Bird Community Monitoring of O'Dell Creek Restoration Project

2011 Final Report

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Executive Summary

In 2005 restoration of O'Dell Creek, a tributary of the Madison River, was initiated to reestablish one of southwest Montana's largest spring-fed wetlands, restoring critical trout spawning and year round fisheries habitat, and recreating a diverse wetland complex. Since then, 9 miles of new stream and over 500 acres of wetland habitat have been restored.

Integral to restoration is the inclusion of monitoring to evaluate the ecological success of the project, provide feedback for adaptive management, and guide future restoration design. Birds are ideal indicators of environmental conditions because they have diverse habitat requirements, are relatively abundant in a small area, are easily surveyed, and provide feedback from an entire community rather than a single species.

In 2006, The Avian Science Center (ASC) implemented a multiple-method riparian bird monitoring plan as part of the O'Dell Creek restoration project. This progress report describes the field effort, summarizes data collected in 2011, and reports results of all monitoring years to date. During the 2011 breeding season, we completed 86 points count surveys targeting songbirds, 34 playback surveys for secretive marsh birds, and 5 weekly waterbird and waterfowl brood count surveys. Spring waterfowl pair counts and spring and fall season migratory waterbird counts were conducted by Rob Hazlewood (Ranchland Wildlife Consultants).

Highlights from the 2011 monitoring program include:

- 78 species observed, including 6 new to the project area;
- Increased summer breeding abundance for 7 of 12 waterfowl species;
- Decline in waterfowl brood numbers from 5 species and 13 broods in 2009 to 2 species and 3 broods in 2011;
- Two new marshbird species observed (e.g. American Bittern and Virginia Rail);
- Significant increases in abundance of early colonizing focal species since restoration;
- Increased riparian songbird species richness and diversity across all phases of restoration;

Acknowledgements

We would like to thank PPL Montana and the Bureau of Land Management (BLM) for providing funding for our bird monitoring work, and the U.S. Fish and Wildlife Service (USFWS), Partners for Fish and Wildlife Programs, and the National Resources Conservation Service (NRCS) for funding the overall restoration effort. We owe a particular debt of gratitude to the Laszlo family for their support of this massive restoration effort. We are also very grateful to the Granger and Longhorn Ranches for allowing us access to their land and assisting our investigations. We thank Rob Hazlewood for his passion and vision for a restored O'Dell Creek, as well as countless hours spent conducting migratory bird surveys. We also thank our technicians for their hard work in the field. Many more supported this effort, to which we are grateful. A list of all participants is available upon request.

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Introduction

In 2005 restoration of O'Dell Creek was initiated to rebuild critical trout spawning habitat and recreate one of southwest Montana's largest spring-fed wetlands. Since then, 9 miles of new stream and over 500 acres of wetland habitat have been restored.

Integral to restoration is the inclusion of monitoring to evaluate the ecological success of the project, provide feedback for adaptive management, and guide future restoration design (Block et al 2001). Multi-species monitoring is critical to determine whether the needs of the entire system are being met. Birds are ideal indicators of environmental conditions because they have diverse habitat requirements, are relatively abundant in a small area, are easily and inexpensively surveyed, and provide feedback from an entire community rather than a single species (Carigan & Villard 2002, Hutto 1998).

In addition, birds are a priority for monitoring during restoration of riparian areas, because riparian and wetland areas are considered critical habitat for a large number of bird species during breeding, dispersal, and migration. Indeed, riparian areas are known to support the highest diversity of breeding birds of any habitats in the western U.S., including at least 134 (55%) of Montana's 245 bird species and 54 (50%) of the 107 Montana Partner's in Flight (PIF) priority species. The restoration and conservation of riparian and wetland habitats in Montana is critical to the future of Montana's bird populations.

In 2006, we implemented a multiple-method monitoring plan to 1)evaluate how restoration efforts are influencing bird abundance, distribution, and species composition, and 2) determine key habitat associations and environmental factors influencing restoration outcomes. The goal of this monitoring program is to provide feedback to managers and biologists involved in restoration along O'Dell Creek, and to inform future restoration efforts in Montana.

2011 Objectives

1. Continue point count surveys across the entire proposed restoration area and control sites;
2. Broadcast playbacks for secretive marshbirds to improve detection probabilities;
3. Conduct weekly vantage and flush counts of restored pond and wetland habitats targeting waterfowl and other waterbirds;
4. Map waterfowl nests and record nest fate.

Project Area

O'Dell Creek is a 12 mile-long tributary of the Madison River, located seven miles south of Ennis, Montana (Fig. 1). The project area, which is located on Granger Ranch and neighboring landownerships, includes approximately 8,000 acres of floodplain and contains a mosaic of riparian, grassland, and wetland habitats.

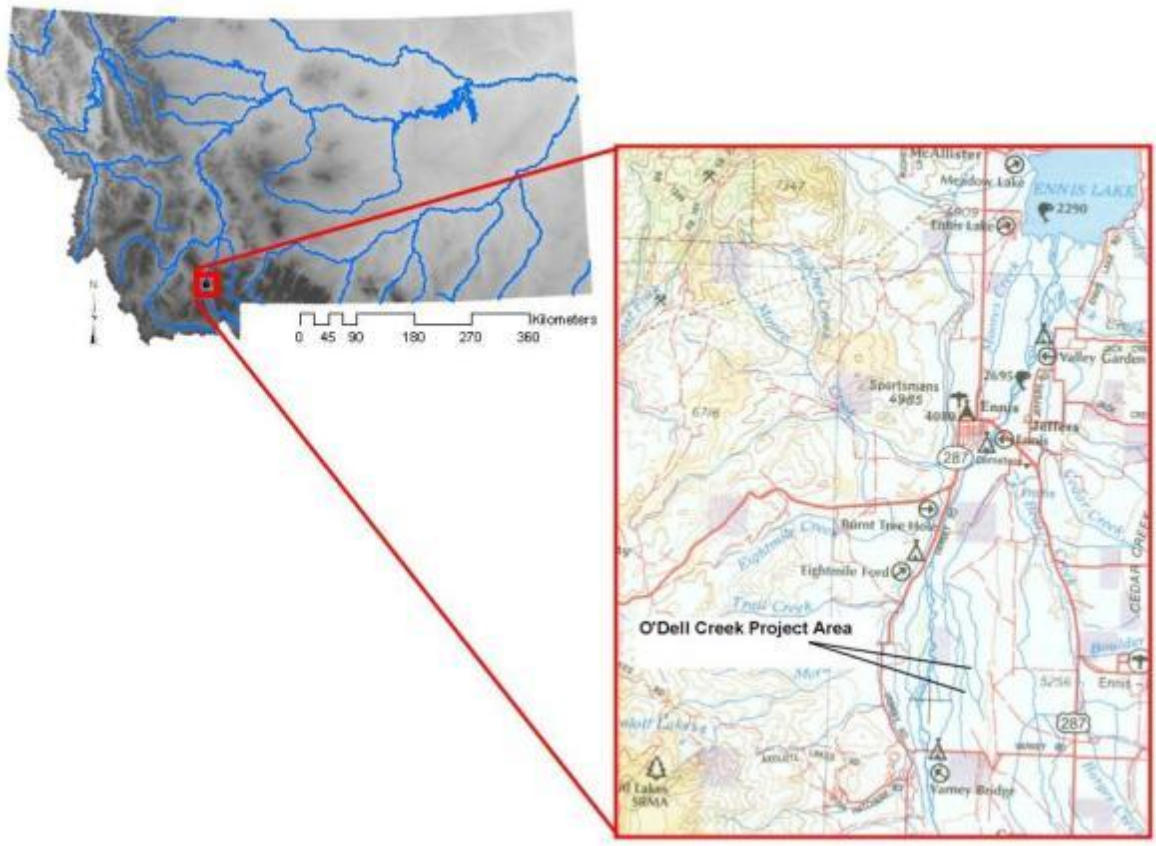

Figure 1. Location of O'Dell Creek, a tributary of the Madison River, MT, near the town of Ennis.

