Density and Trends of Grassland Birds on City of Fort Collins Properties in the Mountains to Plains area of Northern Colorado

2017 TECHNICAL REPORT

Bird Conservancy of the Rockies

Connecting People, Birds and Land

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Technical Report: I-MTP-FCNAP-17

BIRD CONSERVANCY OF THE ROCKIES

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***Vision**: Native bird populations are sustained in healthy ecosystems*

***Core Values**: (Our goals for achieving our mission)*

1. ***Science** provides the foundation for effective bird conservation.*
2. ***Education** is critical to the success of bird conservation.*
3. ***Stewardship** of birds and their habitats is a responsibility we all share.*

Bird Conservancy accomplishes its mission by:

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***Researching** bird ecology and response to anthropogenic and natural processes. Our research informs management and conservation strategies using the best available science.*

***Educating** people of all ages to instill an awareness and appreciation for birds and a conservation ethic.*

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Cover Photos: Lark Bunting (male) on Meadow Springs Ranch. Photo by Walter Wehtje

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EXECUTIVE SUMMARY

The City of Fort Collins and other partners have been working since 2004 to protect a unique biological and scenic corridor stretching between the Rocky Mountains and the Great Plains of northern Colorado in a project called The Laramie Foothills Mountains to Plains (MTP) Project. The area has been identified by The Nature Conservancy, Colorado Parks and Wildlife, the US Forest Service, the US Fish and Wildlife Service and others as one of the highest priority conservation areas in the Shortgrass Prairie Bird Conservation Region (BCR 18). Beginning in 2006, Bird Conservancy of the Rockies partnered with the City of Fort Collins in what has become an ongoing effort to aid conservation and management of the shortgrass prairie in the area through grassland bird inventory and monitoring on over 45,000 acres of city-owned properties in Larimer and Weld Counties. This report summarizes the 11th year of monitoring activities and highlights our findings of 2017.

This region supports 19 high-priority grassland birds, including Ferruginous Hawk, Swainson's Hawk, Golden Eagle, Northern Harrier, Loggerhead Shrike, Burrowing Owl, Mountain Plover, Prairie Falcon, Lark Bunting, McCown's and Chestnut-collared Longspur, Long-billed Curlew, Cassin's, Lark, Vesper, Grasshopper, Brewer's Sparrow, and newly detected in the last 3 years, Baird's Sparrow. Grassland birds have declined more steeply and consistently in the last 50 years than any other North American group of birds and are among the top priorities for governmental and non-governmental wildlife conservation organizations. Among the management concerns for these species in the MTP are grazing management, energy development, recreation, invasive species, and prairie dog habitat conservation and plague management.

During the 2017 breeding season we conducted early- and mid-season point count surveys at 295 stations. We surveyed approximately 3,086 acres of prairie dog colony habitat (PDCH) on Meadow Springs Ranch, Soapstone Prairie Natural Area and Round Butte Ranch. At each station we also surveyed vegetation and recorded observations of other wildlife. During 30 survey days in 2017, we observed 3,873 individual birds of 53 species. We estimated densities of 16 common breeding bird species occurring within active and inactive PDCH.

The most common birds within the 2017 study area were Horned Lark, Western Meadowlark McCown's Longspur, and Vesper Sparrow, which together accounted for 83% of all individual birds observed. A comparison of annual densities of McCown's Longspur within the prairie dog colony habitat suggests that the population continues to decline steadily and rapidly, especially after the documented plague event in 2009, resulting in a >50% reduction in population since 2006. Mountain Plovers have not been detected in Soapstone Prairie Natural Area since 2014. It is hoped that plague management will help in the recovery of the prairie dogs, and thus the plover population, but additional prescribed burns and other actions are necessary to keep the species from disappearing from the MTP area. Populations of Burrowing Owl appear to be stable in the area. The continued detection of Baird's Sparrows on the properties is exciting as they are a species of continental conservation concern and have never been documented or suspected of breeding in Colorado.

The City of Fort Collins Natural Areas and Utilities Department lands in northeast Colorado offer an exceptional opportunity to steward a diverse landscape and sustain populations of several unique species of wildlife that are declining within this disappearing ecosystem. Managers should pay particular attention to the shortgrass prairie obligate species that are declining on the properties and range-wide. In order to maintain populations of these and other grassland-obligate species, managers should strive to conserve and augment prairie dog populations, maintain and restore native shortgrass prairie through prescribed burns and intensive grazing, minimize disturbance from natural resource development and recreation, and continue monitoring to inform management priorities and actions.

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INTRODUCTION

The area in northeastern Colorado known as the Laramie Foothills contain some of the last remaining high-quality, extensive shrubland and shortgrass prairie along the Colorado Front Range, and comprise the southern end of the largest remaining contiguous shortgrass prairie in North America, which stretches from northeastern Colorado to Alberta and Saskatchewan and east into Nebraska and the Dakotas. The region is considered one of the highest priority conservation areas in the Shortgrass Prairie BCR by TNC, Colorado Parks and Wildlife (CPW), the US Forest Service, the US Fish and Wildlife Service and others. Several partners in Colorado have been working since 2004 to protect this biological and scenic corridor stretching between the Rocky Mountains and the Great Plains in a project called The Laramie Foothills Mountains to Plains (MTP) Project. The shortgrass prairie of the MTP area supports breeding populations of 16 high-priority grassland bird species. Bird Conservancy of the Rockies (BCR) has partnered with the City of Fort Collins Natural Areas Program (FCNAP) for the past eleven years to aid in the conservation and management of these grasslands through grassland bird inventory and monitoring on 45,000 acres of city-owned properties in the MTP region.

The goal of this long-term monitoring is to help managers conserve grassland bird species and their habitats on FCNAP properties in northern Colorado by understanding the abundance, distribution, trends and habitat requirements of breeding birds on the properties. The area has experienced several cycles of documented sylvatic plague since 2008 that have significantly decreased the Black-tailed prairie dog (*Cynomys ludovicianus*) populations, a keystone species that creates ideal nesting habitat for bird species of concern like Mountain Plover, Burrowing Owl and McCown's Longspur. Successful efforts have been made by the FCNAP and CPW to encourage prairie dog re-colonization including prescribed burns, dusting treatments for fleas, and a 3-year oral vaccination program from 2013-2015. The objectives are to monitor populations of grassland bird species, document the migratory and breeding bird use of the project area and their response to management activities, and to provide locations of sensitive bird species.

STUDY AREA & METHODS

Between May 1st and July 7th of 2017, we conducted breeding grassland bird point count surveys on FCNAP properties in Larimer and Weld counties of northern Colorado (Appendix A): Soapstone Prairie Natural Area (SPNA), Meadow Springs Ranch (MSR), and Round Butte Ranch (RBR).

Soapstone is dominated on the east by native shortgrass prairie dominated by blue grama (*Bouteloua gracilis*) & buffalo grass (*Bouteloua dactyloides*) with rolling hills, wide shallow washes, and abrupt rocky outcroppings, and on the west is bordered by the largest contiguous community of Mountain Mahogany (*Cercocarpus montanus*) in the state of Colorado (Rondeau et al. 2011), with a large patch of old growth ponderosa pine, limestone cliffs running northwest to southeast, and hills dotted with Skunkbush (*Rhus trilobata*).

Meadow Springs Ranch is comprised primarily of native shortgrass and mixed-grass prairie grassland, but also has riparian and cliff areas lined with Plains Cottonwood (*Populus deltoides*) in the northern Lonetree pastures, rolling hills scattered with Four-winged saltbush (*Atriplex canescens*) in the Lewis and Benson pastures, tall grass ranchland in the Meadow pasture, and an extensive gently sloping prairie dog colony surrounding the US Fish & Wildlife's Ferret Center in the southern Bulger pastures.

Figure 1: Sunrise on Round Butte Ranch (photo by E. Youngberg)

Round Butte Ranch has two large buttes in the middle of the property surrounded by Mountain Mahogany which transitions to Saltbush. Yucca (*Yucca* spp.) is the next most abundant ground cover, and there are several weathered sandstone outcroppings throughout the property.

We limited our point counts in 2017 to areas of prairie dog colony habitat (PDCH) using spatial data provided by FCNAP of prairie dog colony habitat that was active in the preceding fall of 2016. A point was considered in PDCH if it was within 100m of a burrow, and labeled as "active" if the nearest burrow showed signs of recent prairie dog activity (grazing, scat, fresh digging), and labeled as "inactive" if there were no signs of recent activity. We also surveyed a recent burn area on MSR in the hopes of detecting Mountain Plover, as past burns have been successful at attracting the birds (Youngberg et al., 2011, Augustine et al., 2012).

Avian Point Count Surveys

Using a systematic 250-m grid of point count stations created in Arc Map 9.3.1 to survey the properties since 2006, we identified 295-point count stations in 2017 in the target habitat (69 of them in a recent burn area) (Fig 2). Points in PDCH were surveyed earlier in the season between May 1st and May 30th 2017 to increase detectability of the early nesting species. Each point count station was surveyed twice, with the second survey between June 15th and July 7th. The burn points were only visited once during the earlier survey effort. Point count surveys started one half-hour before sunrise and ended by 11 a.m., often earlier.

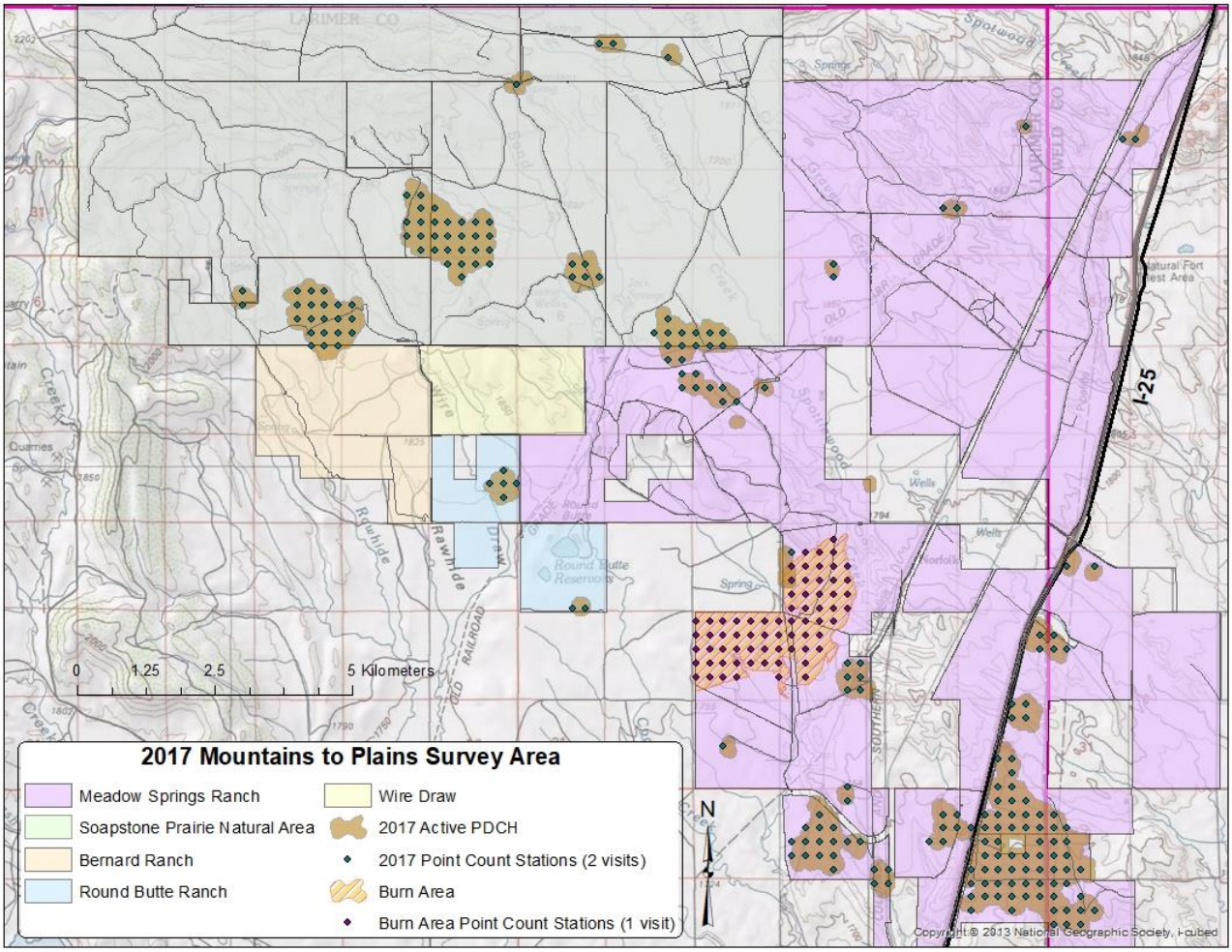

Figure 2: 2017 Survey area and point count stations on FCNAP properties in the MTP region.

