow	0	0	1	0
Cedar Waxwing	0	1	73	0
Spotted Towhee	1	4	0	0
Violet-green Swallow	0	3	0	0
Broad-tailed Hummingbird	1	2	0	0
Ruby-crowned Kinglet	0	2	0	0
Common Raven	0	1	0	0
Orange-crowned Warbler	0	1	0	0
Swainson's Hawk	0	1	0	0
Turkey Vulture	0	1	0	0
Woodhouse's Scrub-jay	0	1	0	0
Peregrine Falcon	1	0	0	0
Blue-winged Teal	1	0	0	0

**Note: there were a different number of survey visits during each year, so the total observations are not directly comparable and they do not represent the abundance of these species in the area.*

We had the most observations of Black-billed Magpies (120 observations), Bullock's Orioles (43), Northern Rough-winged Swallows (43), Red-winged Blackbirds (40), and European Starlings (36) in 2016 (Table 1, Figure 2). Black-billed Magpies were the top most observed species for all years, but otherwise there were changes each year within the top five species (Figure 2).

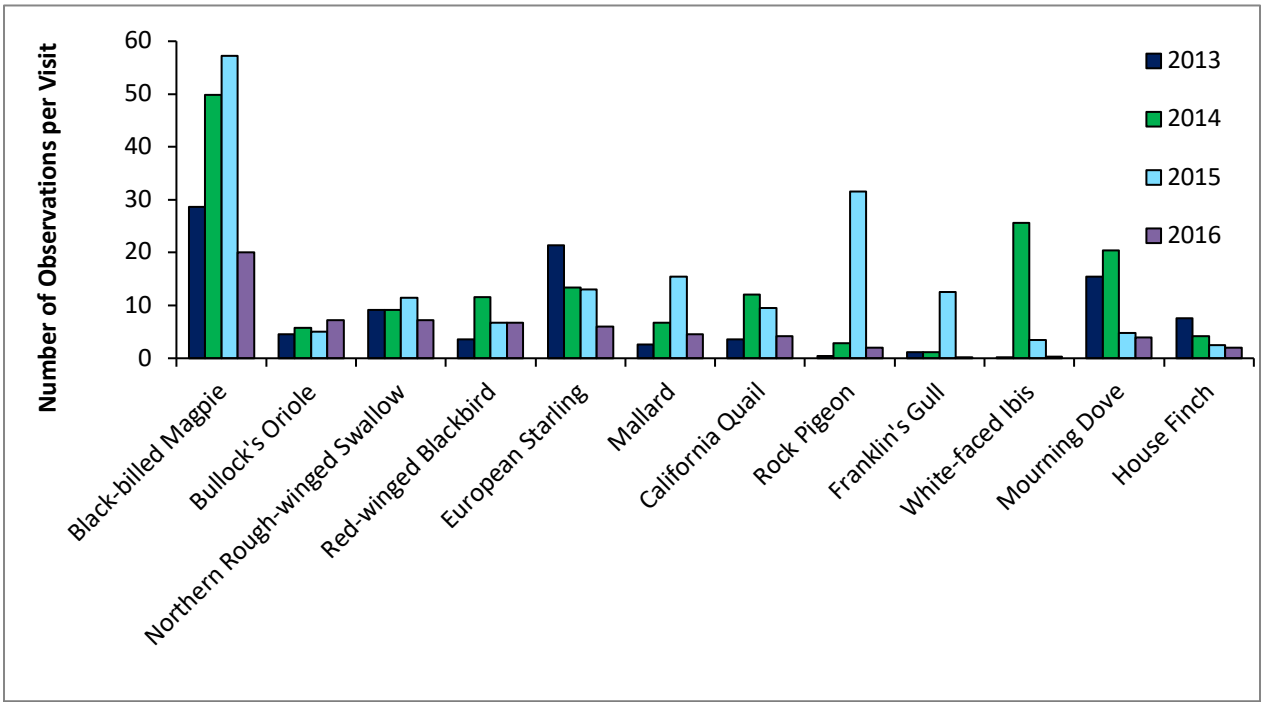

Figure 2. The top 5 species with the most observations during 2013-2016 and the total number of observations per visit.