Land Use History and Restoration Efforts

Hay and livestock production have been the primary land use along O'Dell Creek since the 1900's. In 1955, upper O'Dell creek was ditched, channelized, and riparian areas were drained, which subsequently reduced aquatic and streamside wetland habitat (Peters 2005, 2006) (Fig. 2).

In 2005 restoration of O'Dell Creek was initiated to rebuild critical trout spawning habitat and recreate one of southwest Montana's largest spring-fed wetlands. Since then, 9 miles of stream channel and over 500 acres of wetland habitat have been restored. Restoration of the creek floodplain is ongoing. The first phases (e.g. Phase 1-4)of restoration involved filling drainage ditches and returning the upper section of the creek to a natural channel. In 2008, additional channel was restored and 17 acres of wetland pond were created to mimic natural oxbow and beaver complex habitats. From 2009-2010 the lower sections of the Granger Ranch portion of the creek were restored, bank structures were improved along the upper channels, and nesting habitat for trumpeter swans and other birds was created within the wetland pond complex (Phase 5). Additional activities are planned for future years.

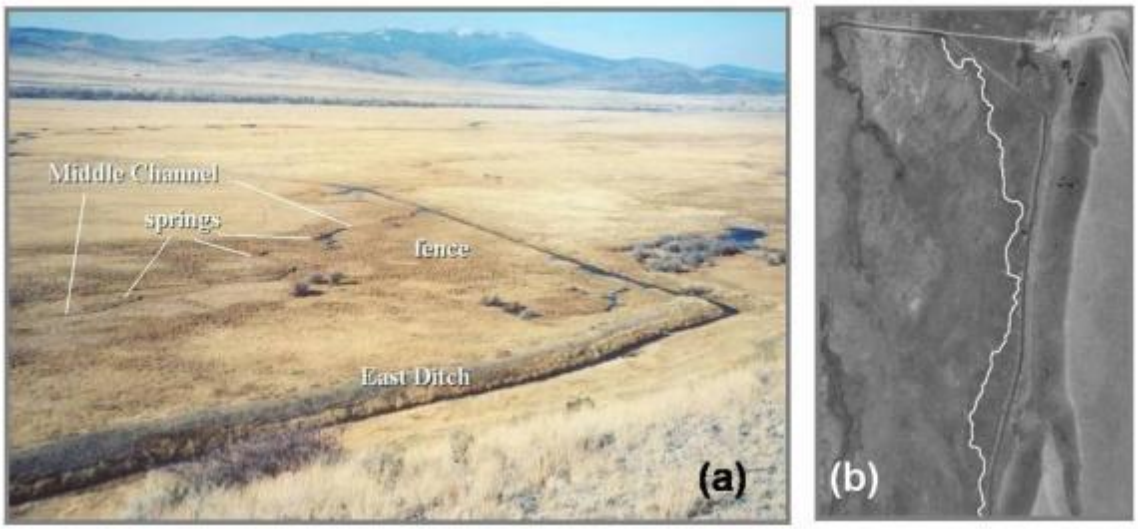

Figure 2. (a) Pre-restoration photograph of the 'East Ditch' area of O'Dell Creek, which was restored in 2005. (b) Photograph of the historic channel that was restored. Photographs are taken from Peters (2005, 2006).

Methods

The diversification of habitat types in the O'Dell Creek area led us to expand our bird monitoring methods in 2009 from point count surveys to include targeted monitoring for waterfowl and secretive marshbirds. In 2011, we continued these expanded efforts. Figure 3 shows the extent of monitoring conducted across the O'Dell Creek restoration project area, including point count locations, broadcast playback locations for secretive marshbirds, and vantage point surveys for waterfowl and other waterbirds.