Point count locations were navigated to on foot using a handheld GPS unit. We recorded atmospheric data (temperature, cloud cover, precipitation, and wind speed) and time of day at the start and end of each daily survey effort. All GPS data were logged in Universal Transverse Mercator (UTM) North American Datum 1927. At each station, we conducted a 6-minute point count survey consisting of six consecutive 1-minute intervals. This protocol, which is described more fully by Hanni et al. (2016), uses Distance sampling (Buckland et al. 2001) with removal (Farnsworth et al. 2002). For each bird detected, observers recorded species, sex, how it was detected (call, song, visual, wing beat, other), distance from observer at time of detection, and the 1-minute interval in which it was detected. We measured distances using a Nikon ProStaff 550 laser rangefinder. Point counts were not conducted during periods of heavy snow, rain, or wind greater than 10 mph. Between point count surveys, we recorded the presence of high-priority and other rare or unusual bird species, but we did not use these observations in our analyses. We also noted the presence of any other wildlife or interesting site observations.

Figure 3: Swift fox in Soapstone Prairie Natural Area (photo by W. Wehtje)

Habitat Surveys

After each avian point count survey, we completed a rapid habitat survey by estimating several vegetation parameters. Within 5 m of each point we visually estimated percent cover of grasses, forbs, bare ground, exotic/ non-native plants, cactus, low woody plants (< 30cm), animal scat, rock, and 'other cover' to the nearest 1%. 'Other cover' included other minor ground cover types such as lichen, litter, or categories defined in the notes (i.e. metal scraps). Also within this radius we measured average grass height with a ruler to the nearest cm and listed the dominant grass species. Within 50 m of each station we documented any shrub (> 30cm) and over-story tree species, estimated the percent cover to the nearest 1%, and the average height of each. We recorded whether point count stations in PDCH were 'active' or 'inactive'.

Analyses

We estimated bird species density using Program Distance 6.0 release 2 (Thomas et al. 2010). We appended the 2017 survey data to previous years' data (2006-2016) which used Half-normal cosine, Hazard-rate cosine, and Uniform cosine detection function models to determine the best fit model for each species (see Youngberg, et al. 2012). For estimating bird densities, we pooled all point count data from 2006 through 2017 to generate species-specific detection functions, and then post-stratified density estimates by PDCH and non-PDCH. Although species' density estimates calculated with less than 75 observations may be unreliable representations of true populations (Buckland et al. 2001), we present density and population estimates for all species with n ≥ 25 (non-truncated values) from 2017, and for high-priority species with fewer observations. Many species of high conservation interest often occur in low density, and having even rough estimates of density in a comparable format to other species, along with associated measures of error, can aid in the conservation and management of these species. Nonetheless, we urge that caution be used in interpreting estimates derived from relatively few observations, and that special attention be paid to %CV and confidence limits.

RESULTS

Avian Surveys

In 2017 we detected 3,873 birds during point count surveys, and observed 53 species within the study area. Of the species detected, 14 are of conservation interest. (Appendix B).

Figure 4: Ferruginous hawk in the South Bulger pasture on Meadow Springs Ranch (photo by W. Wehtje)

We analyzed data for 16 breeding bird species. Horned Lark and Western Meadowlark had the highest densities within PDCH (Table 1).

Table 1: Density and population estimates in 2017 in Prairie Dog Colony Habitat (n = truncated # detections in 2017, D = # of birds/ km^2), % Coefficient of Variation, and 95% lower (LCL) and upper (UCL) confidence limits.

Species	n	D	%CV	LCL	UCL	Estimated pop size
Horned Lark	783	179.57	5.37	161.57	199.57	2242.65
Western Meadowlark	1263	48.89	6.46	43.08	55.49	610.57
McCown's Longspur*	192	46.13	13.26	35.56	59.84	576.07
Vesper Sparrow*	78	8.91	17.69	6.31	12.57	111.22
Red-winged Blackbird	35	4.70	40.89	2.17	10.20	58.72
Grasshopper Sparrow*	22	4.38	21.74	2.87	6.68	54.65
Lark Bunting*	28	4.12	23.55	2.61	6.52	51.51
Brewer's Blackbird	14	3.45	32.8	1.84	6.47	43.09
Burrowing Owl*	45	2.24	21.12	1.48	3.38	27.96
American Kestrel	24	1.16	28.16	0.68	2.00	14.52
Baird's Sparrow*	9	0.90	44.81	0.39	2.09	11.23
Savannah Sparrow	4	0.56	61.29	0.18	1.70	6.96
Ferruginous Hawk*	5	0.52	58.76	0.18	1.52	6.48
Loggerhead Shrike*	3	0.24	59	0.08	0.70	2.99
Swainson's Hawk*	7	0.13	38.59	0.06	0.27	1.59
Mountain Plover*	2	0.11	71.21	0.03	0.39	1.40

* = Species of concern

Two prairie dog obligate species continue to show declines in the Mountains to Plains area; McCown's Longspur densities have declined drastically since 2006 (Fig. 5) from an estimated density of 250 birds/km^2 to less than 50 birds/ km^2 on PDCH in 2017 and Mountain Plover densities have not shown any significant increase since the year after the prescribed burn on Jack Springs pasture in 2012 (Fig. 6). However, Burrowing Owl densities have remained fairly stable to increasing, with the highest density to date at 2.24 birds/ km^2 in 2017 (Fig. 7), and their population trend does not follow the same pattern as the other two species.

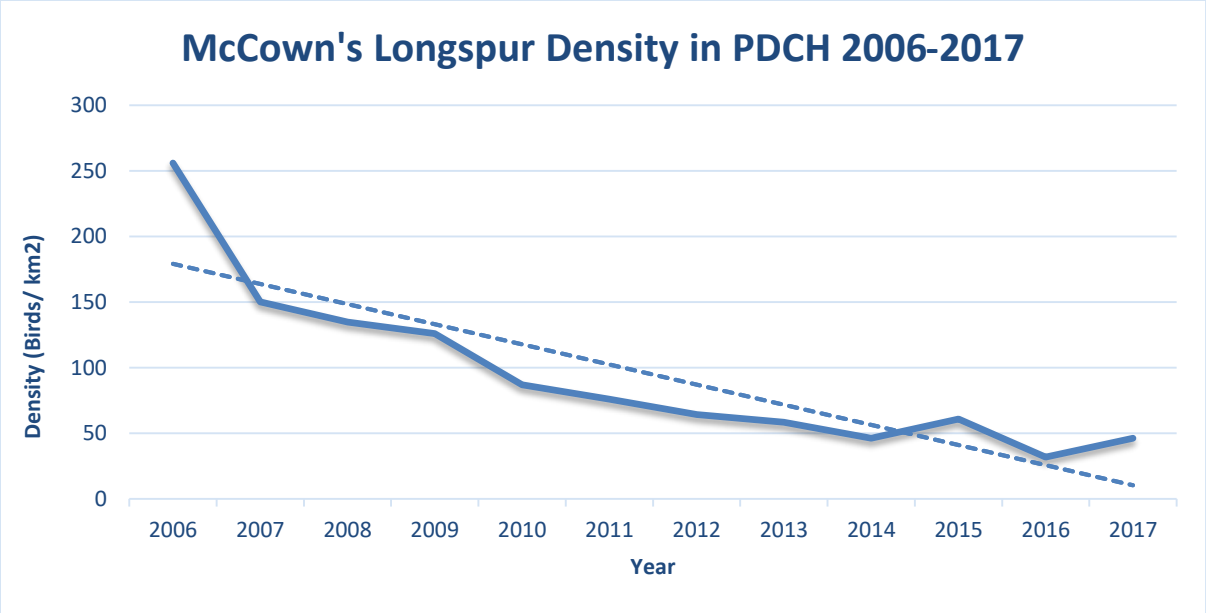

Figure 5: McCown's Longspur density trend in MTP area from 2006-2017

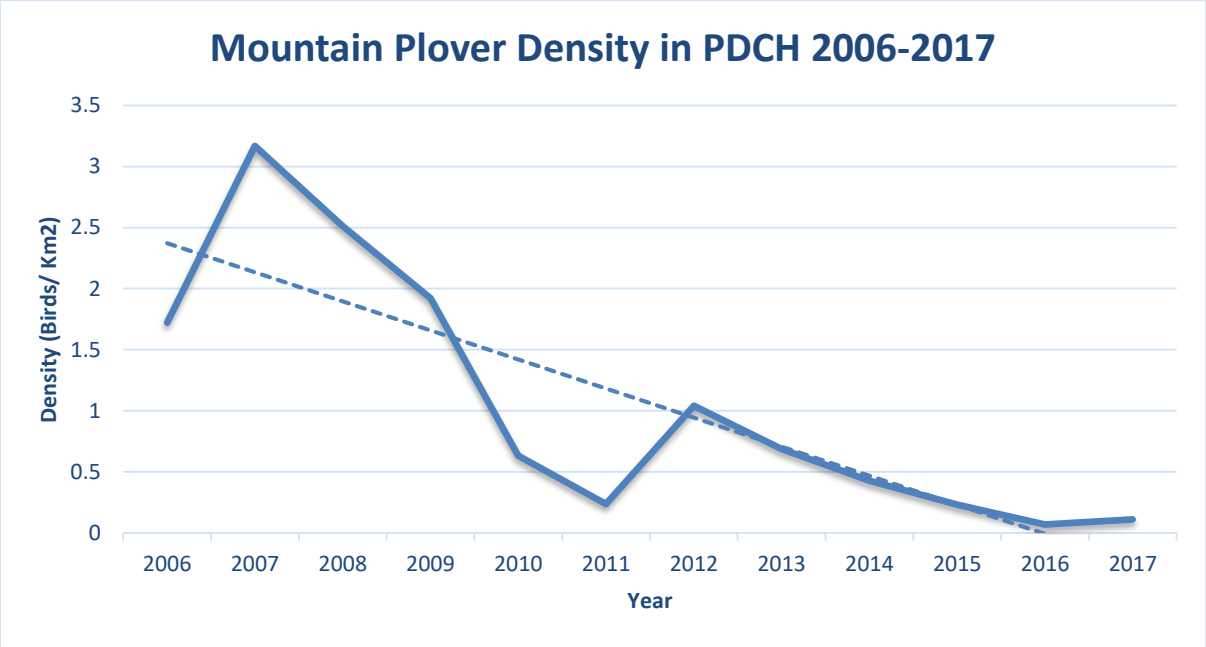

Figure 6: Mountain Plover density trend in MTP area from 2006-2017

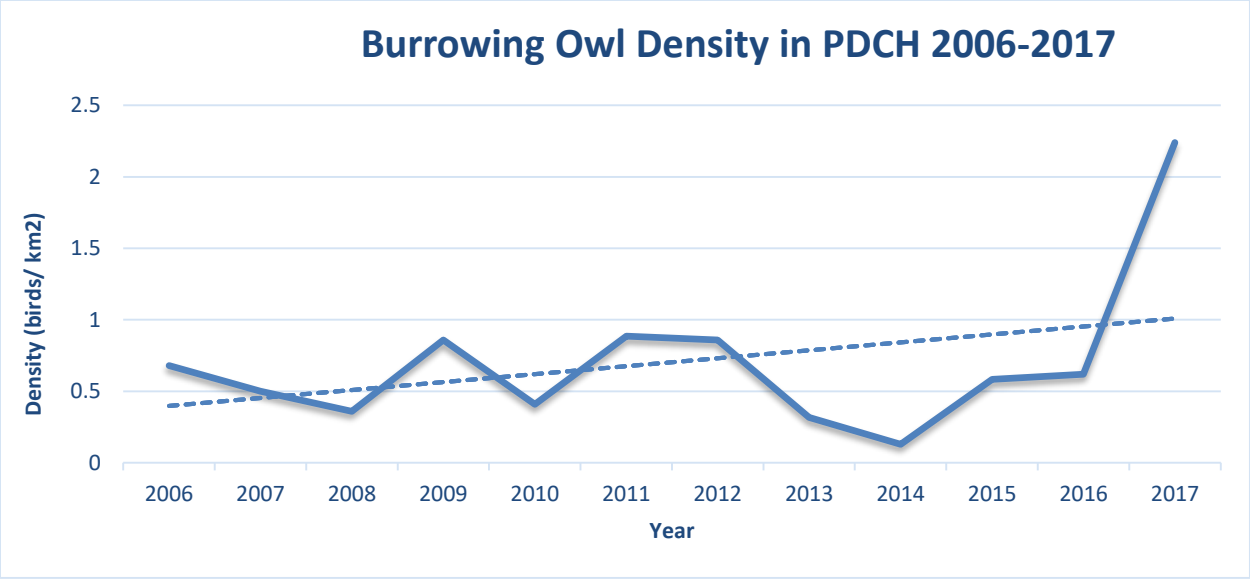

Figure 7: Burrowing owl density trend in MTP area from 2006-2017

The point count detections of Baird's Sparrows occurred mainly on points that were located at the edges of active PDCH, or in areas recently effected by plague in denser, taller grasses. We detected several other singing individuals on the properties outside of official point counts both in Soapstone and Meadow Springs Ranch (Figs 8 & 9) starting mid-May and continuing through the breeding season. Many opportunistic attempts were made to confirm nesting of this species by behavioral observations, playback, and even rope-dragging, but the species' nests are notoriously difficult to find. No nesting was confirmed, but it is worth noting that the birds are returning to the same locations, and singing through the breeding season for the 3rd year in a row. This suggests the species may be establishing territories for the purpose of breeding here, an exciting occurrence for the MTP area, and the State of Colorado.