Bullock's Orioles, Ring-necked Pheasants, Rock Pigeons, Red-winged Blackbird, Mallards, European Starlings, California Quail, Black-billed Magpies, and American Robins were all very widespread species throughout Big Bend, and they were detected at all eight of the sampling points. Barn Swallows, Brown-headed Cowbirds, Double-crested Cormorants, House Finches, Mourning Doves, Northern Rough-winged Swallow, Song Sparrows, and Western Kingbirds were relatively widespread, and were detected at 7 of the 8 sampling points.

Non-breeding Surveys

During the monthly non-breeding surveys in January, February, March, April, August, September, and October of 2016, we detected 79 species (Table 2). Of these species, 36 were detected exclusively during the non-breeding surveys, making the total 2016 species count 87 different bird species.

Table 2: Species detected during non-breeding surveys in 2016, and the month or months in which they were detected.

Species	January	February	March	April	August	September	October
American Coot	X	X	X				X
American Goldfinch	X	X			X	X	
American Kestrel	X	X	X	X	X	X	X
American Pipit	X						X
American Robin	X	X	X	X	X	X	X
American White Pelican				X			
Bald Eagle	X						
Bank Swallow					X		
Barn Swallow				X	X	X	
Belted Kingfisher			X			X	X
Black-billed Magpie	X	X	X	X	X	X	X
Black-capped Chickadee	X	X	X		X	X	
Black-chinned Hummingbird					X	X	
Black-crowned Night-heron					X		
Blue-gray Gnatcatcher					X	X	
Broad-tailed Hummingbird					X		
Bufflehead	X	X					
California Gull				X			X
California Quail	X	X	X	X	X	X	X
Canada Goose	X	X	X	X	X	X	X
Caspian Tern				X		X	
Cedar Waxwing						X	
Common Goldeneye	X	X					
Common Merganser		X					
Common Raven	X						
Cooper's Hawk				X	X	X	
Dark-eyed Junco	X	X					X
Double-crested Cormorant		X	X	X			
Eurasian Collared-Dove	X	X	X	X	X	X	X
European Starling	X	X	X	X	X	X	X
Franklin's Gull				X	X		
Gadwall	X			X			X
Great Blue Heron		X			X	X	X
Great-tailed Grackle				X			
Green-winged Teal		X	X				
Hermit Thrush							X
House Finch	X	X			X	X	X
House Sparrow			X	X		X	
Killdeer		X	X	X	X	X	
Lark Sparrow					X		
Lazuli Bunting					X		
Lesser Goldfinch	X				X	X	X
Lincoln's Sparrow						X	
MacGillivray's Warbler						X	

Table 2 continued.

Species	January	February	March	April	August	September	October
Mallard	X	X	X	X	X	X	X
Marsh Wren		X					
Merlin				X			
Mourning Dove	X	X	X	X	X	X	X
Northern Flicker	X	X	X	X		X	X
Northern Pintail		X					
Northern Rough-winged Swallow				X	X		
Northern Shoveler	X						
Orange-crowned Warbler						X	
Osprey				X			
Peregrine Falcon	X						
Pied-billed Grebe						X	X
Plumbeous Vireo						X	
Prairie Falcon				X			
Red-tailed Hawk						X	
Red-winged Blackbird	X	X	X	X	X	X	X
Ring-billed Gull		X					
Ring-necked Duck	X	X					
Ring-necked Pheasant				X			
Rock Pigeon	X	X	X	X	X	X	X
Ruby-crowned Kinglet	X	X	X				
Rufous Hummingbird					X		
Say's Phoebe			X	X			
Sharp-shinned Hawk	X						
Song Sparrow	X	X	X	X		X	X
Spotted Sandpiper					X		
Spotted Towhee	X	X	X				X
Townsend's Warbler					X		
Western Kingbird					X		
Western Meadowlark				X			
White-crowned Sparrow	X	X	X	X		X	X
White-faced Ibis				X	X		
Yellow Warbler					X		
Yellow-headed Blackbird	X	X					
Yellow-rumped Warbler		X				X	X

Jordan River Riparian Index Analysis

We used data from breeding bird surveys surveys at Big Bend as part of a larger analysis of riparian bird communities along the Jordan River. Many species of bird have specific habitat relationships, especially in riparian areas, and their presence and abundance in an area can provide important information about the health of that ecosystem (Bureau of Land Management 1998). For example, as riparian areas became degraded or their vegetation is

modified, certain bird species might stop using the area, or the community could be replaced by another suite of species (Bureau of Land Management 1998, Rottenborn 1999).