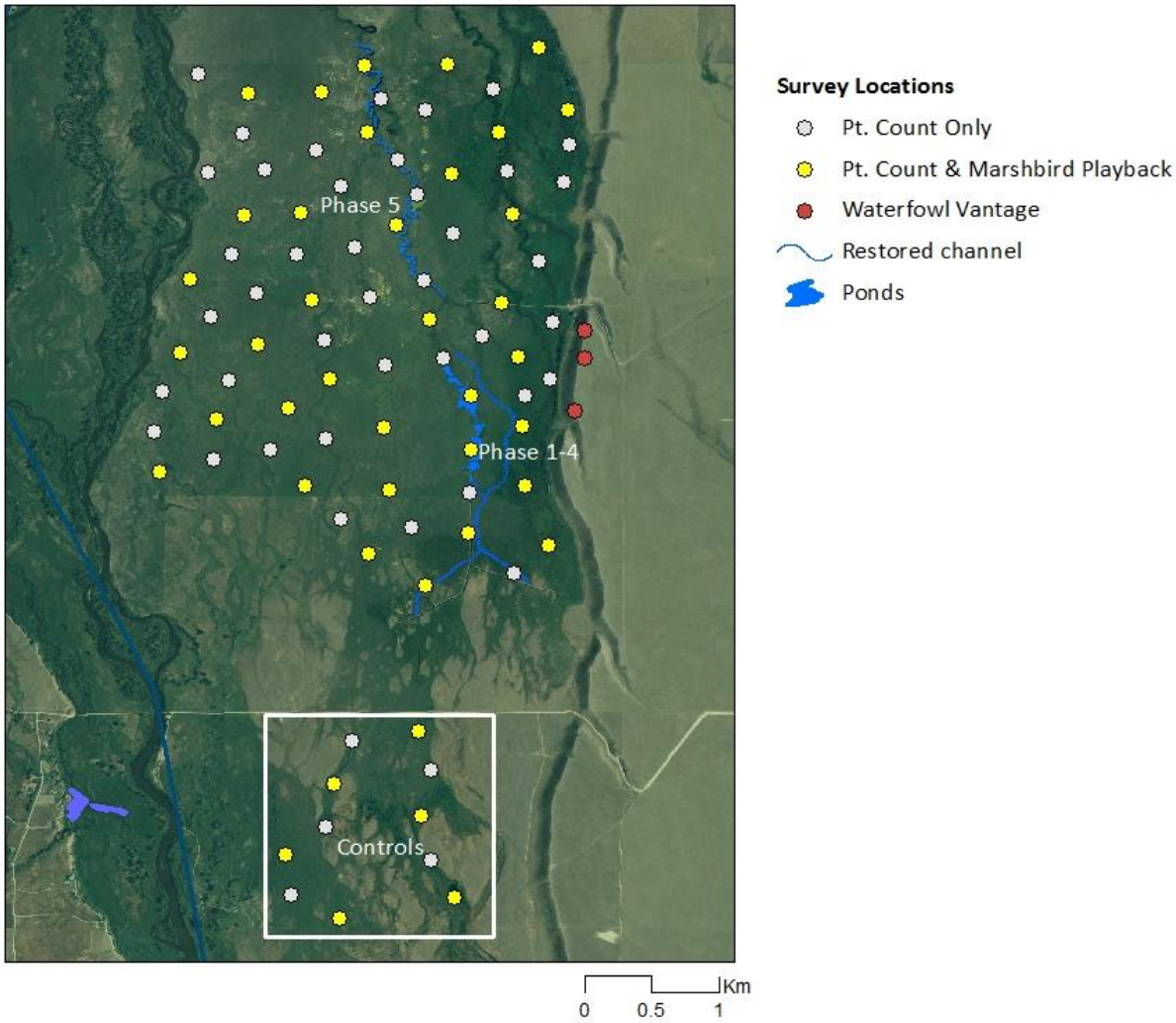

Figure 3. Locations of surveyed points in 2011, including point counts, marshbird playbacks, and waterfowl vantage surveys.

Waterfowl Surveys

Weekly surveys for waterfowl pairs and broods were conducted across all created ponds from 3 vantage points established in 2009 (Figure 3). Vantage surveys were conducted for 2 hours at dawn by scanning all open habitats. Individual broods were identified to species, age, and number of ducklings following Gollop and Marshall's (1954) protocol. Immediately following vantage surveys, we conducted an intensive area search across all wetland habitats around the ponds to locate any species or broods not visible from above. We documented all nests encountered, including species, clutch size, and geographic coordinates. Nests were re-visited weekly until assigned a final status (e.g. predated, hatched, or abandoned).

Point counts

We continued monitoring points established in 2006 and 2009 using available GIS layers to randomly select point count locations that covered all land types and uses within the project area (Figure 3); points were spaced at least 200 m apart. Additional reference points were established on the lower O'Dell Creek as a benchmark for restoration success. We followed standard 10-minute point count protocols (see: http://avianscience.dbs.umt.edu/projects/documents/Riverinesurveysmethodsmanual_final_001.pdf). Surveys were conducted for the 5 hours after sunrise and were not conducted during high wind velocities (≥ 20 km/hr) or during consistent precipitation. During surveys, observers recorded all birds seen or heard, how individuals were detected (song, visual, or call), and distances of birds from the center point. Distances (m) to birds were measured using a rangefinder. All points were visited two times during the breeding season (late May-early July).

Focal Species Abundance

Abundance indices provide information on the relative density of birds in an area. We selected focal bird species for analysis based on riparian breeding status, level of conservation concern, habitat associations, and abundance in the project area. The Red-winged Blackbird, Common Yellowthroat and Tree Swallow were selected as indicators of early restoration response, because they are associated with emergent wetland habitats. The Willow Flycatcher, Gray Catbird, and Yellow Warbler were selected as indicators of later restoration success, with the timing and extent of colonization of these species an indication of mature riparian habitat. Relative abundance for focal species was obtained by selecting the maximum number of detections across two visits at each point.

Species Richness & Diversity

We calculated riparian species richness and diversity for each point and treatment based on known riparian breeders from the region (see Appendix A). Species richness is the total number of species observed whereas, species diversity measures ecological diversity based on the number of species detected weighted by the proportional abundance of each species (Krebs 1994). Species diversity was measured using a transformation of the standard Shannon-Wiener function (H') equal to e^H, that reflects species richness given equal distribution of abundance (Ludgwig & Reynolds 1988). A high score indicates high ecological diversity.

Statistical Analysis

We used a generalized linear mixed model (GLMM) to test for differences in species richness, diversity, and relative abundances of focal species between years and treatments. A Sidak confidence interval correction was used to control for multiple comparisons among factors. Model fit was evaluated with year included as a random effect to account for potential correlation between repeated measures of the same points across years. SPSS 19.0 was used for all statistical analyses.

If restoration has an immediate effect on bird community composition, then we expect: 1) control and treatment sites to be most similar before restoration, 2) controls to remain similar throughout the study, and 3) post-restoration control and restored plots to differ significantly. If there is no effect then we expect no pattern of significance.

Secretive Marshbird Surveys

We conducted systematic playback surveys for secretive marshbirds at all point count survey locations over 400 m apart with suitable habitat, following the Standardized North American Marsh Bird Monitoring Protocol (Fig. 3). We broadcasted calls for four species known to breed in Montana: American Bittern, Pied-billed Grebe, Virginia Rail, and Sora. For further protocol information, follow this link: http://ag.arizona.edu/research/azfwru/NationalMarshBird/downloads/NorthAmericanMarshBirdSurveyProtocols.pdf.

Habitat Measures

Point counts allow for estimating densities of birds across different land use categories and habitat conditions. Therefore, we also measured a variety of plant/habitat metrics at each point-count station after completing bird surveys. Vegetation was measured at four sampling locations within the point-count area: plot center and at three locations 25 m from the center, at 0°, 120°, and 240° (Figure 4).

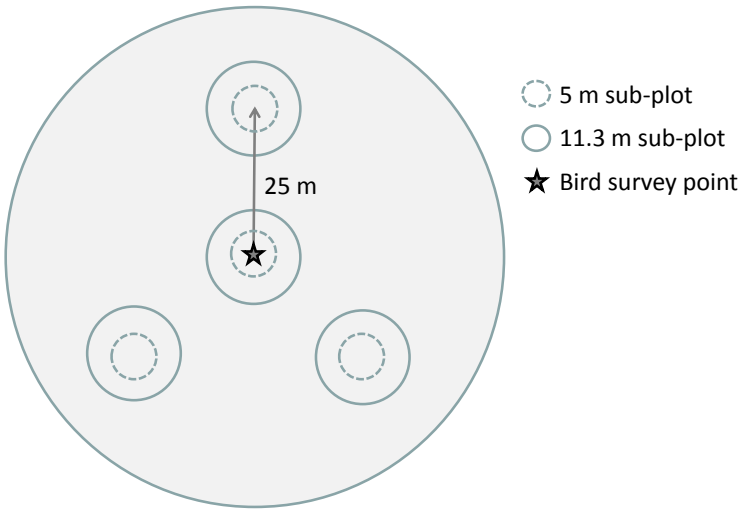

Figure 4. Vegetation sampling circle showing the arrangement of 5m and 11.3m plots.

At each sampling location we measured vegetation composition and structure at two scales: 5m-radius subplot and 11.3m-radius plot. Within the 5m sub-plot, we recorded ocular estimates for: shrub cover (by species) and height of shrubs > 1m, sapling cover (by species), ground cover structure, and exotic species cover (by species). Ground cover categories included woody stems, grass, forb, sedges/rushes, course woody debris, water, rock, litter, and bare ground. We also counted the number of cow pies and ungulate mounds within each 5m plot.