Figure 8: Baird's sparrow in Soapstone Prairie Natural Area, 2017 (photo by W. Wehtje)

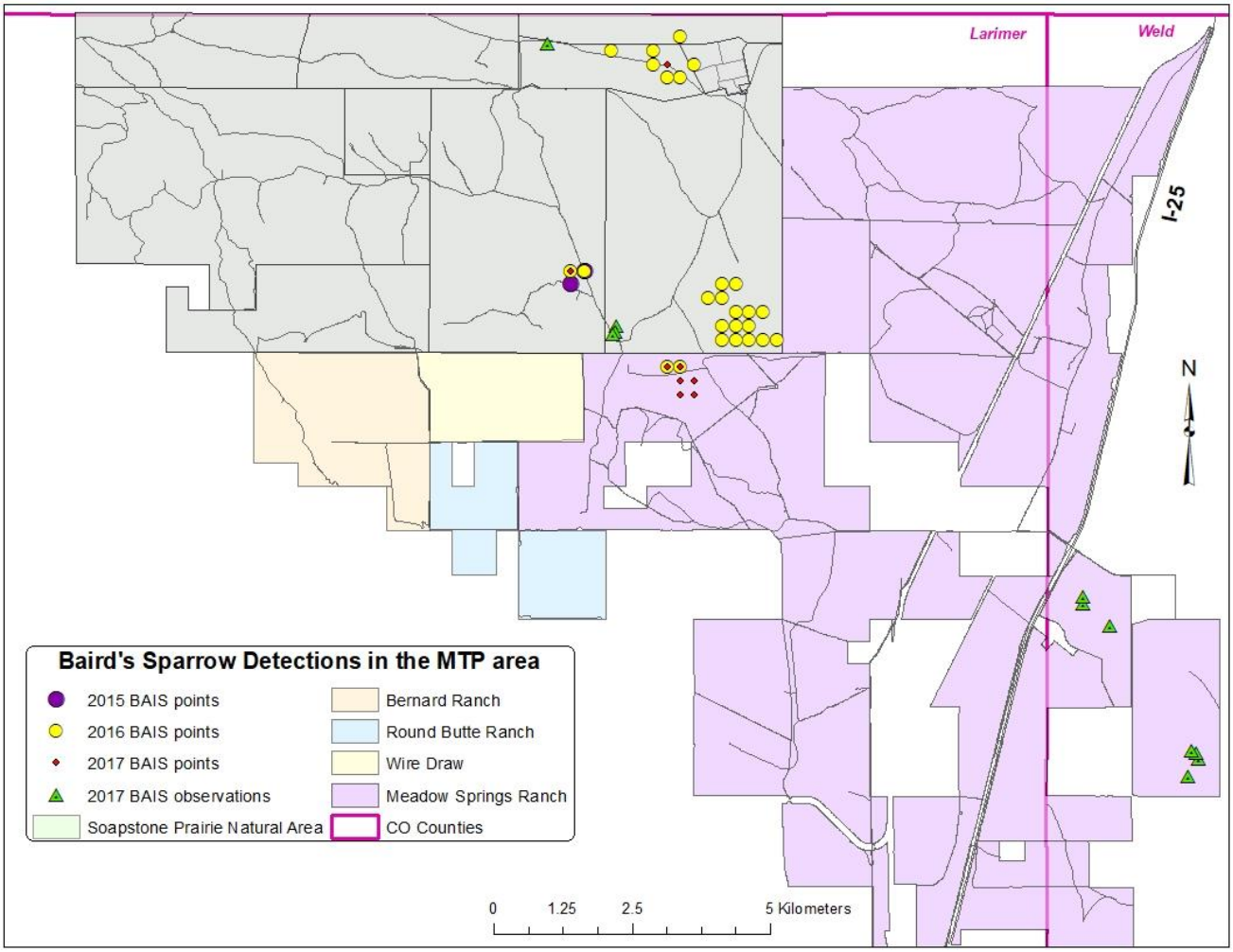

Figure 9: Baird's Sparrow locations in the survey area, both at point count stations and incidental observations (2015 - 2017)

Habitat Surveys

Grass was the dominant ground cover type (70%) in the 2017 PDCH, followed by bare ground (12%) (Fig 10). The surveys in 2017 show a higher percentage of bare ground than 2016; 12% vs 8% (Fig 11), but significantly less than 2013 (5 yrs ago); 12% vs 21% (Fig 12). Grass cover remains close to the same percent cover as 2013, with a noticeable increase in percent forb cover in the last 5 years; 2% in 2013, 7% in 2016 and 8% in 2017. All sites show low percentages of cactus, rock, scat and low woody cover (shrubs <30cm) across years.

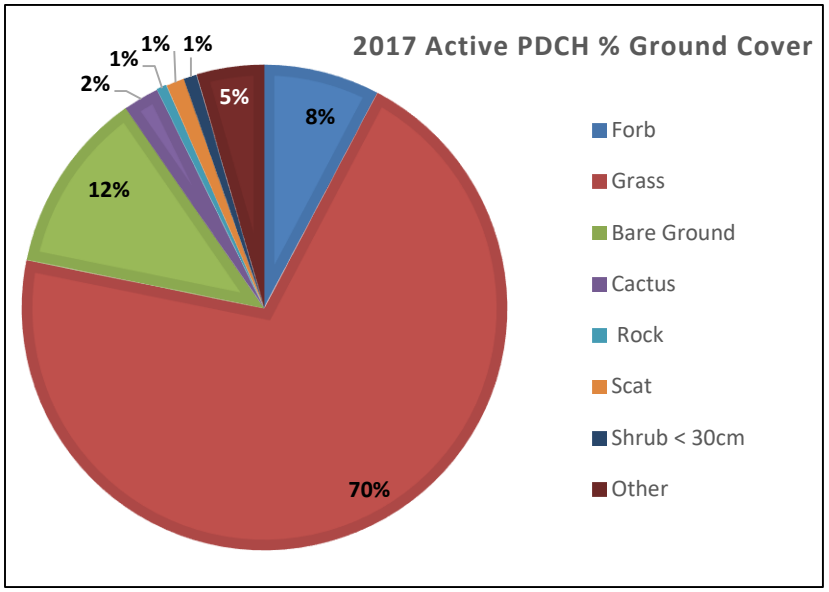

Figure 10: Percent Ground Cover at point count stations in 2017

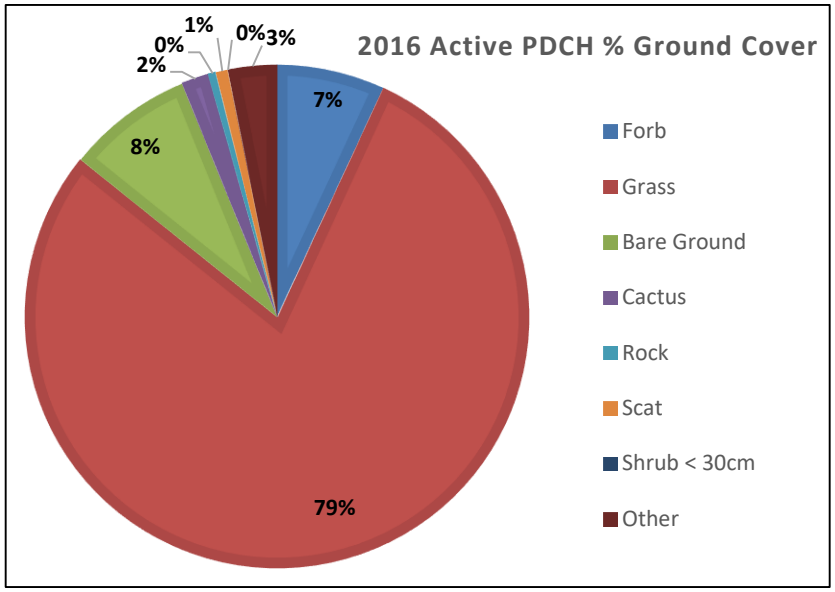

Figure 11: Percent Ground Cover at point count stations in 2016

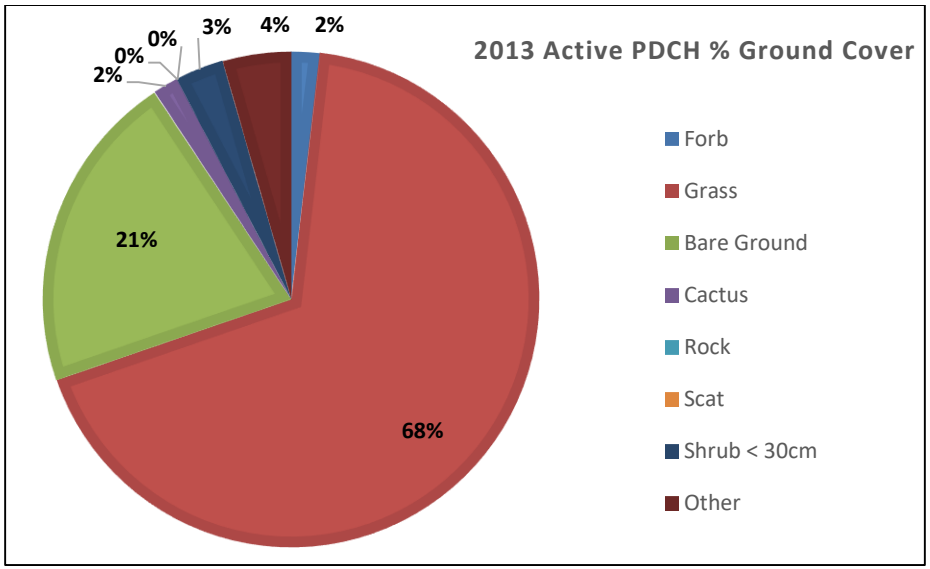

Figure 12: Percent Ground Cover at point count stations in 2013

Discussion and Management Recommendations

With the survey effort in 2017, there is now 11 consecutive years of bird monitoring data for the MTP region where Bird Conservancy has monitored grassland birds annually since 2006. The cyclical reoccurrence of the sylvatic plague in the area (which was first documented in 2008) continues to affect the black-tailed prairie dog population, and consequently the short and sparse vegetative structure that several shortgrass prairie birds depend on. The decreased grazing activities of the prairie dogs has encouraged taller grasses and forbs to grown into the areas that were once sparsely vegetated and used by Mountain Plover and McCown's Longspur as nesting habitat.

Our data indicate that Mountain Plover densities have declined since 2006 from 1.72 birds/km^2 to .11 birds/km^2, with only 2 individual detections in 2017 (5 total, but only 2 qualified for the analyses). Since the 2008 plague event, the prairie dog colony around the USFWS ferret center has consistently hosted the largest and most stable population of plovers within the MTP area. It is hoped that the plague vaccine implemented by CPW and continued insecticidal dusting for fleas in the colonies will help to reduce the prevalence of plague and further aid in the recovery of the prairie dog populations. Regeneration of the prairie dog colony habitat will aid in the restoration of Mountain Plover and McCown's Longspur populations. However, given that the plovers do not appear to be recolonizing other recently expanding prairie dog colonies in the MTP region, additional management actions such as increased grazing pressure and especially controlled burns may be needed in targeted areas to prevent the immediate loss of Mountain Plovers from the MTP area. These actions will likely have a positive effect for McCown's

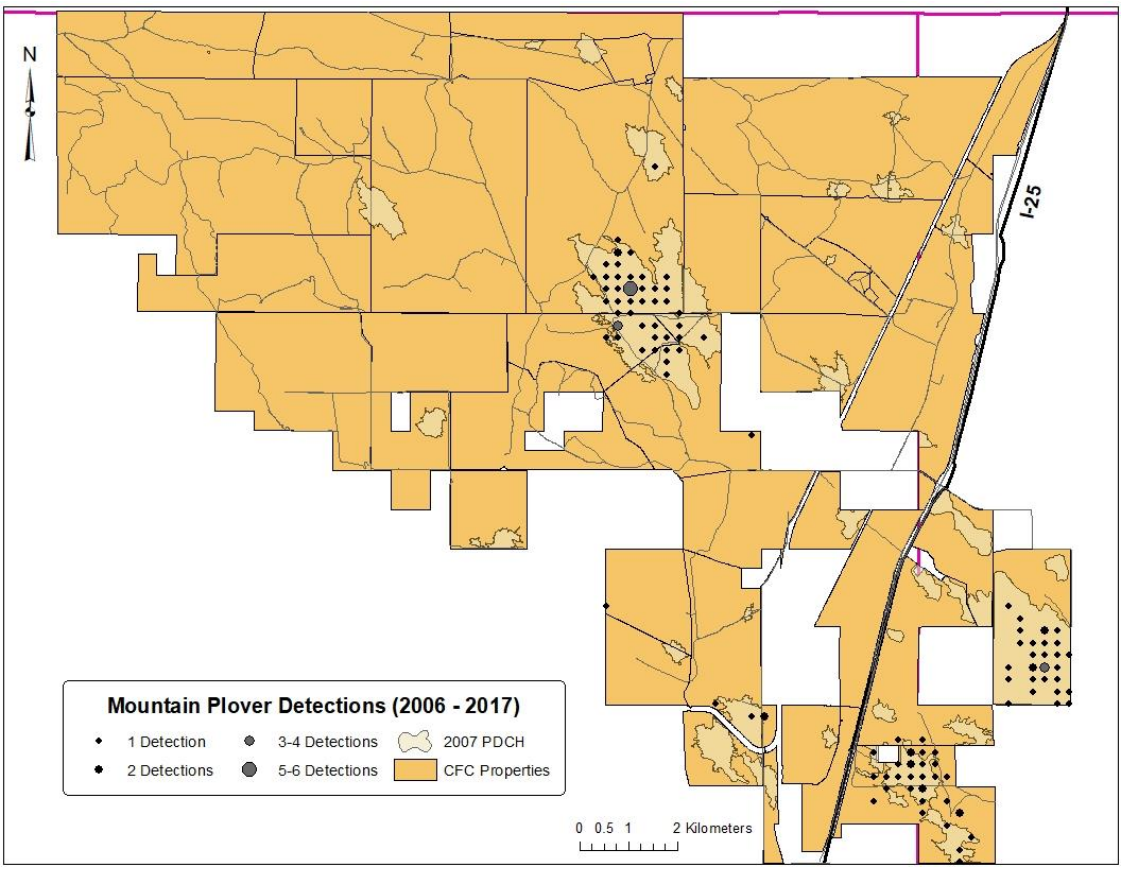

Figure 13: All Mountain Plover detection locations from 2006-2017 on MTP properties

Longspur as well, which also prefers the very short vegetation structure of heavily grazed grasslands. Continued monitoring of bird populations will help measure the response of these and other bird species to those actions.

