

Density and Trends of Grassland Birds on City of Fort Collins Properties in the Mountains to Plains area of Northern Colorado through an Episode of Sylvatic Plague



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Suggested Citation:

Youngberg E.N. and Panjabi A.O. 2014, *Density and Trends of Grassland Birds on City of Fort Collins Properties in the Mountains to Plains area of Northern Colorado through an Episode of Sylvatic Plague*

Photo: McCown's Longspur (*Rhynchophanes mccownii*) female on a nest in Soapstone Prairie Natural Area. Photo taken by Denis Perez, 2013.

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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 area has been identified by The Nature Conservancy (TNC), Colorado Parks and Wildlife (CPW), 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). 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. For the past eight years, Rocky Mountain Bird Observatory (RMBO) has partnered with the City of Fort Collins Natural Areas Program (CFCNAP) in an ongoing effort to aid conservation and management of these grasslands through grassland bird inventory and monitoring on approximately 60,000 acres of city-owned properties in the MTP region. These properties support breeding populations of more than 21 high-priority grassland bird species.

The goal of this long-term project is to help managers conserve grassland bird species and their habitats on CFCNAP properties in northern Colorado by better understanding the abundance, distribution, trends and habitat requirements of breeding birds on the properties. The area is slowly recovering from an episode of sylvatic plague that significantly decreased the Black-tailed prairie dog (*Cynomys ludovicianus*) population in 2008. Successful efforts have been made by the CFCNAP and CPW to encourage re-colonization including prescribed burns, dusting treatments for fleas, and a pilot prairie dog vaccination program. The objectives are to monitor populations of grassland bird species, document the migratory and breeding bird use of the project area, which RMBO has had the unique opportunity to observe before, during and after the plague event, and to provide locations of sensitive bird species.

This project was funded by the City of Fort Collins Natural Areas Program and the Neotropical Migratory Bird Conservation Act (NMBCA #4846 & #5152). The City of Fort Collins Natural Areas Department also provided valuable in-kind matching support for this project. Colorado Division of Parks and Wildlife partnered with RMBO to perform avian surveys on prairie dog colonies in 2013, and performed the avian point counts and vegetation data collection in 2014.

The most common birds within the study area are Horned Lark, McCown's Longspur, Lark Bunting, and Western Meadowlark, which together accounted for 76% of all individual birds observed. A comparison of annual densities of McCown's Longspur within the prairie dog colony habitat from 2006-2013 suggests that the population has declined steadily and rapidly, especially since 2009, resulting in a >50% reduction. Mountain Plover densities have also declined by more than 50% since 2006, although more rapidly after the 2008 plague event, and have since recovered slightly, mainly in response to management activities (i.e. controlled burns, flea dusting). Continued monitoring and management efforts are warranted for these species.

The City of Fort Collins Natural Areas and Utilities Department lands in Northeast Larimer and Northwest Weld counties, Colorado offer an exceptional opportunity to protect and steward a signature landscape to sustain a disappearing ecosystem for unique wildlife. In order to maintain populations of these grassland-obligate species, managers should strive to conserve and augment prairie dog populations, maintain and restore native shortgrass prairie, minimize disturbance from natural resource development and recreation, and closely monitor populations of grassland birds to inform management priorities and actions.

STUDY AREA & METHODS

Each year starting in mid-April we conducted breeding grassland bird point count surveys on City of Fort Collins Natural Areas Program (CFCNAP) properties in Larimer and Weld counties of northern Colorado. We limited our point counts to areas of prairie dog colony habitat (PDCH) using spatial data provided by CFCNAP of prairie dog colony habitat that was active in the preceding fall. A point was considered in PDCH if it was within 100m of an active burrow.

The acreage of PDCH has almost returned to its pre-plague size of 4,321 acres in 2007, with approximately 3,110 acres in 2013.

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 point count stations each year in the target habitat. Points in PDCH were surveyed earlier in the season between 22 April and 1 June 2013 to increase detectability of the early nesting species. Each point count station was surveyed twice, about 2-3 weeks apart.