Within the 11.3m plot, we counted trees by species and size class, and estimated grazing and browsing intensity. Canopy cover of the tallest vegetation layer was estimated by averaging 4 densiometer readings (one in each cardinal direction). We also took a photograph of each site to permit visual monitoring of change over time.

Results

A total of 78 bird species were observed from May 24th-June 27th, including 21 Partner's in Flight (PIF) Priority Species and 10 Montana Species of Concern (SOC). Four of these SOC were new species, observed for the first time in 2011 within the project area. See Appendix A for a complete list of species detected across all survey methods in 2011.

Waterbirds

Spring Pair Counts-- Spring waterfowl pair counts were completed by Rob Hazlewood of Ranchland Wildlife on May 12th. These surveys have been completed within the same date range in May since 2005, and represent an estimate of yearly breeding pair use of the area.

During the single count, 21 waterbird species, including 11 waterfowl were observed (Table 1). This was 5 more species than observed during the spring count in 2009, and included the first sighting of Eared Grebes for the project area.

While the number of waterfowl species using the area remained high (e.g. 65 pairs) compared to pre-restoration counts in 2005, pair counts dropped from 2009 for 4 species, including big declines in Mallard pairs. However, several species showed increased numbers, including a three-fold increase in Green-winged Teal from 9 pairs in 2009 to 21 pairs in 2011.

Table 1. Spring waterbird pair counts before restoration in 2005, and following restoration (2009-2011). Single birds are in parentheses.

Common Name	Before	After	
	2005	2009	2011
Canada Goose	-	2	5
Gadwall	-	1	1
American Widgeon	-	1	1
Mallard	1	48(14)	19(21)
Blue-winged Teal	-	2	3
Cinnamon Teal	-	11	9
Northern Shoveler	-	5	2
Northern Pintail	-	2	1
Green-winged Teal	11	9	21(9)
Ring-necked Duck	-	-	1
Lesser Scaup	-	1	2
Common Merganser	-	-	1
Eared Grebe	-	-	(26)
American White Pelican	-	-	-
American Bittern	-	-	(1)
Great Blue Heron	-	(3)	(3)
White-faced Ibis	-	-	-
Sora	-	-	-
American Coot	-	-	1
Sandhill Crane	-	4	5
Killdeer	-	1	1
Long-billed Curlew	-	(1)	(1)
Wilson's Snipe	-	-	(7)
Wilson's Phalarope	-	-	-
Ring-billed Gull	-	(5)	-

Summer Breeding Surveys--We completed 5 weekly vantage and flush surveys of waterbirds and broods.

While species richness was lower during the summer than during the spring count, 5 waterbird species that weren't sighted in the spring were observed, including the first White-faced Ibis detection (Table 2). Abundance increased for 7 of 11 waterfowl species compared to previous years (Figure 5). Two waterfowl species detected in 2009 were not observed during summer counts in 2011 (e.g. Ring-necked Duck and Northern Pintail). However, both species were recorded during the spring count.

Table 2. Waterbirds observed during summer vantage and flush surveys in 2011.

Common Name	Total Individuals
Mallard	28
Green-winged Teal	22
Cinnamon Teal	21
Lesser Scaup	15
Gadwall	9
Wilson's Phalarope[a]	8
Common Merganser	7
Canada Goose	6
American Avocet[a]	3
American White Pelican[a]	2
Blue-winged Teal	2
Sandhill Crane	2
American Coot	1
Great Blue Heron	1
Northern Shoveler	1
White-faced Ibis[a]	1

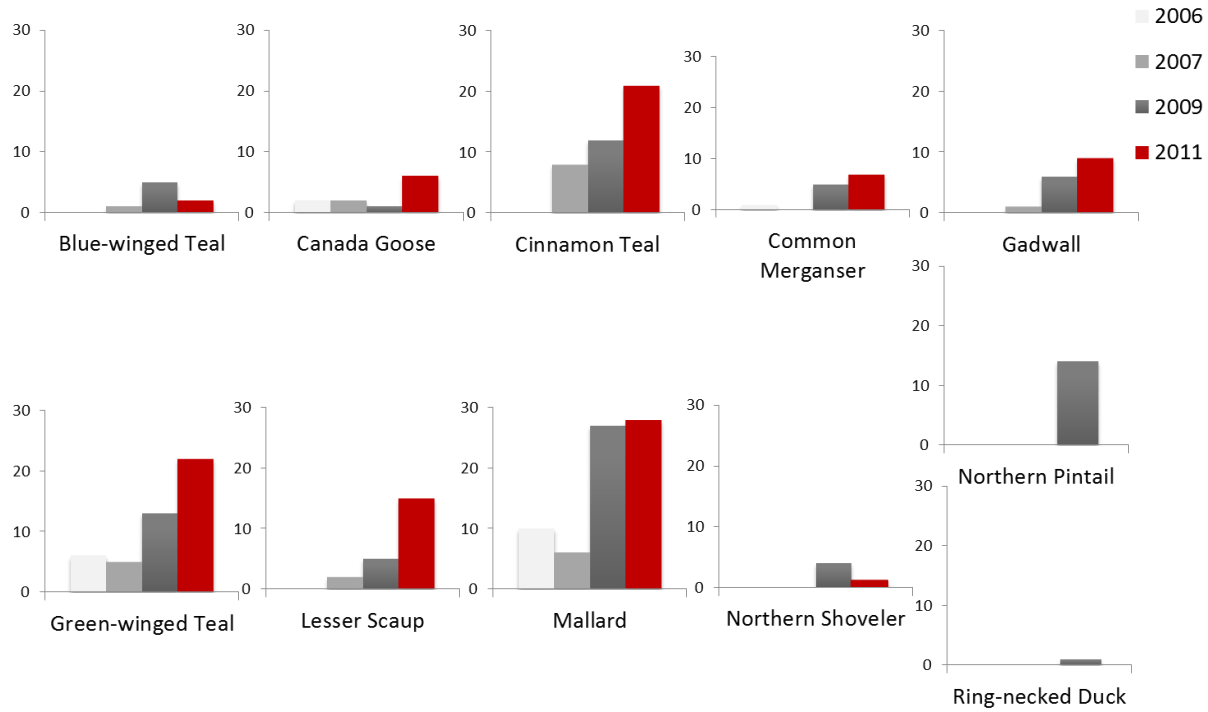

Figure 5. Abundance of waterfowl during summer surveys at O'Dell Creek from 2006-2011.

As waterfowl begin incubating and caring for broods, males and females are less likely to be paired, making counts less reliable for evaluating breeding pairs. However, species presence and total number of individuals can be used to help evaluate breeding season use. Total numbers of waterfowl declined over the summer, from 100 individuals and 8 waterfowl species on May 23rd to 38 individuals and 5 species on June 24th (Fig. 6).