Looking at all of the plover detection locations from 2006 - 2017, it appears that the species prefers to occupy the larger-sized prairie dog colonies (Fig. 13) and with most detections occurring towards the middle of the colony, where vegetation tends to be the shortest/ most heavily grazed.

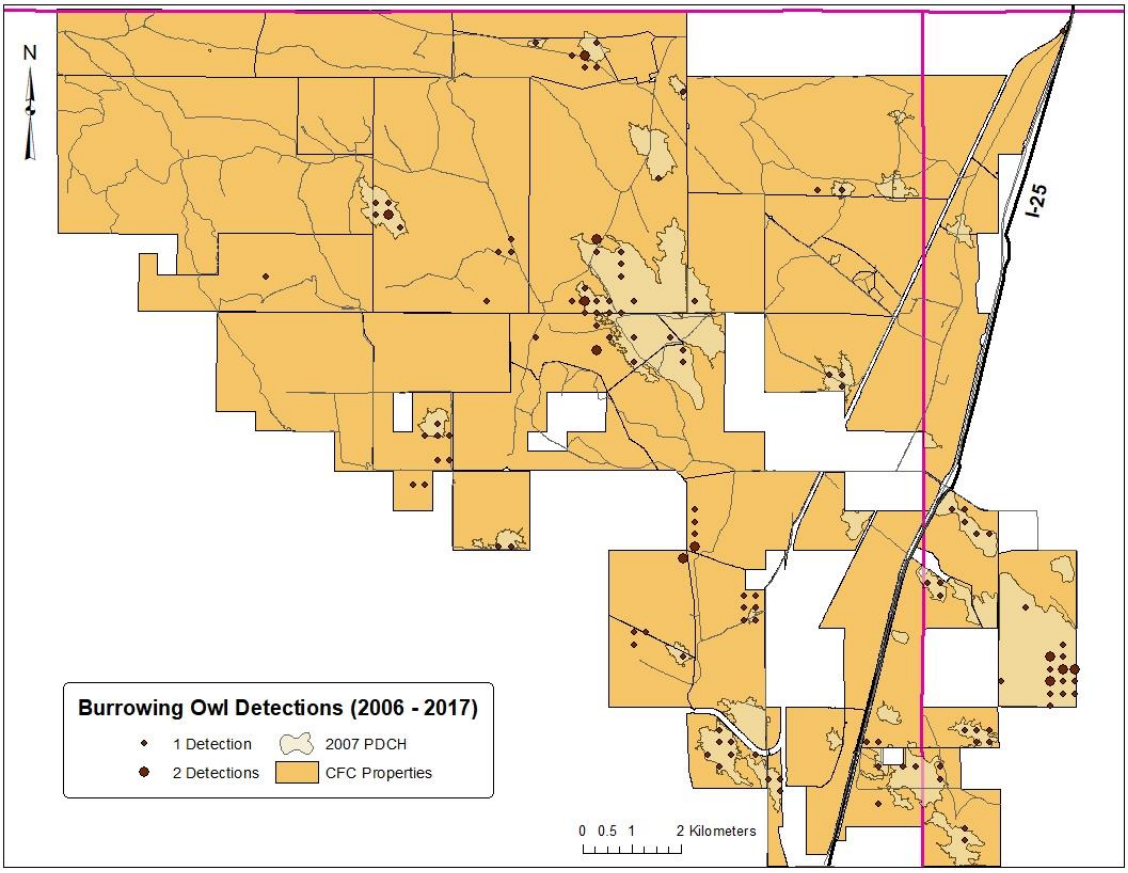

Figure 14: All Burrowing Owl detection locations from 2006-2017 on the MTP properties

Interestingly, Burrowing Owl density has remained fairly constant over the last eleven years, and the species appears to be adaptable to changes in prairie dog abundance, colony size and habitat management. Figure 14 shows all of the Burrowing Owl detections from 2006-2017, and there are detections in almost every colony of varying sizes. Most of these detections appear to occur near the borders, or edges of the colonies, suggesting the owls somewhat prefer an “edge effect”, and may be more tolerant of smaller patches of habitat. Management effort should strive to maintain both large and small colony sizes to benefit a suite of prairie dog colony obligate species.

The continued detections and observations of Baird’s sparrows on the properties is fascinating and exciting to the regional ornithological community! Baird's sparrows typically breed in the northern Great Plains, from northern Wyoming and South Dakota north to Alberta, Saskatchewan and Manitoba. They are a species of high conservation concern that has experienced significant habitat loss and alteration on both its breeding and wintering grounds, resulting in an estimated 72% loss in global population since 1970 (Rosenberg et al. 2016). First reported in 2015 by the

Colorado Parks and Wildlife bird monitoring crew, Baird's Sparrow detections increased significantly in 2016 (see map in Fig 9). There were four Baird's Sparrow detections on 2 points in the Brannigan pasture in 2015 (purple dots), and 39 detections on 25 points in the east half of Soapstone in 2016 (yellow dots) – two of which were in the same location as the 2015 detections. In 2017 there were 10 detections on 8 points, again with birds detected in the same locations as previous years, with some new observations in the wet meadow on Meadow Springs ranch just south of the Jack Springs pasture. Our 2017 survey effort focused exclusively on prairie dog towns, however, this is not the expected habitat for the species. Point count detections were at the edges of dog towns, often near wet areas where the mix of taller and shorter grasses likely provided the needed habitat structure, including nesting cover. A large number of other individual birds were heard singing and/or seen during the breeding season outside of PDCH, during targeted efforts to find Baird's Sparrows after daily point count surveys, and those individual locations were marked with a GPS (green triangles in Fig 9). Baird's Sparrows prefer taller grass than most shortgrass prairie species and have never before been documented breeding in Colorado; in fact, the species is rarely encountered in the state, even during migration. However, the >30 observations in 2016, including several apparent male-female pairs (the species is not dimorphic), suggests it likely did nest here in 2016, and possibly in 2015. Several attempts were made to confirm breeding in 2017, however the species' nests are notoriously hard to find.

A concerted effort consisting of an expanded survey on City-managed lands targeting wet meadows and similar habitats should be made in 2018 to confirm breeding and locate additional Baird's Sparrow territories. Such an effort would provide more information on Baird's Sparrow occurrence, distribution, habitat use, and breeding status within the MTP area. Establishment and documentation of a breeding population in Colorado would be a significant contribution to the current state of knowledge and conservation of this species.

Annual meetings with the FCNAP, ranch managers and BCR to share data & results and determine management, grazing and conservation goals using birds as indicators would help inform and direct future actions and survey efforts.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Augustine D.J. and Derner J.D. 2012. Disturbance regimes and Mountain Plover habitat in shortgrass steppe: large herbivore grazing does not substitute for prairie dog grazing or fire. Journal of Wildlife Management 76(4):721-728.

Buckland S.T., Anderson D.R., Burnham K.P., Laake J.L., Borchers D.L. and Thomas L. 2001. Advanced Distance Sampling. Oxford University Press, New York. 416 pp.

Colorado Division of Wildlife. 2006. Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plans.

Farnsworth G.L., Pollock K.H., Nichols J.D., Simons T.R., Hines J.E. and Sauer J.R. 2002. A removal model for estimating detection probabilities from point count surveys. The Auk, 119: 414-425

Hanni, D. J., C. M. White, N. J. Van Lanen, J. J. Birek, J. M. Berven, and M. F. McLaren. 2016. Integrated Monitoring in Bird Conservation Regions (IMBCR): Field protocol for spatially-balanced sampling of landbird populations. Unpublished report. Bird Conservancy of the Rockies, Brighton, Colorado, USA.

Rondeau R., Decker K., Handwerk J., Siemers J., Grunau L. and Pague C. 2011. The state of Colorado's biodiversity. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado.

Rosenberg K. V., Kennedy J. A., Dettmers R., Ford R. P., Reynolds D., Alexander J.D. ,Beardmore C. J., Blancher P. J., Bogart R. E., Butcher G. S., Camfield A. F., Couturier A., Demarest D. W., Easton W. E., Giocomo J.J., Keller R.H., Mini A. E., Panjabi A. O., Pashley D. N., Rich T. D., Ruth J. M., Stabins H., Stanton J. and Will T. 2016. *Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States.* Partners in Flight Science Committee.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr. and W. A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966 - 2011. Version 07.03.2013 USGS Patuxent Wildlife Research Center, Laurel, Maryland.

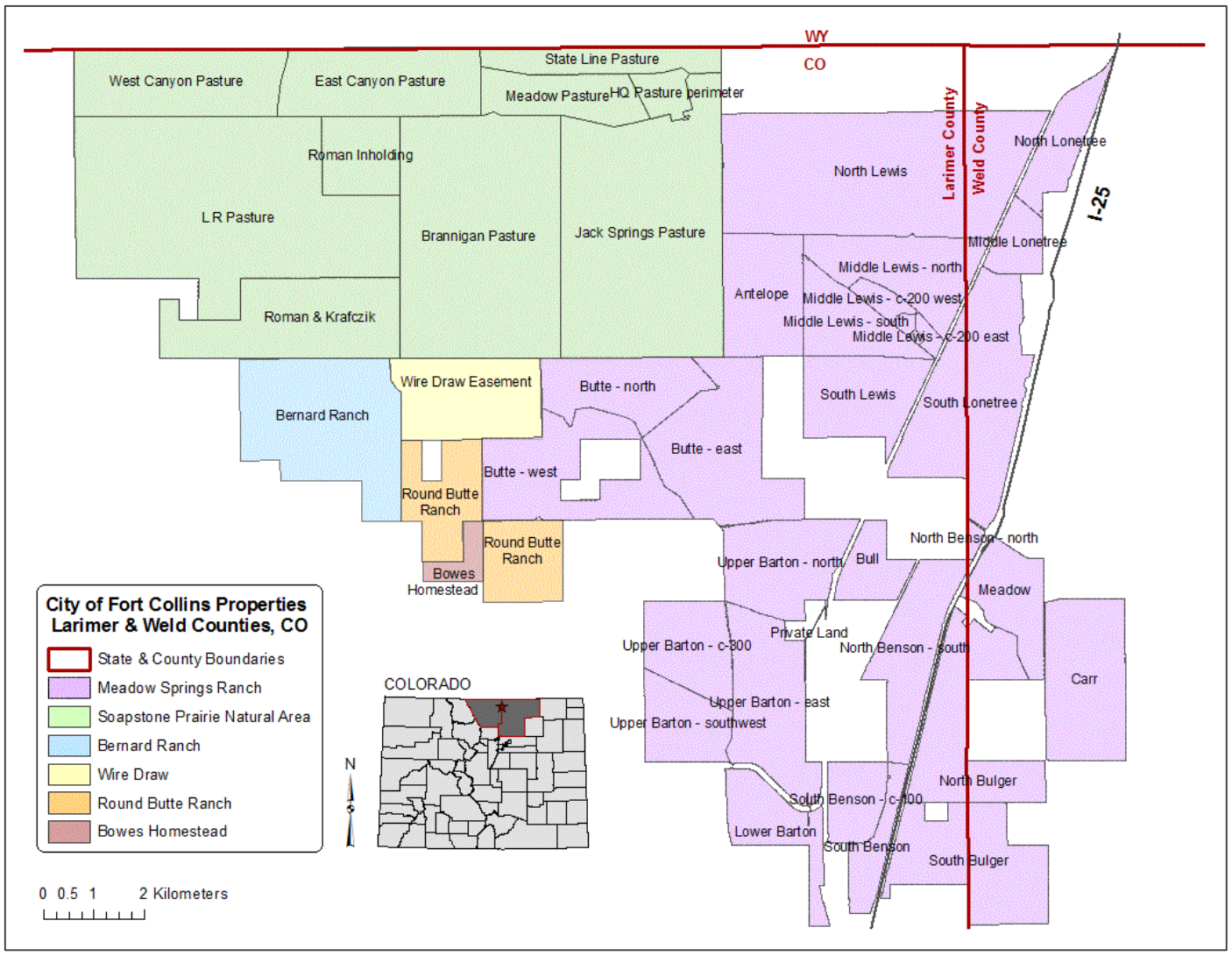
Thomas L., Buckland S.T., Rexstad E.A., Laake J.L., Strindberg S., Hedley S.L., Bishop J.R.B., Marques T.A. and Burnham K.P. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology. 47: 5-14. DOI: 10.1111/j.1365-2664.2009.01737.x

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.