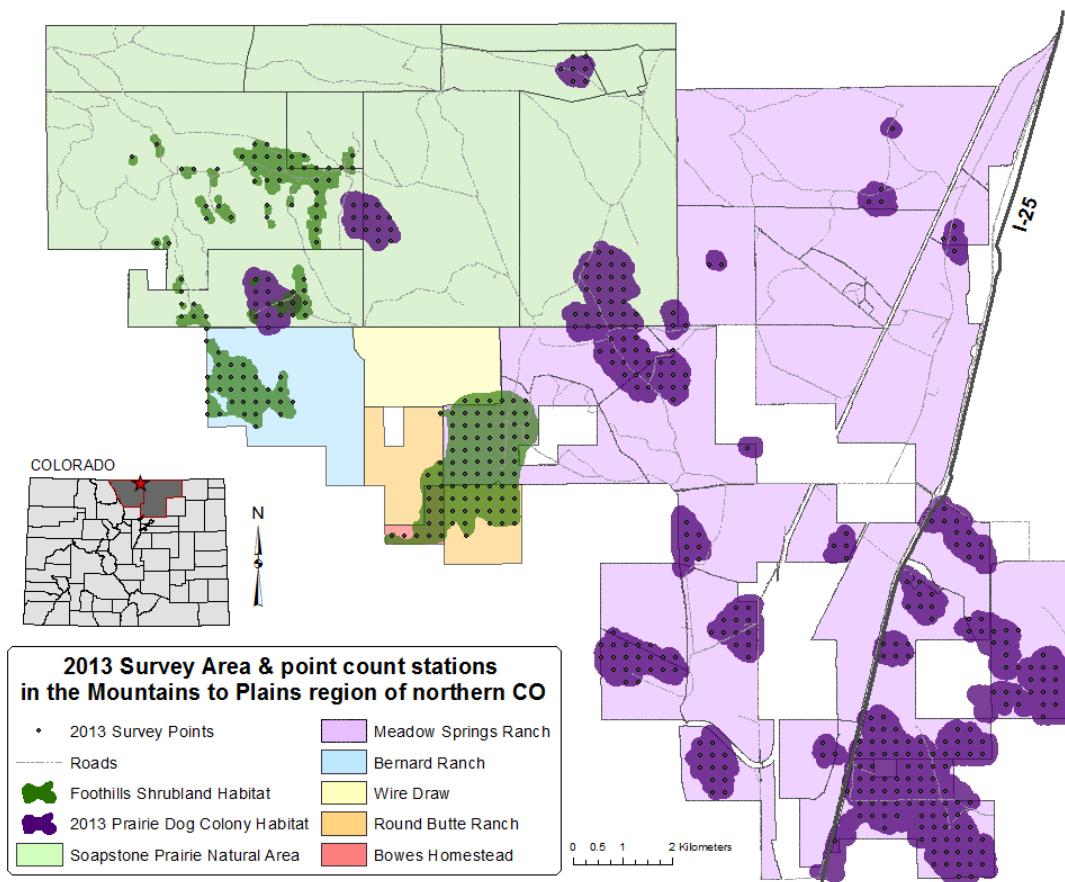


Figure 1: 2013 Survey area and point count stations on CFCNAP properties in the MTP region.

Point count surveys started one half-hour before sunrise and ended at 11 a.m., often earlier. 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 5-minute point count survey consisting of five consecutive 1-minute intervals. This protocol, which is described more fully by Hanni et al. (2009), 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.

Habitat Surveys

After completing each avian point count survey we completed a rapid habitat survey at each point 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, 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 two dominant grass species. Within 50 m of each station we documented shrub and over story tree species and estimated 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 each year's survey data to previous years' data (2006-2013) 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 2013 to generate species-specific detection functions, and then post-stratified density estimates by habitat type. Although species' density estimates calculated with less than 75 observations may be unreliable representations of true populations (Buckland et al. 2001), we present estimates for all species with $n \geq 25$, 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

From 2006 to 2013 we detected 20,514 individual birds during point count surveys, and observed 85 species within PDCH (Appendix A). Long-billed Curlew and Sandhill Cranes were observed using the study area during migration.