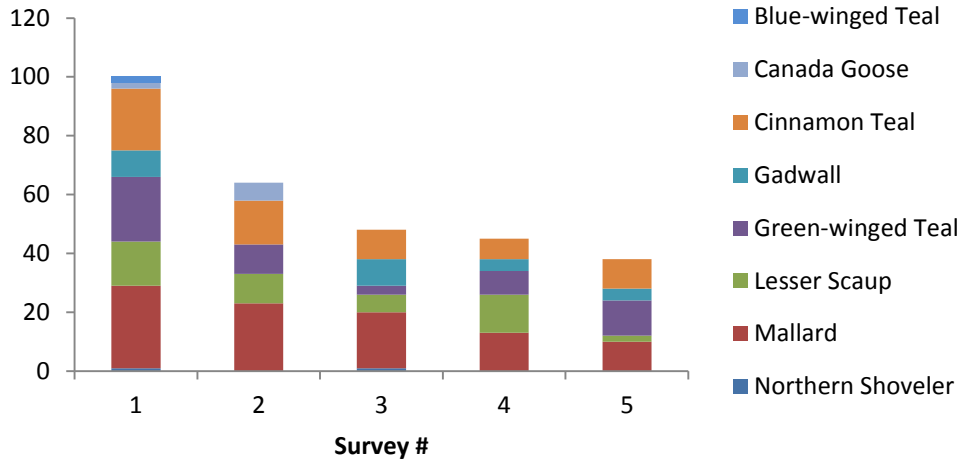

Figure 6. Waterfowl numbers across summer surveys in 2011.

Nesting--Eight waterfowl nests were documented during area searches, including 5 Mallard, 1 Green-winged Teal, and 2 unknown (Table 3). For all nests with positive species identification, females were sighted flushing from the nest. Remaining nests all had pale whitish eggs, and were likely Mallard. All nests contained eggs at first observation. Final status for nests found was 1 still incubating, 1 apparently abandoned, 1 with evidence of a successful hatch (see Fig. 7), and 5 unknown fate (2 nests were empty on return visit with no shells, and 3 were not located for a re-visit). Nests were primarily located in the restored wetland and stream channel area along the eastern portion of the project area, with a single nest found adjacent to one of the created ponds (Fig. 8).

Table 3. Species, number, and final status of waterfowl nests found at O'Dell Creek in 2011.

Date	Species	# Eggs	Final Status
5/23	Unk.	9	Unk.[a]
5/27	Mallard	9	Unk.[a]
5/27	Unk.	7	Unk.[b]
6/03	Mallard	7	Hatched
6/03	Green-winged Teal	7	Unk.[b]
6/03	Mallard	4	Unk.[b]
6/17	Mallard	1	Abandoned
6/17	Mallard	8	Incubating

[a] No eggs or shells in or near nest.
[b] Not found for a re-visit. Final status unknown.

Broods--Three waterfowl broods and 1 juvenile Sandhill Crane were observed during surveys (Fig. 8, Table 4). Two of the waterfowl broods were identified as Mallard, and the third was not positively identified.

Based on the plumage classification, which is used to identify broods across multiple surveys, it appears that all the broods sighted were unique groups. This is a major decline from 2009 when 5 waterfowl species were observed with 13 unique broods (Table 5).

Figure 7. Mallard egg shells with evidence of hatching found at O'Dell Creek in 2011 (note the pin feathers and apparent pecked opening on the lower egg).

Table 4. Waterbird broods counted during standard surveys in 2011.

Date	Species	Brood Size	Plumage		No. Females
			Class	Subclass	
17-Jun	Mallard	6	2	A	1
17-Jun	Sandhill Crane	1	2	A	1
17-Jun	Unknown	4+	1	C	0
24-Jun	Mallard	9	2	A	1

Table 5. Waterfowl brood counts from 2006-2011.

Species	2006	2007	2009	2011
Blue-winged Teal	-	1	2	-
Cinnamon Teal	-	2	2	-
Gadwall	-	1	-	-
Green-winged Teal	9	1	5	-
Mallard	-	2	3	2
Northern Shoveler	-	-	1	-
Unknown	-	-	-	1
Total	9	7	13	3

Figure 8. Location of waterfowl nests and broods, including a single Sandhill Crane juvenile in 2011.

Point Counts

All 86 points were surveyed two times during the breeding season, from 24 May through 27 June. We counted a total of 3,122 birds representing 71 species during point count surveys (Appendix A).

Total species richness was down since 2009, when we observed 84 species during point count surveys. However, 3 new species were recorded including Caspian Tern, McCown's Longspur, and Burrowing Owl (observed using the project area on June 20th ;Fig. 9). The most abundant species observed was the Savannah Sparrow, followed by the Western Meadowlark, both of which are associated with the grassland-dominated upland habitat of the project area.

Point count data was analyzed to evaluate changes in bird species distributions and densities since restoration was initiated. We also pooled point count data into measures of species richness and diversity to evaluate individual restoration phases.

Figure 9. A Burrowing Owl was documented within the O'Dell Creek restoration area on June 20th (photo credit: Andrew Kastning)

Restoration Effects on Focal Species Abundance

We calculated the abundance per survey point of focal bird species in order to evaluate individual species response to restoration activities.

Pre-restoration Differences--We found no measurable differences in mean abundance between control and restored points prior to restoration.

Restoration Effects--Two focal species, the Red-winged Blackbird and the Tree Swallow, showed a significant increase in abundance following restoration (GLMM p-value 0.002 and 0.03, respectively; Figure 12). For both species, mean abundance was significantly greater at restoration points than control points in 2009 and 2011 (Table 6). Mean abundance of Red-winged Blackbirds was 1.0 higher at restored sites than controls starting in2009, meaning there was on average 1 more individual detected at restored sites than controls. Tree Swallow abundance increased to 0.7 more individuals at restored than control sites in 2009 and 1.0 more in 2011. Both of these species were selected as indicators of early restoration response, and these results suggest that restoration activities have improved emergent wetland habitat conditions within the project area. One focal species selected as an early indicator of restoration conditions, the Common Yellowthroat, did not show a significant response. This species is often found in areas with some shrub cover, and restored areas may not have matured sufficiently. As expected, no change in abundance was measured for any of the focal species associated with mature riparian habitats (e.g. Willow Flycatcher, Gray Catbird, and Yellow Warbler; see Table 6 and Figure 12). Tracking the colonization of restored habitats by these species may take decades, but will indicate that restoration has followed the desired trajectory.

Table 6. Pairwise contrasts of focal species abundance between restored and control sites (e.g. Restored minus Control) from 2006-2011 (* denotes Sidak corrected p-value <0.05).