Youngberg E.N. and Panjabi A.O. 2011ʳ Density and Distribution of Breeding Birds on Meadow Springs Ranch, and Soapstone Prairie Natural Area in northern Colorado: Final Report. BCR technical report I-NEOTROP-MTP-10-01. Bird Conservancy of the Rockies, Brighton, CO, 34pp.

Appendix (A): Map of Fort Collins Properties

Map of Mountains to Plains properties owned and managed by the City of Fort Collins Natural Areas Program and Utilities: Soapstone Prairie Natural Area, Meadow Springs Ranch, Round Butte Ranch, Bernard Ranch, Wire Draw Easement, and the Bowes Homestead with pasture names.



Appendix (B): Species Detections in the Mountains to Plains Area

Number of individuals (non-truncated detections) of all species during point counts in The Mountains to Plains Area on Fort Collins' Properties from 2006 – 2017.

Common Name	*Scientific Name*	2006	2007	2008	2009	2010	2011	2012	2013	2014[t]	2015[t]	2016	2017	Total
		(800 pts) 800 effort	(737 pts) 737 effort	(730 pts) 779 effort	(1169 pts) 1169 effort	(408 pts) 408 effort	(531 pts) 1373 effort	(302 pts) 604 effort	(507 pts) 1014 effort	(412 pts)	(522 pts)	(224 pts) 448 effort	(275 pts) 550 effort	
Canada Goose	*Branta canadensis*		12	33	13	11	13			20	14	29	27	**172**
Gadwall	*Mareca strepera*						2							**2**
American Wigeon	*Mareca americana*										5			**5**
Mallard	*Anas platyrhynchos*	6	2	2	18	3	38		5	2	7	7	9	**99**
Blue-winged Teal	*Spatula discors*						2				6			**8**
Green-winged Teal	*Anas crecca*						1							**1**
Cinnamon Teal	*Spatula cyanoptera*											2		**2**
Northern Shoveler	*Spatula clypeata*				2									**2**
Chukar	*Alectoris chukar*		2											**2**
American White Pelican	*Pelecanus erythrorhynchos*				18	9	6							**33**
Double-crested Cormorant	*Phalacrocorax auritus*				20	6	9					4		**39**
Great Blue Heron	*Ardea herodias*	1			26	4	10				4		1	**46**
Cattle Egret	*Bubulcus ibis*	1												**1**
Turkey Vulture	*Cathartes aura*	9	10		5		3		2	1	2	1	2	**35**
Bald Eagle	*Haliaeetus leucocephalus*								1					**1**
Northern Harrier *	*Circus hudsonius*	2	1	2	11	8	6	4	5	4	1	4	1	**49**
Sharp-shinned Hawk	*Accipiter striatus*		1				2							**3**
Cooper's Hawk	*Accipiter cooperii*		2			2								**4**
Swainson's Hawk *	*Buteo swainsoni*	11	6	5	60	9	22	4	7	8	5	18	11	**166**
Red-tailed Hawk	*Buteo jamaicensis*		4	4	31		10	2	3					**54**
Ferruginous Hawk *	*Buteo regalis*	11	2	2	18	1	32	2	6	1		6	7	**88**
Golden Eagle *	*Aquila chrysaetos*	6	4	4	7	3	5	2	3	1			2	**37**
American Kestrel	*Falco sparverius*	10	6	7	27	15	68	13	10	4	3	19	29	**211**
Merlin	*Falco columbarius*				1		1							**2**
Peregrine Falcon	*Falco peregrinus*					1								**1**
Prairie Falcon *	*Falco mexicanus*	5	5	5	9	10	9	1	2	5	5	5	1	**62**
Sora	*Porzana carolina*												1	**1**
Sandhill Crane *	*Antigone canadensis*					2			1		1			**4**
American Golden-Plover	*Pluvialis dominica*									1				**1**
Killdeer	*Charadrius vociferus*	90	28	16	123	15	79	10	10	18	24	18	15	**446**
Mountain Plover *	*Charadrius montanus*	6	18	7	42	14	16	30	26	5	6	2	5	**177**

American Avocet	*Recurvirostra americana*				4		7				6			**17**
Greater Yellowlegs	*Tringa melanoleuca*				1									**1**
Willet	*Tringa semipalmata*											1		**1**
Upland Sandpiper	*Bartramia longicauda*		2	1			3							**6**
Whimbrel	*Numenius phaeopus*									2				**2**
Long-billed Curlew *	*Numenius americanus*	3		1	11	14	72	11	2	1		6	8	**129**
Wilson's Snipe	*Gallinago delicata*	55	11	9	13		30	2	5	3	9	10	13	**160**
Wilson's Phalarope	*Phalaropus tricolor*	2	4		7	3	2				4			**22**
Red-necked Phalarope	*Phalaropus lobatus*				7									**7**
Rock Pigeon	*Columba livia*	11	2	3	7	3	43		6				11	**86**
Eurasian Collared-Dove	*Streptopelia decaocto*		1	2			1							**4**
Mourning Dove	*Zenaida macroura*	238	155	104	53	40	137	25	86	26	28	19		**911**
Barn Owl	*Tyto alba*		1											**1**
Great Horned Owl	*Bubo virginianus*	1												
Burrowing Owl *	*Athene cunicularia*	6	2	5	21	10	54	30	16	3	19	38	59	**263**
Short-eared Owl	*Asio flammeus*		1											**1**
Common Nighthawk	*Chordeiles minor*	67	14	31	24	7	20	11	20	4	2	1	8	**209**
Common Poorwill	*Phalaenoptilus nuttallii*	1	1						1					**3**
Broad-tailed Hummingbird	*Selasphorus platycercus*	1	3	1	2	1					2			**10**
Red-headed Woodpecker	*Melanerpes erythrocephalus*						1							**1**
Northern Flicker	*Colaptes auratus*			1			11		1		2			**15**
Western Wood-Pewee	*Contopus sordidulus*	3	3	3	3				2					**14**
Dusky Flycatcher	*Empidonax oberholseri*		2											**2**
Cordilleran Flycatcher	*Empidonax occidentalis*		1											**1**
Say's Phoebe	*Sayornis saya*	56	14	15	26	8	31	10	14	1	2	1	5	**183**
Cassin's Kingbird	*Tyrannus vociferans*												1	**1**
Western Kingbird	*Tyrannus verticalis*	11	5	16	69	4	35	8	25	18	22		17	**230**
Eastern Kingbird	*Tyrannus tyrannus*	10	5	11	13	1	13				7		1	**61**
Loggerhead Shrike *	*Lanius ludovicianus*	3	21	11	10	5	27	25	48	6	1	12	6	**175**
Warbling Vireo	*Vireo gilvus*		2		1									**3**
Woodhouse's (Western) Scrub-Jay	*Aphelocoma woodhouseii*	6	6						2					**14**
Black-billed Magpie	*Pica hudsonia*	12	6					1	6				1	**26**
American Crow	*Corvus brachyrhynchos*		2		2							3		**7**
Common Raven	*Corvus corax*	7	8	1	10	9	32	5	15	31	34	7	26	**185**
Horned Lark	*Eremophila alpestris*	3661	1006	1375	4378	1617	3559	1694	2464	1356	1737	1845	1229	**25921**
Tree Swallow	*Tachycineta bicolor*	2	7		10		3		2	6		1		**31**
Violet-green Swallow	*Tachycineta thalassina*	12	12	1	4						1			**30**

Northern Rough-winged Swallow	*Steligdopteryx serripennis*	22	15	13	3	6	1	4	12	1	24	15	1	**117**
Bank Swallow	*Riparia riparia*	3	5		1		4	1		1			1	**16**
Cliff Swallow	*Petrochelidon pyrrhonota*	22	24	82	166	96	175	12	13	1	1	2	11	**605**
Barn Swallow	*Hirundo rustica*	46	62	13	35	12	160	1	15	47	28	35	1	**455**
Black-capped Chickadee	*Poecile atricapillus*						1							**1**
Mountain Chickadee	*Poecile gambeli*										1			**1**
Red-breasted Nuthatch	*Sitta canadensis*		1											**1**
Rock Wren	*Salpinctes obsoletus*	103	37	63	13	18	11	13	44	2	1	2	8	**315**
House Wren	*Troglodytes aedon*	1	2				1							**4**
Ruby-crowned Kinglet	*Regulus calendula*										1			**1**
Blue-gray Gnatcatcher	*Polioptila caerulea*	10	47	1			1		5			1	1	**66**
Mountain Bluebird	*Sialia currucoides*	1	1						2					**4**
Western Bluebird	*Sialia mexicana*				1				1					**2**
Hermit Thrush	*Catharus guttatus*		1											
Swainson's Thrush	*Catharus ustulatus*						2							**2**
American Robin	*Turdus migratorius*	23	27	9	7	3	40		1			2		**112**
Gray Catbird	*Dumetella carolinensis*	6												**6**
Northern Mockingbird	*Mimus polyglottos*	16	7	1	1		7	3	27		1		4	**67**
Sage Thrasher	*Oreoscoptes montanus*	8		1			1	22	15		4			**51**
Brown Thrasher	*Toxostoma rufum*	22	16						13			1	3	**55**
Curve-billed Thrasher	*Toxostoma curvirostre*	1												**1**
European Starling	*Sturnus vulgaris*	4	4	39	198	11	116	1	2	65	64	9	8	**521**
Virginia's Warbler	*Oreothlypis virginiae*		9											**9**
Yellow Warbler	*Setophaga petechia*	2	14	4	2		7							**29**
Yellow-rumped Warbler	*Setophaga coronata*		1				2			17				**20**
Common Yellowthroat	*Geothlypis trichas*	1												**1**
Wilson's Warbler	*Cardellina pusilla*	1												**1**
Yellow-breasted Chat	*Icteria virens*	1	1				1							**3**
Western Tanager	*Piranga ludoviciana*						2							**2**
Green-tailed Towhee	*Pipilo chlorurus*	150	177			7		1	31					**366**
Spotted Towhee	*Pipilo maculatus*	524	288	2		4			183	5	2	8	18	**1034**
Cassin's Sparrow *	*Peucaea cassinii*			26	13	19	63		54					**175**
Chipping Sparrow	*Spizella passerina*	11	2		10	5	47		3		26	44		**148**
Clay-colored Sparrow	*Spizella pallida*	31		1	14	4	23		6					**79**
Brewer's Sparrow *	*Spizella breweri*	74	87	111	244	113	95	193	220	31	48	22	17	**1255**
Vesper Sparrow *	*Pooecetes gramineus*	369	187	103	102	130	122	210	346	42	139	87	142	**1979**
Lark Sparrow	*Chondestes grammacus*	50	54	36	43	14	138	44	69	12	65	18	12	**555**
Bells' (Sage) Sparrow	*Amphispiza belli*									2				**2**