In order to assess the health of riparian areas along the Jordan River, and to better understand how to manage and restore riparian areas in a way that will protect and benefit birds, we collected and analyzed breeding bird survey data from 4 sampling sites along the Jordan River (Table 3). We used data collected by our team of citizen scientist volunteers to investigate the factors that influence how riparian areas support healthy riparian bird communities.

Methods

We conducted breeding bird point count surveys at 43 sampling points within four different survey sites along the Jordan River (Table 3). We measured canopy percent cover and species cover, understory percent cover and species cover, and ground cover at each sampling point using the Bird Conservancy of the Rockies Integrated Monitoring in Bird Conservation Region protocol (Hanni et al. 2015).

Table 3: Survey sites along the Jordan River, Salt Lake County, UT used in the riparian bird index analysis.

Site	Total Area	No. Sampling Points
Regional Athletic Complex	44 acres	6
Jordan River Golf Course	15 acres	2
Big Bend	80 acres	8
Galena Soo'nkhanni Preserve	252 acres	27

The presence of a suite of riparian obligate and dependent birds can indicate high quality vegetation, water, and insect communities within a riparian area (Young et al. 2013). We created a riparian bird index to signify a functioning riparian bird community based on work by Young et al. (2013), who found that overall riparian habitat condition could be effectively assessed using species richness of riparian-obligate and riparian-dependent birds. We created the riparian index using the following criteria: 1) the species had been detected in Salt Lake County and 2) the species was classified as either riparian-obligate (>90% of nests/abundance are in riparian vegetation) or riparian-dependent (60%-90% of nests/abundance are in riparian vegetation) (Bureau of Land Management 1998). Our final list consisted of 28 bird species (Table 4). For each sampling point, we calculated the number of those 28 species that were detected in the area (within 125m).

We generated a list of 6 habitat characteristics that we hypothesized would influence the riparian bird community: total size of the preserve, grass cover, forb cover, overstory (trees >3m) canopy cover, understory (trees and shrubs 0.25m-3m) canopy cover, and percentage of the understory that is non-native.

We built multiple linear regression models to examine the relationship between the habitat characteristics and the riparian bird index. We included one and two covariates in the models, and we used Akaike's Information Criterion (AIC) for model selection.

Table 4: Index of riparian-obligate and riparian-dependent bird species in Salt Lake County used for the Jordan River riparian index analysis.

#	Species	Classification	#	Species	Classification
1	American Dipper	Obligate	15	Lazuli Bunting	Dependent
2	American Goldfinch	Dependent	16	Lesser Goldfinch	Dependent
3	Bank Swallow	Dependent	17	MacGillivray's Warbler	Dependent
4	Belted Kingfisher	Obligate	18	Northern Goshawk	Dependent
5	Black-capped Chickadee	Dependent	19	Orange-crowned Warbler	Obligate
6	Black-headed Grosbeak	Dependent	20	Red-naped Sapsucker	Dependent
7	Blue Grosbeak	Dependent	21	Song Sparrow	Obligate
8	Bullock's Oriole	Dependent	22	Swainson's Thrush	Dependent
9	Common Yellowthroat	Obligate	23	Warbling Vireo	Dependent
10	Cooper's Hawk	Dependent	24	Western Wood-pewee	Dependent
11	Cordilleran Flycatcher	Dependent	25	Willow Flycatcher	Obligate
12	Eastern Kingbird	Dependent	26	Wilson's Warbler	Obligate
13	Fox Sparrow	Dependent	27	Yellow Warbler	Obligate
14	Gray Catbird	Dependent	28	Yellow-breasted Chat	Obligate

Results

Based on the two best supported models, size, canopy cover, and native understory cover were the best indicators of a healthy riparian bird community (Table 5). As the total size of the preserve increased, there were a higher number of riparian birds in the community (β= 0.012, Standard Error = 0.04). The riparian bird index was also positively related to overstory canopy cover (β= 0.044, Standard Error = 0.02). Finally, as the percentage of non-native understory increased, the number of riparian birds in the community also increased (β= 0.071, Standard Error = 0.03).

Table 5: Top multiple linear regression models (ΔAIC>2) relating habitat covariates to riparian bird index at sites along the Jordan River, Salt Lake County, UT.