Focal Species	2006	2007	2009	2011
Early Colonizers				
Common Yellowthroat	0.0	0.0	-0.1	0.2
Red-winged Blackbird	0.7	1.2	1.0*	1.0*
Tree Swallow	-0.1	0.0	0.7*	1.0*
Late Colonizers				
Gray Catbird	0.0	0.0	0.0	0.0
Willow Flycatcher	0.0	0.1	0.0	0.0
Yellow Warbler	0.0	0.0	0.0	-0.1

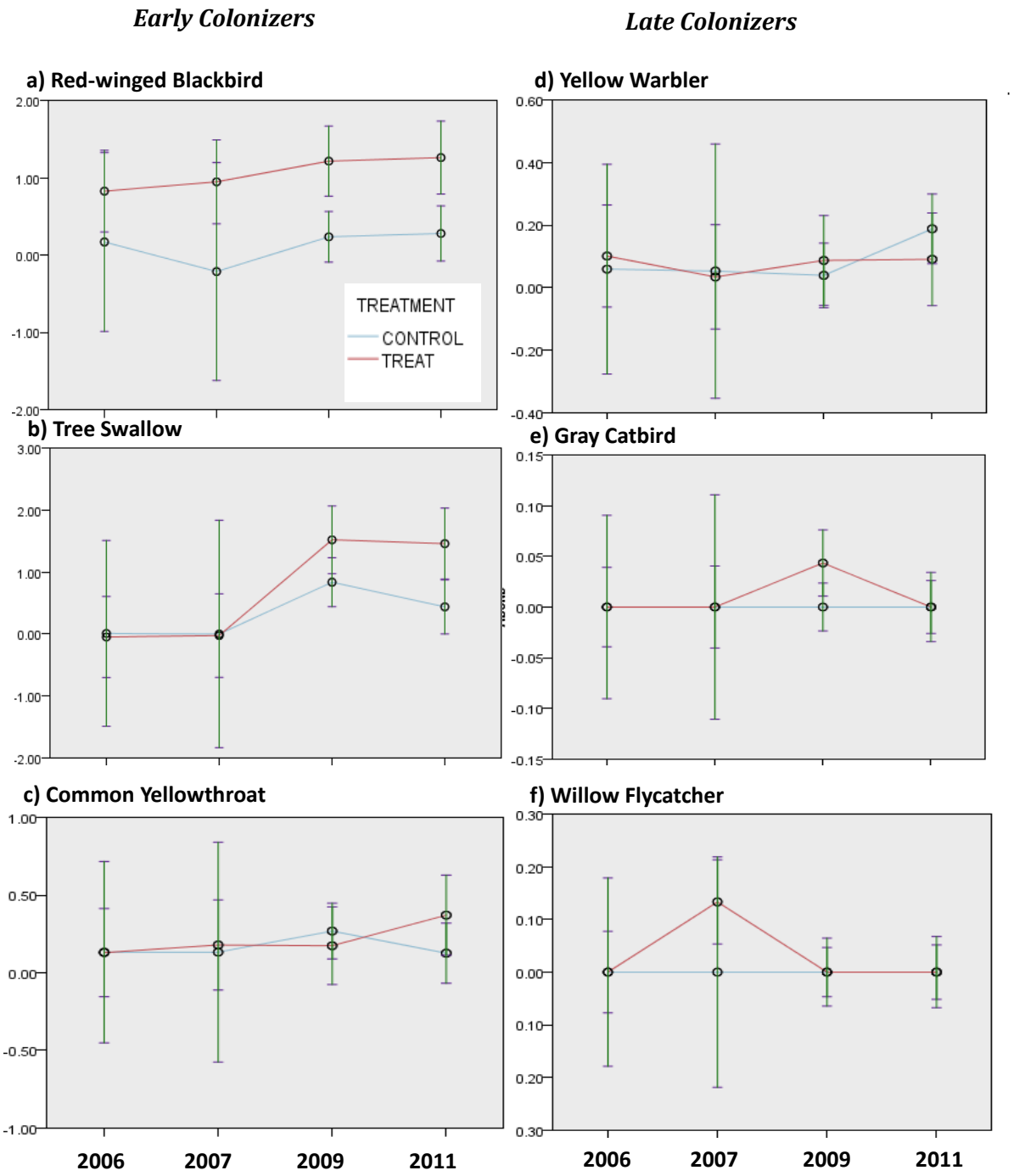

Figure 10. Relative abundance of focal bird species within restored (TREAT) and control sites at O'Dell Creek from 2006-2011.

Species Richness & Diversity Response by Project Phase

Examining riparian species richness and diversity by treatment and year, we are able to track both the quality of habitat created relative to control and reference sites, and the timing of ecological response to specific restoration actions (phases) within the project area (see Figure 3 for location of restoration phases).

Pre-restoration Differences--We found no measurable differences in species richness or diversity between control and individual project phase areas prior to restoration (Fig. 11 and Table 7).

Annual Differences--Significantly higher species richness and diversity was observed in 2009 than all other monitoring years (GLMM p-value <0.05; Fig. 11 and Table 7). However, tests of pairwise differences showed that the only significant between-year differences were within restored and reference sites, while no measurable difference was detected within controls. This suggests that the factors increasing riparian bird communities in 2009 did not extend to areas of poor or non-existent habitat.

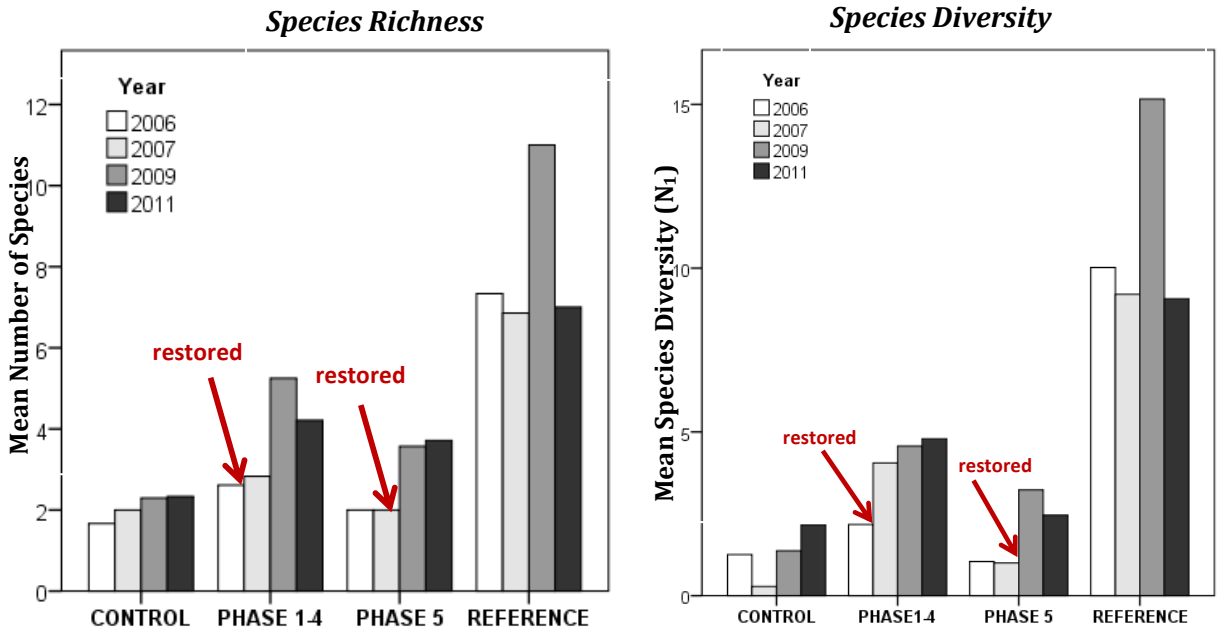

Figure 11. Riparian species richness and diversity (N1) within two restoration phases at O'Dell Creek from 2006-2011, with control and reference sites for comparison.