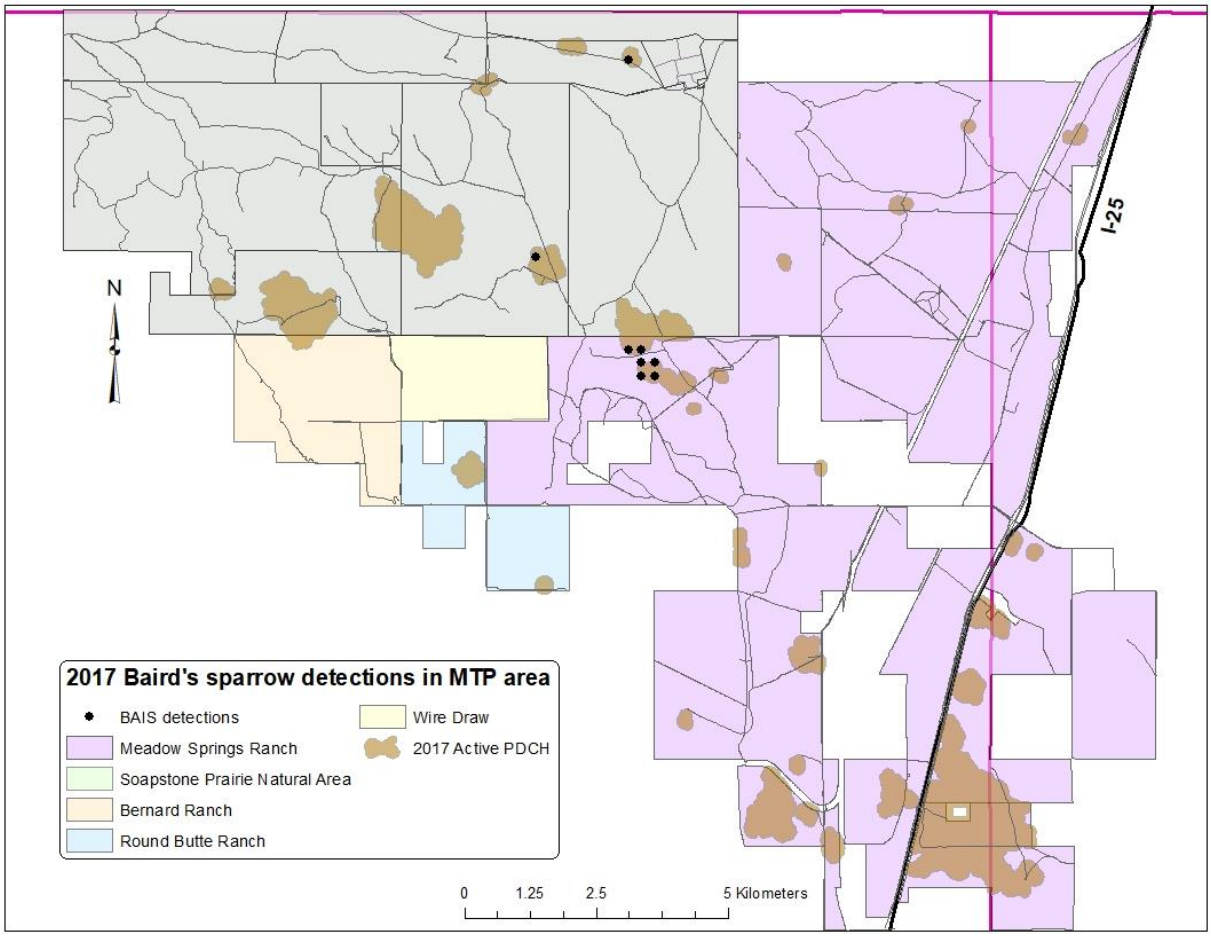
Lark Bunting *	*Calamospiza melanocorys*	451	554	233	3171	119	1212	504	1336	1385	837	122	76	**10000**
Savannah Sparrow	*Passerculus sandwichensis*	93	56	1	34	2	7		1			11	13	**218**
Grasshopper Sparrow *	*Ammodramus savannarum*	1	2	24	150	49	220		11	7	210	102	25	**801**
Baird's Sparrow	*Ammodramus bairdii*										2	39	11	**52**
Song Sparrow	*Melospiza melodia*	1		1			1					1		**4**
Lincoln's Sparrow	*Melospiza lincolnii*											10		**10**
White-crowned Sparrow	*Zonotrichia leucophrys*						2						1	**3**
McCown's Longspur *	*Rhyncophanes mccownii*	1620	725	951	2334	735	1772	480	679	377	564	514	264	**11015**
Chestnut-collared Longspur *	*Calcarius ornatus*	11	1	1	29	78	26	12	10	2	4	1		**175**
Snow Bunting	*Plectrophenax nivalis*										5			**5**
Black-headed Grosbeak	*Pheucticus melanocephalus*	1	29						4					**34**
Blue Grosbeak	*Passerina caerulea*		1	2					11					**14**
Lazuli Bunting	*Passerina amoena*		10				1							**11**
Bobolink *	*Dolichonyx oryzivorus*					2								**2**
Red-winged Blackbird	*Agelaius phoeniceus*	355	84	53	190	29	311	23	65	129	190	65	141	**1635**
Eastern Meadowlark	*Sturnella magna*	1		2		1	2	4	5			2	1	**18**
Western Meadowlark	*Sturnella neglecta*	3156	699	581	1693	757	2824	1074	933	672	1208	1335	1558	**16490**
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*		27	4	1						1			**33**
Brewer's Blackbird	*Euphagus cyanocephalus*	197	223	33	112	30	62	12	162	22	157	75	33	**1118**
Common Grackle	*Quiscalus quiscula*	5	9	1	11		32		18	3	1	6	1	**87**
Great-tailed Grackle	*Quiscalus mexicanus*						48			1				**49**
Brown-headed Cowbird	*Molothrus ater*	224	309	25	40	15	21	2	60	43	16	1	11	**767**
Bullock's Oriole	*Icterus bullockii*	18	35	12	3	2	6	4	15					**95**
House Finch	*Haemorhous mexicanus*		2		4									**6**
Red Crossbill	*Loxia curvirostra*		1											**1**
Pine Siskin	*Spinus pinus*		4											**4**
Lesser Goldfinch	*Spinus psaltria*		11			1	9			4				**25**
American Goldfinch	*Spinus tristis*	50	88	3	1	2	4	3	4			1	1	**157**
House Sparrow	*Passer domesticus*				75		29				1			**105**
Totals	***135 species***	**12012**	**5339**	**4110**	**13808**	**4099**	**12024**	**4513**	**7172**	**4398**	**5560**	**4590**	**3859**	**81484**

* Indicates species of special concern and/or high conservation priority status in Canada and the U.S. as determined by Partners in Flight, the USFWS and Colorado Parks & Wildlife.

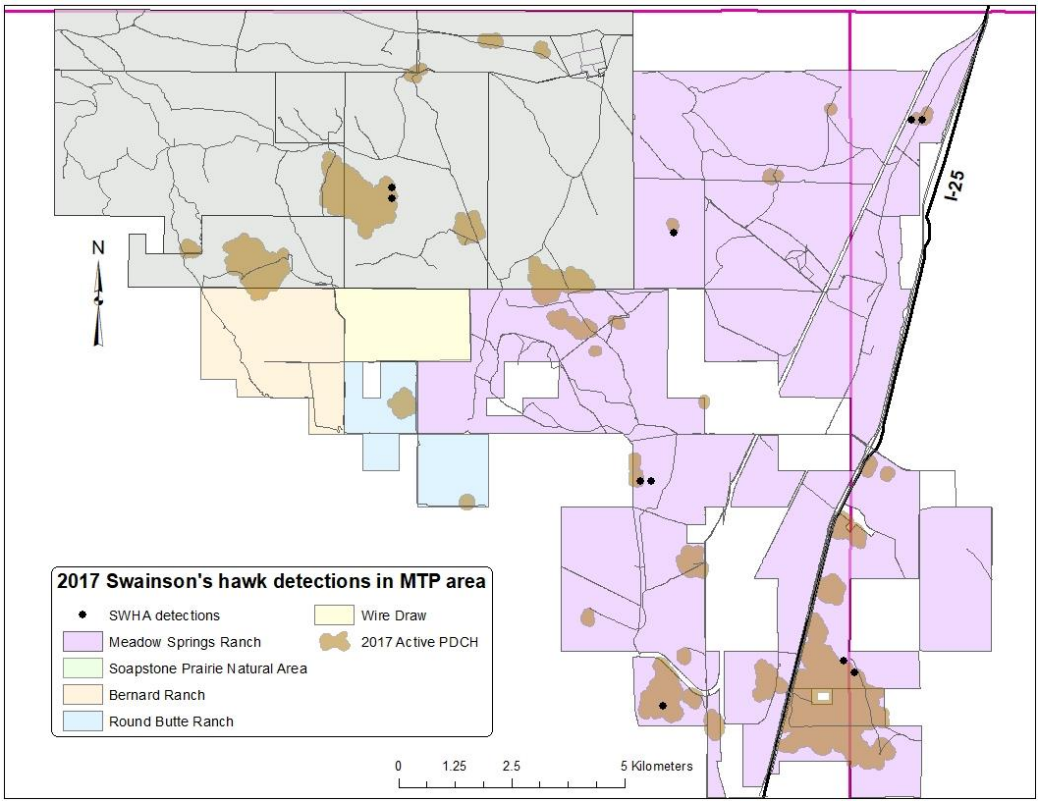
[t] Indicates the years Colorado Parks and Wildlife conducted bird monitoring

Appendix (C): Species Accounts

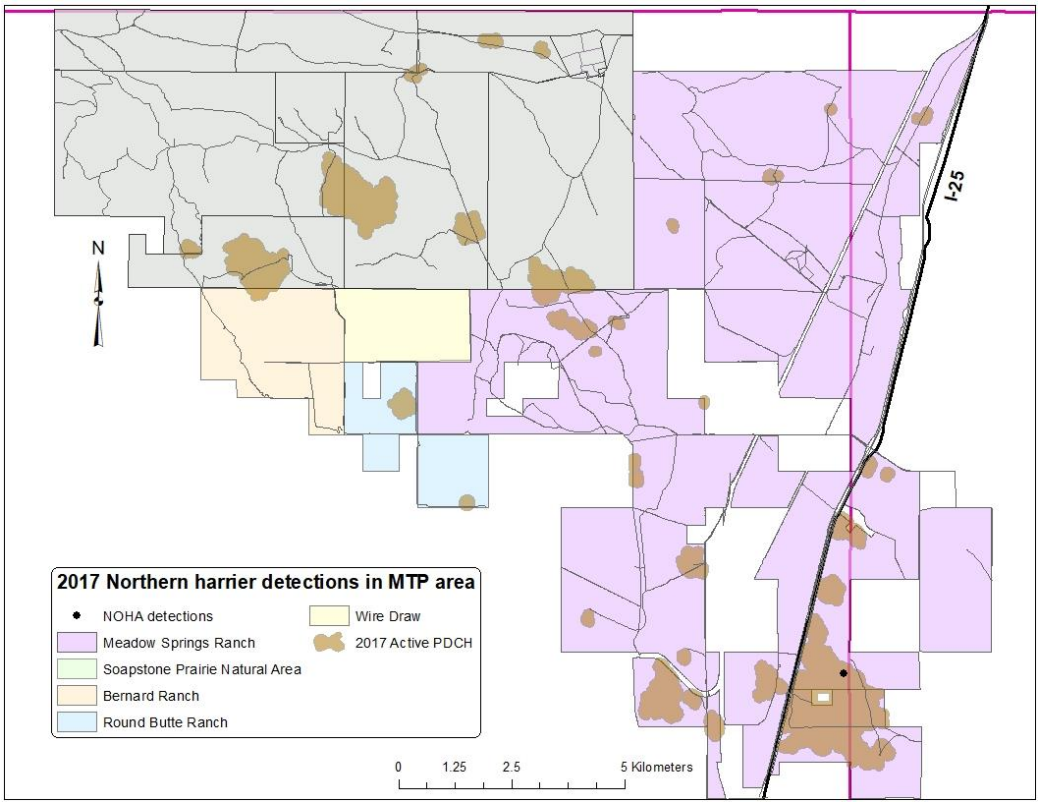
This section presents distribution maps for species of high priority conservation concern in the Mountains to Plains Area. The map for each species indicates location of individual observations recorded during the point count surveys between May 1st – July 7th, 2017.