Model	Adjusted R^2	ΔAIC	AIC
~ Size + OverstoryCC	0.2059	0	192.7125
~ Size + NonNativeUnderstory	0.2052	0.0383	192.7508
~ Size + PercentGrass	0.1874	0.9906	193.7031
~ Size + PercentForb	0.1769	1.5411	194.2536
~ Size + MidstoryCC	0.1733	1.7294	194.4419
~ NonNativeUnderstory + MidstoryCC	0.173	1.7437	194.4562

Discussion

Big Bend supports a diverse bird community, and provides important habitat for migratory and resident bird species. The species richness of the area is comparable, and even higher, than yearly counts of species in other riparian areas in Northern Utah. For example, in a study by Parrish et al. (2007) of Utah's riparian birds surveyed during May to August in 1992-2005, the sites near Ogden, Provo, Logan, and Salt Lake City had an average of 29 to 56 species detected per year. We detected 51 species during the 2016 breeding season.

We also detected several species of conservation concern during both the breeding and non-breeding surveys, indicating the importance of this area as wildlife habitat. We detected 3 of the 24 Partners in Flight Utah Avian Conservation Strategy priority species: the Broad-tailed Hummingbird, American White Pelican, and American Avocet (Parrish et al. 2002). We also detected 7 of the 20 North American Waterfowl Management Plan (NAWMP) priority species, 6 of the 11 North American Waterbird Conservation Plan priority species, 6 of the 37 Great Basin Ecoregional Conservation Blueprint priority species, 3 of the 29 Colorado Plateau Ecoregional Conservation Plan (TNC) priority species, and 2 of the 23 State of Utah Sensitive Species List (1998) (Utah Steering Committee 2005).

Big Bend's breeding bird community contained a 43% of the riparian-obligate and -dependent species commonly found in Salt Lake County. Sampling points 1 and 4 had the lowest riparian bird index (4 riparian species), and point 3 had the highest (9 riparian species), with an average score of 6.4 riparian bird species/point across all sampling points. Big Bend had the second lowest average riparian bird index for the sites that we examined along the Jordan River; Galena Soo'nkhanni had the highest with 8.1 riparian species/point, the Jordan River golf course had the second highest with 7.5 riparian species/point, and the Regional Athletic Complex had the lowest with 5.5 riparian species/point.

The results of the Jordan River Riparian Index Analysis identified a few key factors that are currently influencing the community of riparian birds along the Jordan River. We found that larger protected areas, and those with sufficient vertical structure and canopy cover, support healthier riparian bird communities. As restoration activities happen along the Jordan River, it will be important to preserve large contiguous areas of riparian habitat, and to protect existing established trees and/or replace trees that are removed. We also found that the number of riparian birds in the community increased as the proportion of the understory that was non-native increased. This finding may be surprising given that some studies find negative impacts of non-native plants on bird communities (e.g., Rodewald et al. 2010). However, we found that trees and shrubs across all of our study areas were predominantly non-native. A vast majority (90%) of canopy trees were non-native, with Russian Olives (non-native) making up 78.7% of canopy trees. A majority (55%) of the understory was non-native, with Russian Olives making up 36.6%, and Rabbit Brush (native), making up 20.3% of understory trees and shrubs. The bird communities in these areas exist in a very modified system; non-native trees and shrubs such as Russian Olives are providing most of the vegetative structure and fruits for nesting and foraging.

Management recommendations

1. Management and removal of Russian Olive patches should be done gradually, with consideration for the importance of mature Russian Olives for bird habitat requirements. We recommend that Russian Olive seedlings and young trees (between 1-3in DBH) should be targeted for removal first. Mature trees should be thinned out slowly while they are replaced with native trees and shrubs so vertical structure and fruiting resources are maintained

throughout the restoration process. No tree removal or thinning activities should take place during the breeding and nesting season (April – July).

2. Remnant cottonwood trees should be fenced with high mesh to protect from beaver damage. These trees will be important for future seed production, and patches of cottonwood should be prioritized for preservation in the event of recanalization.

3. We observed Bank Swallows and Belted Kingfishers using the banks of the river for nesting habitat. If possible, slowing the flow of water through this section and using bioengineering with bundled stems of native willow could save nesting habitat while reducing bank erosion.

Conclusion

Riparian areas are often evaluated using measurements of the stream and the surrounding vegetation (Burton et al. 2008), but understanding the bird community provides a more complete picture of the ecosystem as a whole (Bureau of Land Management 1998; Young et al. 2013). Continued bird monitoring in Big Bend will be important to evaluate the site's ecological health as it undergoes restoration, habitat modification, and ongoing management.

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