Effects by Project Phase-- Species richness and diversity increased within all restoration phases relative to pre-treatment levels and controls (Fig. 11). However, the only statistically significant change was in Phase 1-4 in 2009, when both richness and diversity were significantly higher compared to previous years and controls (GLMM p-value <0.05). There were on average 3.0 more species detected in Phase 1-4 than controls in 2009 (Table 7).

Diversity appears to have responded more quickly than species richness within Phase 1-4, with a notable increase of N_1=3.2 starting in 2007(Table 7, Fig. 11). In comparison, species richness had no measurable gains until 2009. This suggests that abundance of riparian-associated species already present in the project area increased before new species began to colonize in 2009. Species richness and diversity were higher in Phase 1-4 than Phase 5 in all years since restoration, likely due to the earlier onset of restoration projects in this area as well as the diversity of habitats created (e.g. ponds, streamside riparian, and emergent wetlands).

While both species richness and diversity have increased across all restoration phases, numbers are still significantly lower relative to reference conditions (GLMM p-value <0.05; Fig. 11). On average 3.3 -7.7 more species were detected at reference sites compared to restored areas across all years. Species diversity was even higher in reference sites compared to restored areas, with average diversity ranging from 5.1-12.4 across years and phases (Table 7). These results suggest that not only do reference sites support a higher number of riparian species; relative abundances are also significantly greater for most species.

Table 7. Pairwise contrasts (e.g. difference between restored and control/reference sites) of riparian species richness and diversity among treatments from 2006-2011 (*denotes Sidak corrected p-value <0.05). A positive number indicates an increase in species richness/diversity.

Contrasts	2006	2007	2009	2011
	Species Richness			
Phase 1-4 *vs*. Control	0.4	0.3	3.0*	1.6
Phase 5 *vs*. Control	0.2	0.06	1.3	1.4
Reference *vs*. Phase 1-4	5.2*	4.3*	6.0*	3.3
Reference *vs*. Phase 5	5.4*	4.6*	7.7*	3.5
	Diversity (N_1)			
Phase 1-4 *vs*. Control	0.5	3.2	3.2*	2.3
Phase 5 vs. Control	0.1	1.1	1.9	0.2
Reference *vs*. Phase 1-4	8.6*	5.6*	11.1*	5.1*
Reference *vs*. Phase 5	9.2*	7.7*	12.4*	7.1*

Riparian Species Presence--To better interpret changes in species richness and diversity, we also evaluated species presence within the project area relative to reference sites (Table X). There were 16 species only observed in restored areas following restoration (e.g. not in controls). All of these species were also detected in reference sites. An additional 6 species were detected at reference sites only. These are the species we anticipate will colonize restored areas over time as riparian habitat matures.

Table 8. Bird species detected only in restored and reference sites from 2006-2011.

Bird Species	
Restored	*Reference*
American Avocet	Black-headed Grosbeak*
Belted Kingfisher	Common Grackle*
Blue-winged Teal	Dusky Flycatcher
Cinnamon Teal	Least Flycatcher
Common Merganser	Veery
Fox Sparrow	Warbling Vireo
Gadwall	Western Wood-Pewee
Gray Catbird	
Great Blue Heron	
Lesser Scaup	
Lincoln's Sparrow	
Northern Pintail*	
Song Sparrow	
Sora	
Willow Flycatcher*	
Yellow-headed Blackbird	

*denotes species not detected in 2011.

Secretive Marshbirds

Playback surveys for secretive marshbirds were conducted at 34 points containing potential habitat for marshbirds (Fig 3). Two marshbird species were detected during surveys: the Sora and the Virginia Rail. While the Sora has been observed in previous years, this is the first observation of a Virginia Rail within the study area. Both species are associated with emergent vegetation within wetlands, and the Virginia Rail requires dense emergent cover. Although not detected during standardized surveys, an American Bittern was also documented using the restored wetland areas in early May, prior to the start of summer surveys by Don Peters and Robert Hazlewood (Fig. 12).

Figure 12. American Bittern within O'Dell Creek restoration project area (photo by Don Peters).

All marshbirds were detected by sound, with a single sighting of a Sora during the flush surveys for waterbirds along the edge of the ponds. While the majority of marshbirds were detected during standard point count surveys, 40% of detections occurred only after calls were broadcast, including the single Virginia Rail detection. There were a total of 9 detections of Sora across 2 visits, with a minimum of 5 total individuals (based on number of detections in a single visit). One Virginia Rail was detected on the first visit at a single point.

Sora numbers are down from 2009 when there were 14 Sora detections across 2 visits, with up to 9 total individuals in a single visit (note that numbers reported here differ from the 2009 report, because we corrected for duplicate detections from points surveyed <400 m apart).

Marshbird detections in 2011 were all located within the Phase 4 wetland and pond restoration project area, while in 2009 3 Sora were detected at control points in the southern portion of the study area (Fig. 13). Also, in 2009 most Sora were detected during the second survey, which was completed one week later than in 2011. It is possible that later surveys have better detection probabilities due to seasonal changes in behavior. Cooler early season temperatures in 2011 may have also delayed or reduced marshbird use of the area compared to 2009.