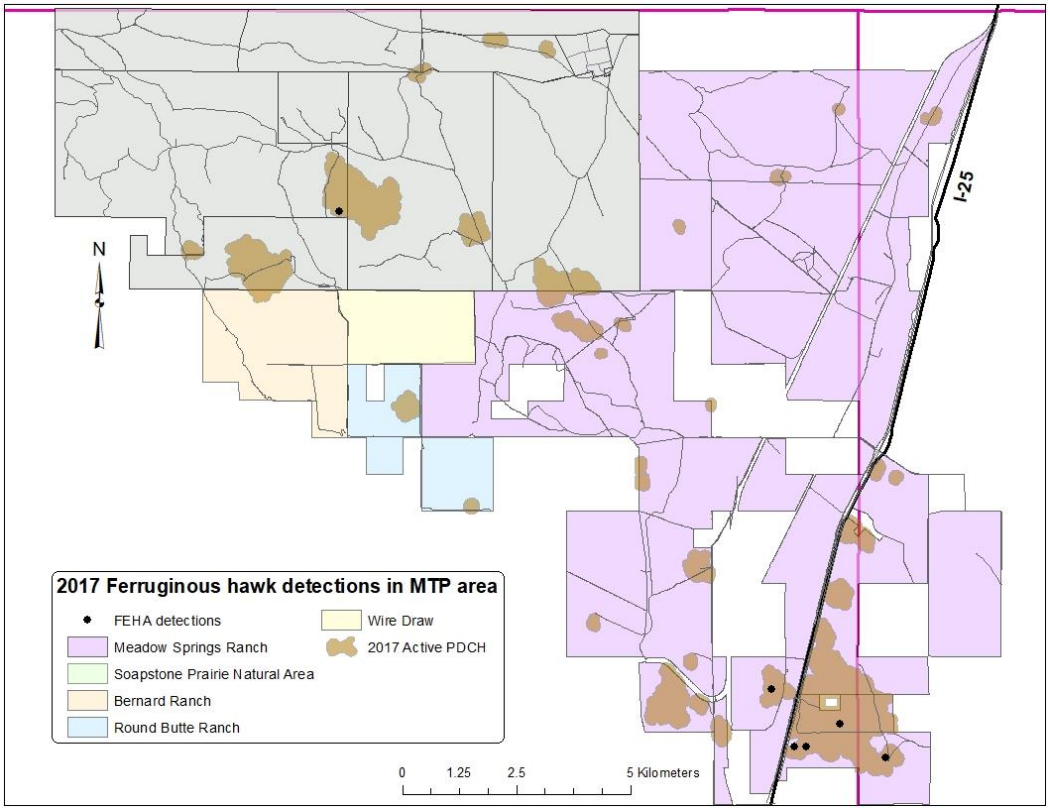
Baird's Sparrow (*Ammodramus bairdii*)