Bird Densities in Prairie Dog Colony Habitat (PDCH)

In 2013 we detected 4,732 individual birds of 51 species within PDCH, including 13 species of conservation interest. We estimated density for 16 species (we also performed point count surveys in saltbush habitat, but for the sake of this article will only address the findings in PDCH). Horned Lark and McCown's Longspur were by far the most abundant bird species within PDCH grasslands (Table 1), but their densities in 2013 were considerably below their historic averages since RMBO monitoring began in 2006 (Youngberg et al. 2012). In particular, McCown's Longspur densities in PDCH appear to have declined by roughly 50% since 2006 (Fig. 2). Also of note, Mountain Plover densities have increased slightly since 2011, but show an overall significant decline since 2006 (Fig 3). Burrowing Owls have declined overall since 2006 from a density of .7 birds/ km² to .3 birds/ km². They have slight visible peaks in density following the plague event in 2009, and again in 2011 and 2012. It has been hypothesized that Burrowing owls will take advantage of a higher occurrence of available burrows which may explain the pattern we see here, but we did not collect the data to support that (Fig 4). Horned Lark populations, although variable through the years, have remained relatively stable since 2006 (Fig. 5).

Table 1: Density estimates in 2013 in Prairie Dog Colony Habitat (n = truncated # detections, D = # of birds/ km²) with 95% lower (LCL) and upper (UCL) confidence limits.

Species	n	D	LCL	UCL
2013 (pooled)				
Horned Lark	1569 (5871)	103.42	53.535	199.78
McCown's Longspur*	584 (3102)	36.45	24.91	53.35
Lark Bunting*	321 (618)	11.31	8.74	14.64
Western Meadowlark	472 (2723)	5.25	3.93	7.02
Vesper Sparrow*	70 (185)	2.36	1.68	3.33
Brewer's Sparrow*	26 (94)	2.29	1.63	3.21
Red-winged Blackbird	30 (93)	0.82	0.57	1.16
Chestnut-collared Longspur*	8 (56)	0.76	0.21	2.70
Mountain Plover*	24 (130)	0.64	0.34	1.21
Burrowing Owl*	13 (105)	0.33	0.09	0.47
Common Nighthawk*	2 (8)	0.04	0.02	0.07
Swainson's Hawk*	6 (29)	0.03	0.01	0.11
Northern Harrier*	5 (24)	0.02	0.00	2.88
Ferruginous Hawk*	4 (22)	0.02	0.00	0.18
Prairie Falcon*	1 (17)	0.01	0.00	145.25
Long-billed Curlew*	2 (29)	0.01	0.00	84.62

* = Species of special concern

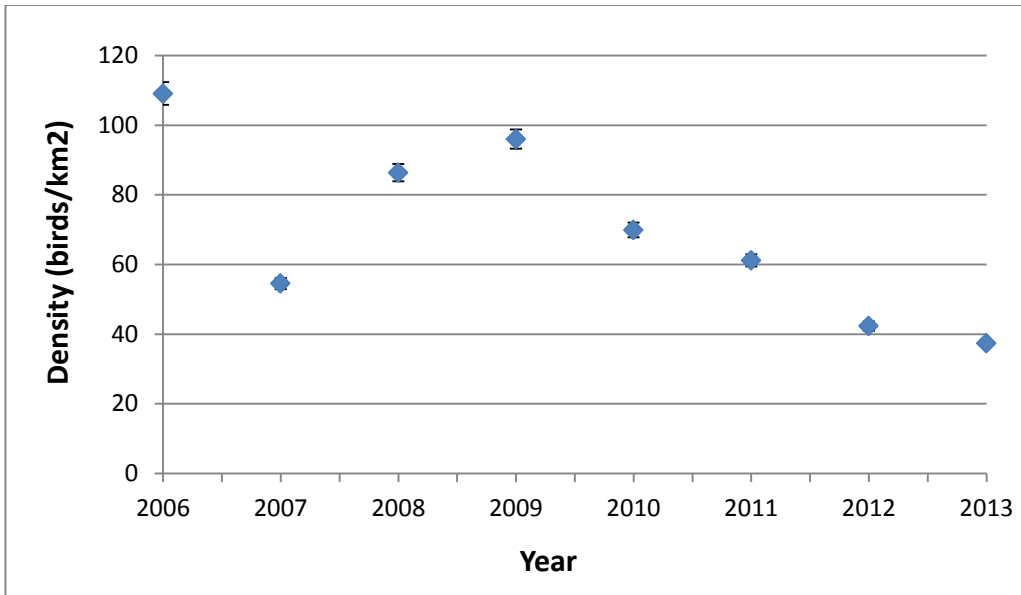


Figure 2: McCown's Longspur density in Prairie Dog Colony Habitat (PDCH) in the Mountains to Plains (MTP) area from 2006-2013.