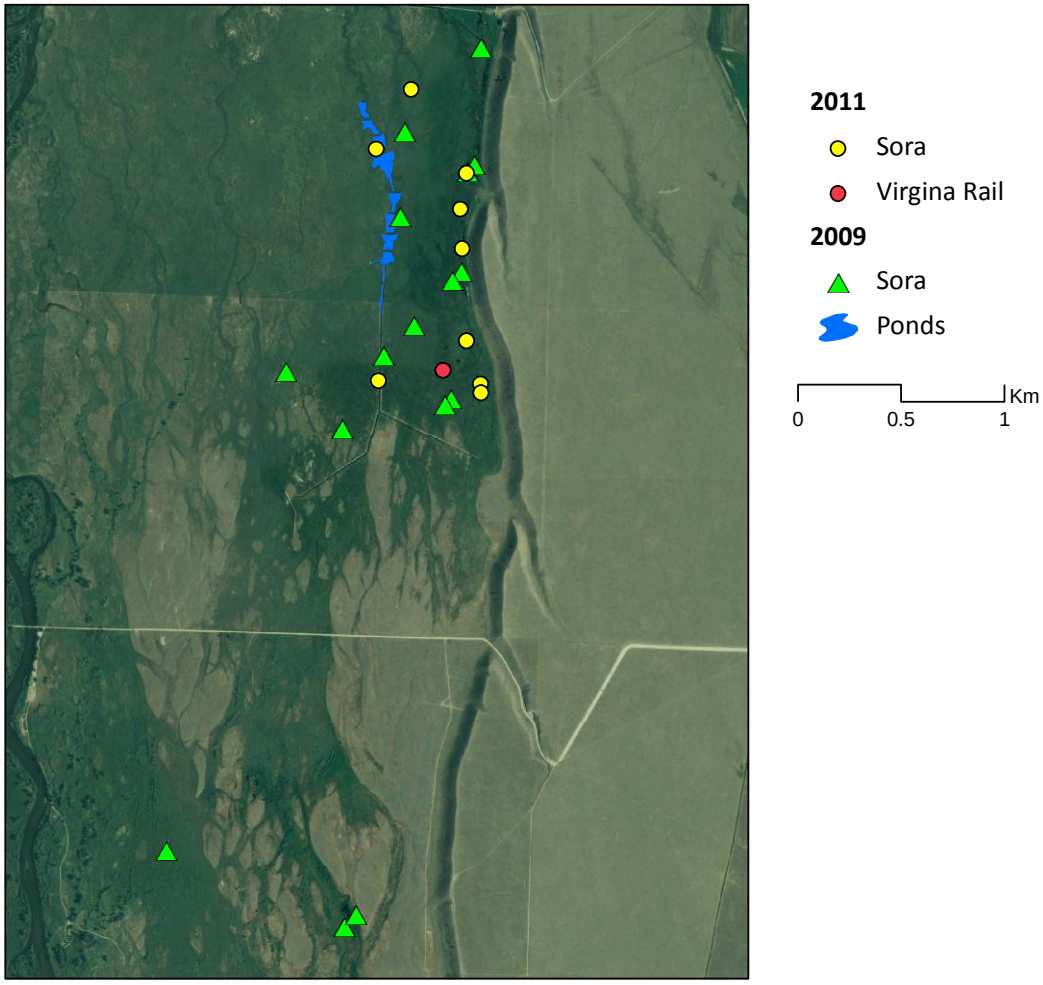

Figure 13. Locations of marshbirds detected during standard point count and playback surveys in 2009 and 2011, calculated using distance and bearing from survey point.

Conclusions

Overall, the number of species using the project area continued to increase since restoration. However, cool weather may have resulted in reduced or delayed breeding, as indicated by lower waterfowl brood counts in 2011 than in all previous years. The abundance of secretive marshbirds also appears to have declined since 2009, perhaps due to weather conditions. Though, detections of two new marshbird species using the project area (e.g. American Bittern and Virginia Rail), suggest overall habitat conditions are continuing to improve for these wetland-restricted species.

Point count data collected across multiple locations provides sufficient sample sizes for statistical analysis of bird community response. Of the 6 focal bird species we evaluated, two showed significant increases in relative abundance following restoration (e.g. Red-winged Blackbird and

Tree Swallow). We predicted these species would be among the first to respond to restoration, since each are associated with emergent wetland habitats for breeding and foraging, respectively. Tracking the colonization of restored habitats by the remaining focal species will permit a measure of ecological success for species requiring mature riparian habitats.

Restoration of the project area is ongoing with unique management actions and timelines associated with different phases of the project. Examining riparian bird species richness and diversity by treatment and year, we are able to track both the quality of habitat created relative to reference sites, and the timing of ecological response to specific restoration actions (phases) within the project area. Both species richness and diversity increased at restored sites relative to controls beginning in 2009. Comparing species richness and diversity to reference sites suggest that while restoration has resulted in measurable increases in the riparian bird community, restored sites are not yet comparable to mature riparian habitats in the area.

Recommendations & Future Directions

- Continued bird monitoring will be important to determine whether restoration is following its intended trajectory over time. **We recommend future monitoring of the area every 3 years.**
- Given the influence of annual variability in weather conditions on bird numbers, as witnessed in 2011, accounting for annual conditions will be important in evaluating restoration outcomes in future years. **Therefore, we recommend monitoring for 2-3 consecutive years.**
- Once vegetation has matured, we will utilize habitat measures collected since 2006 to determine which environmental factors are most strongly associated with increases in riparian bird species diversity and abundance. These results will provide specific recommendations for best management practices for associated bird communities.

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Appendix A. *Bird species encountered during surveys across all sites within the O'Dell Creek area. Species without recorded abundance were detected outside the 50-m point count survey. Species in* ***bold*** *were observed for the first time in 2011. * denotes riparian-associated species more commonly found in riparian areas during the breeding season than other habitats.*

Common Name	Abundance[a]	PIF Priority[b]	Montana SOC[c]
American White Pelican*	-	III	S3B
Great Blue Heron*	-		S3
White-faced Ibis*	-	II	S3B
Canada Goose*	-		
Gadwall*	3		
Mallard*	12		
Blue-winged Teal*	1		
Cinnamon Teal*	-		
Northern Shoveler*	-		
Green-winged Teal*	13		
Lesser Scaup*	2		
Common Merganser*	-		
Osprey*	-		
Bald Eagle*	-		
Northern Harrier*	2	III	
Red-tailed Hawk	-		
Ferruginous Hawk	-	II	S3B
American Kestrel	1		
Virginia Rail*	-		
Sora*	-		
American Coot*	-		
Sandhill Crane*	5		
Killdeer*	17	III	
American Avocet*	-		
Spotted Sandpiper*	24		
Long-billed Curlew*	5	II	S3B
Wilson's Snipe*	4		
Wilson's Phalarope*	-	III	
Franklin's Gull*	-	II	S3B
Caspian Tern*	-	II	S2B
Mourning Dove*	2		
Burrowing Owl	-	I	S3B
Short-eared Owl	-	III	
Belted Kingfisher*	-		

Appendix A. Continued.

Common Name	Abundance[a]	PIF Priority[b]	Montana SOC[c]
Hairy Woodpecker*	-		
Northern Flicker*	-		
Western Wood-Pewee*	-		
Least Flycatcher*	-	III	
Hammond's Flycatcher	-	II	
Dusky Flycatcher*	-		
Eastern Kingbird*	1		
Warbling Vireo*	-	III	
Black-billed Magpie*	12		
American Crow	-		
Common Raven	1		
Horned Lark	5		
Tree Swallow*	74		
Violet-green Swallow*	2		
Bank Swallow*	1		
Cliff Swallow*	74		
Barn Swallow*	1		
Black-capped Chickadee*	2		
House Wren*	2		
Marsh Wren*	9		
American Robin*	5		
Gray Catbird*	-	III	
Sprague's Pipit	2	I	S3B
Cedar Waxwing*	2		
Yellow Warbler*	16		
Yellow-rumped Warbler	-		
Northern Waterthrush*	-		
Common Yellowthroat*	17		
Western Tanager	-		
Vesper Sparrow	-		
Savannah Sparrow	252		
Fox Sparrow*	2		
Song Sparrow*	2	III	
Lincoln's Sparrow*	3		
McCown's Longspur	-	II	S3B
Red-winged Blackbird*	44	III	
Western Meadowlark	77		
Yellow-headed Blackbird*	-	III	

Appendix A. Continued.

Common Name	Abundance[a]	PIF Priority[b]	Montana SOC[c]
Brewer's Blackbird	36	III	
Brown-headed Cowbird*	32		
Bullock's Oriole*	1		
Pine Siskin	2		
American Goldfinch*	1		

[a] Abundance was calculated as the maximum number detected within 50 m. in 2 visits, and summed across points.
[b] Partner's in Flight (PIF) Priority levels, with I being species of greatest conservation concern based on threats, population declines, and proportion of range occurring in Montqna.
[d] Montana Species of Concern (SOC) is a ranking system to denote status within Montana (Source: Montana Natural Heritage Program).