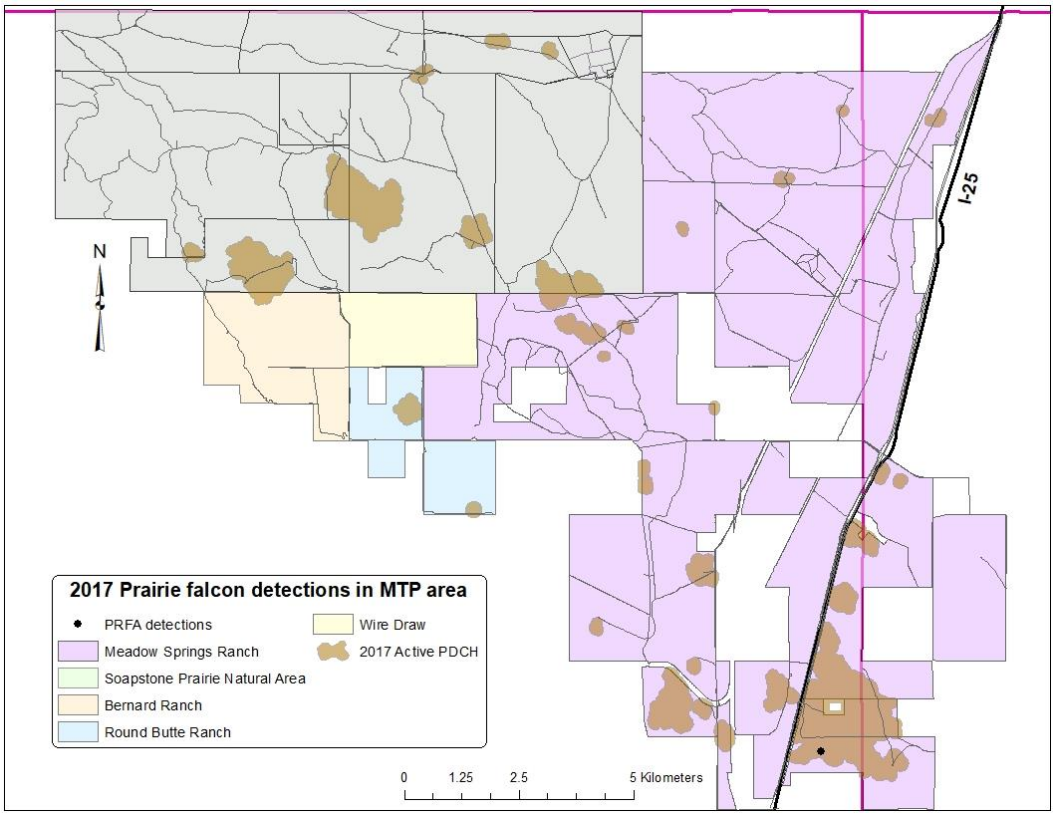
Swainson's Hawk (*Buteo swainsoni)*



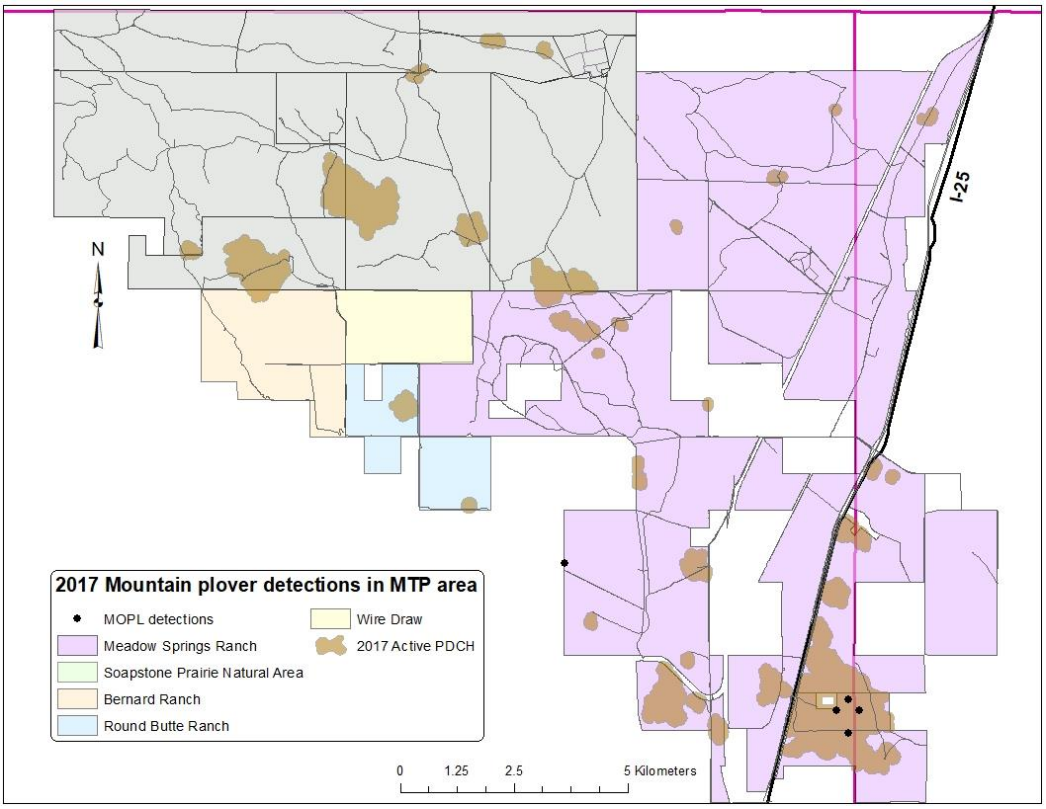
Northern Harrier (*Circus cyaneus)*



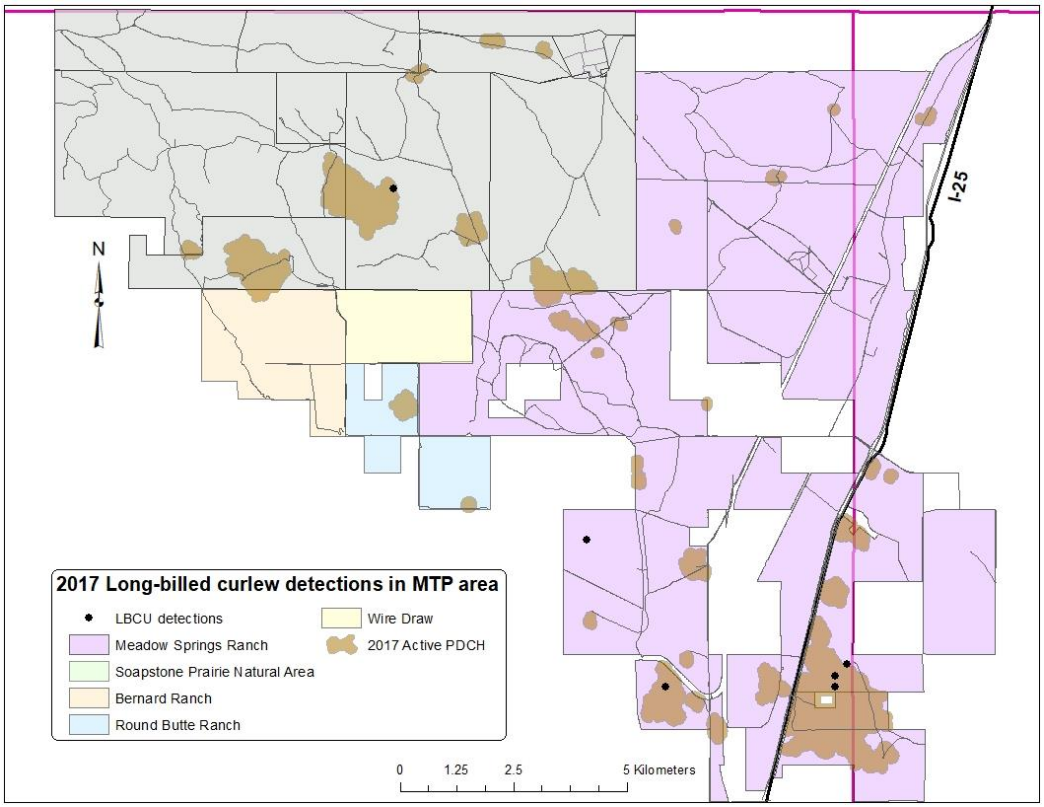
Ferruginous Hawk *(Buteo regalis)*



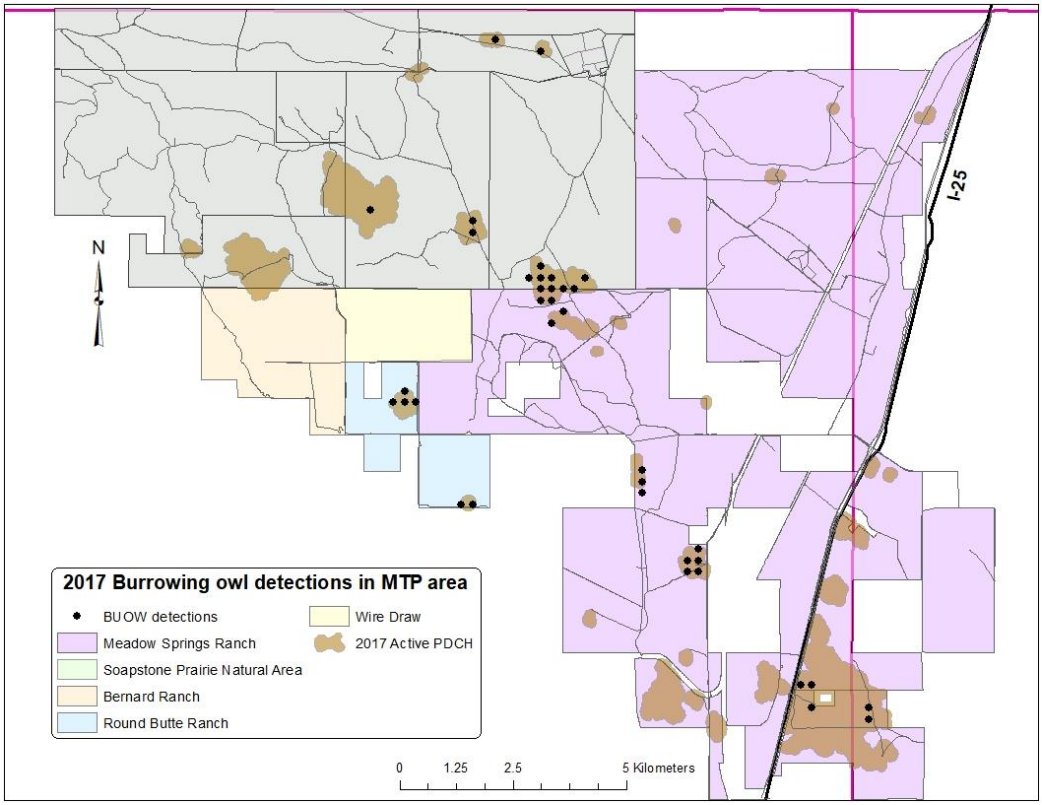
Prairie Falcon *(Falco mexicanus)*



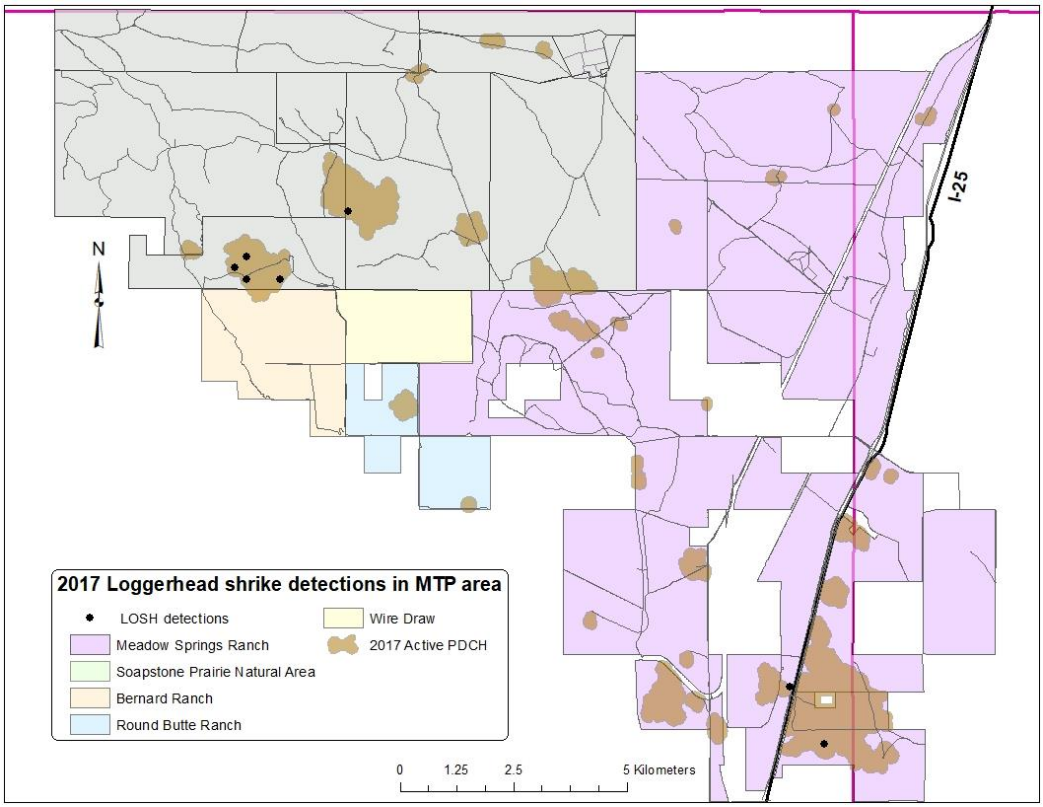
Mountain Plover (*Charadrius montanus)*



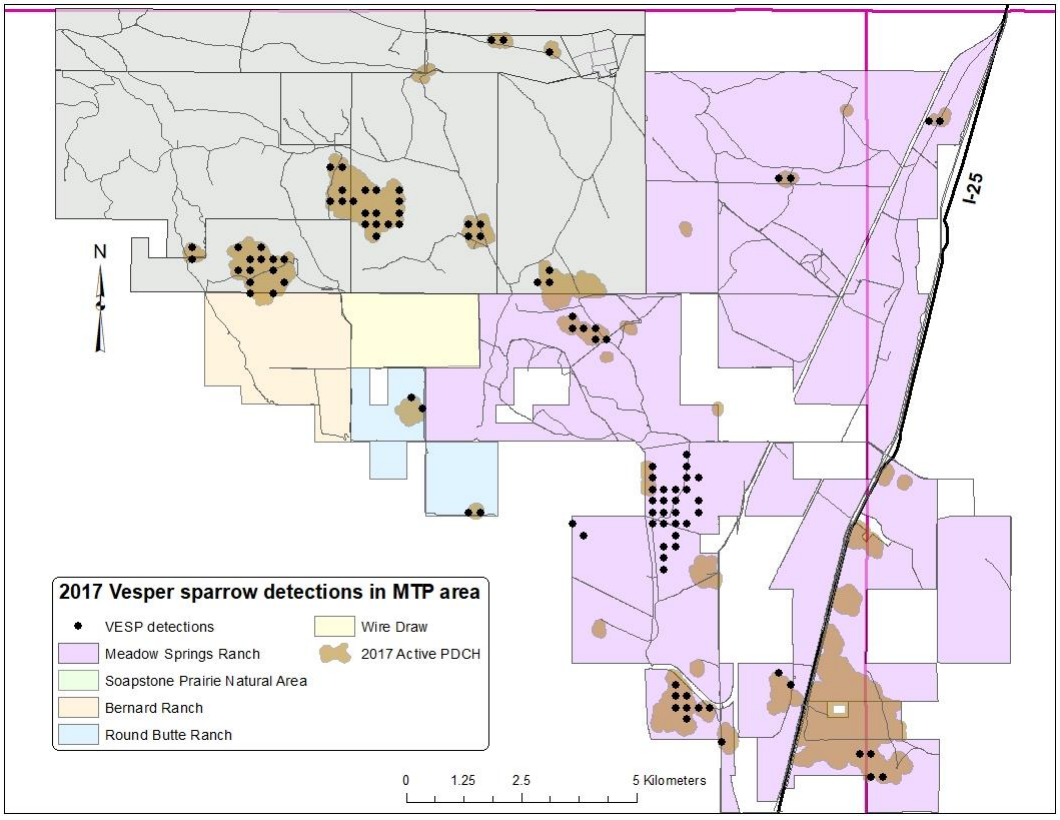
Long-billed Curlew *(Numenius americanus)*



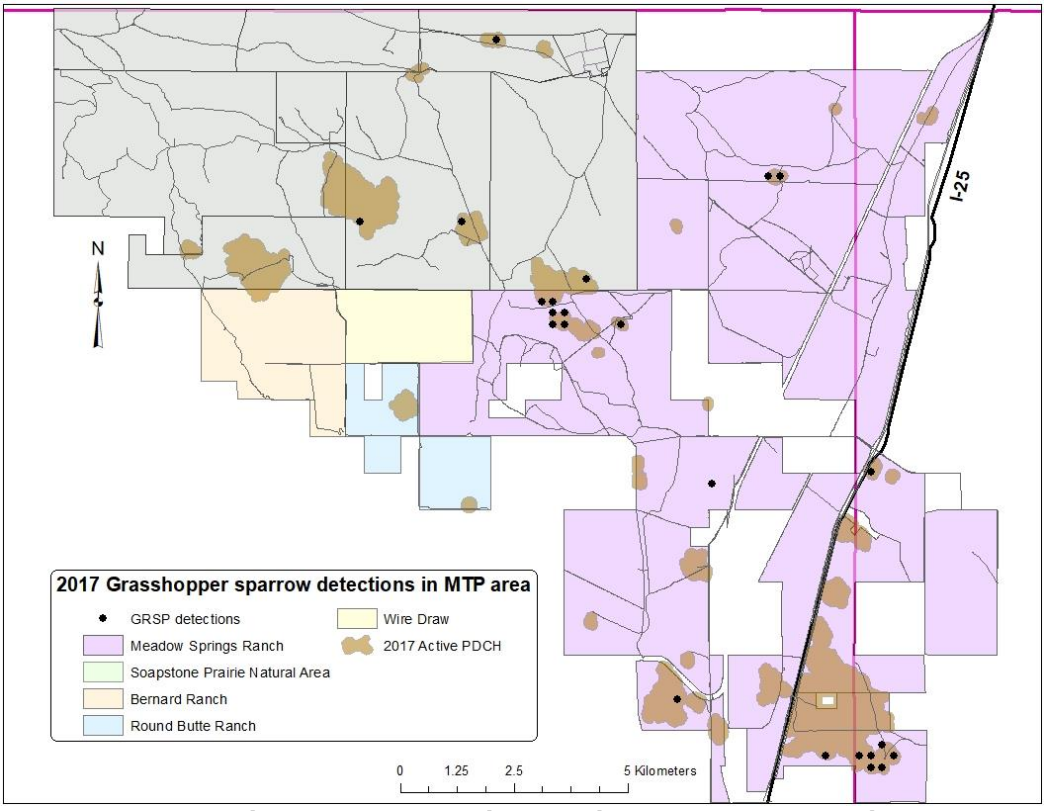
Burrowing Owl *(Athene cunicularia)*



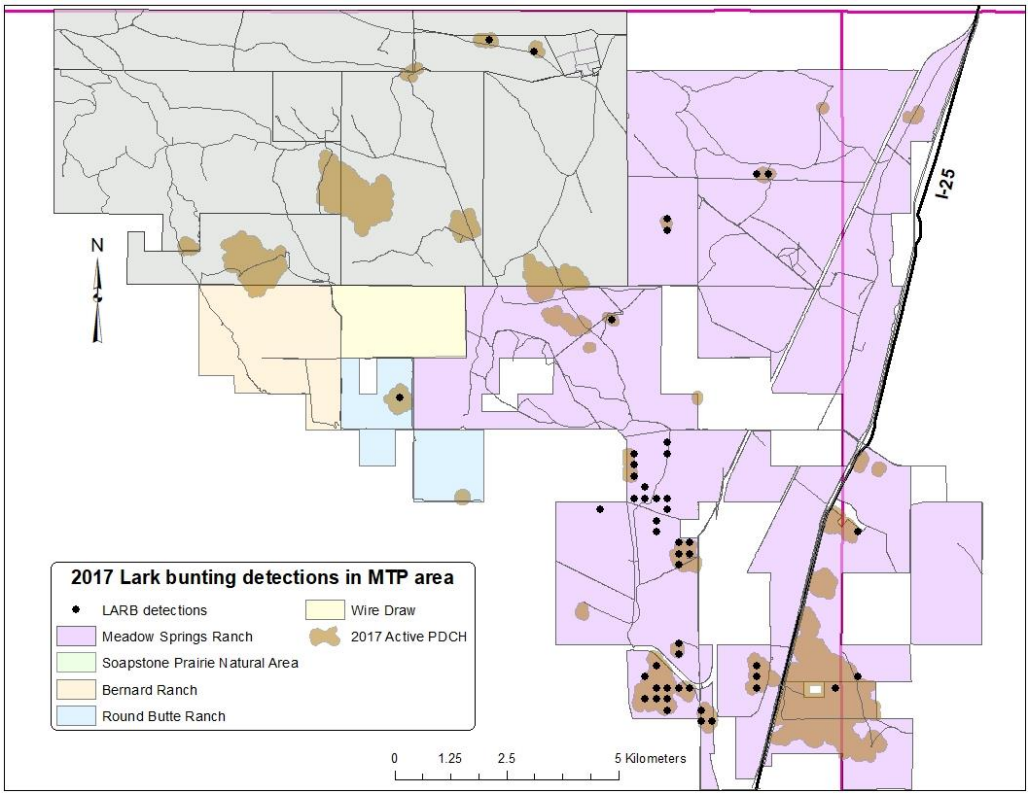
Loggerhead Shrike *(Lanius ludovicianus)*



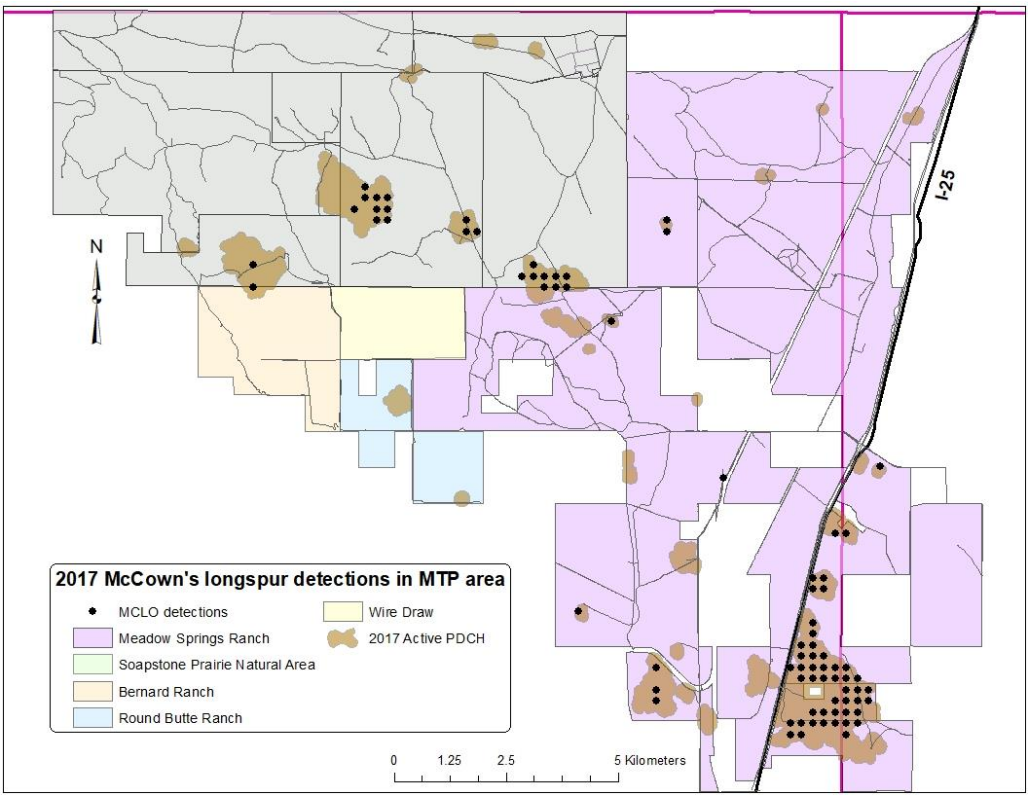
Vesper Sparrow *(Pooecetes gramineus)*



Grasshopper Sparrow (*Ammodramus savannarum*)



Lark Bunting *(Calamospiza melanocorys)*



McCown's Longspur *(Rhyncophanes mccownii)*