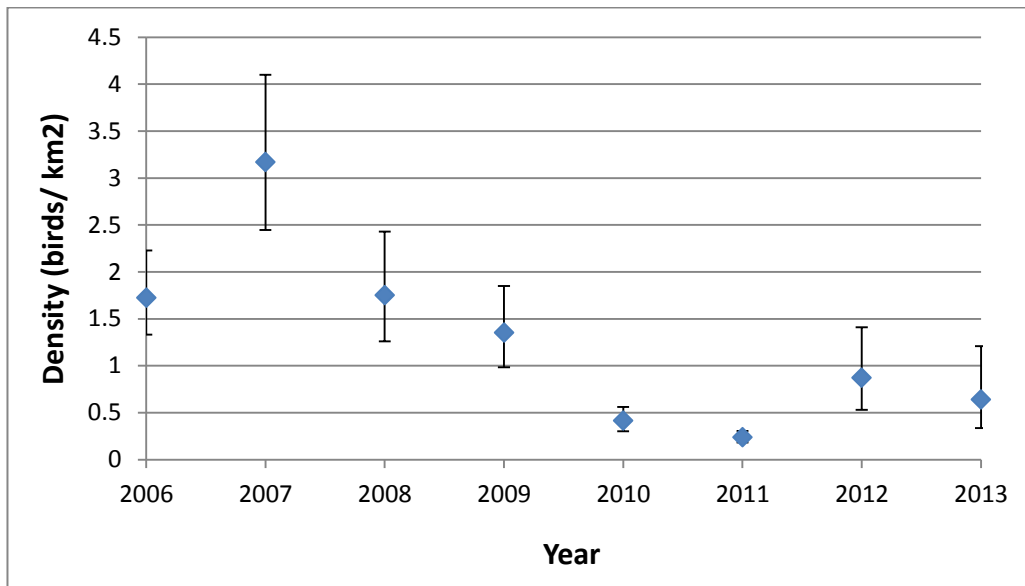


Figure 3: Mountain Plover density in Prairie Dog Colony Habitat (PDCH) in the Mountains to Plains (MTP) area from 2006 – 2013.

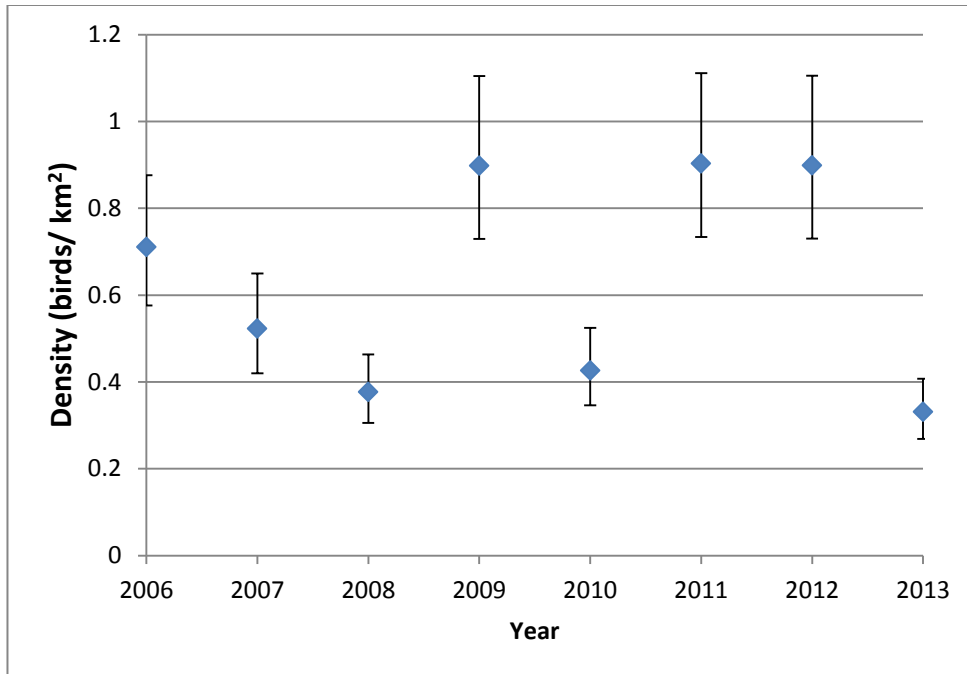


Figure 4: Burrowing Owl density in Prairie Dog Colony Habitat (PDCH) in the Mountains to Plains (MTP) area from 2006 - 2013

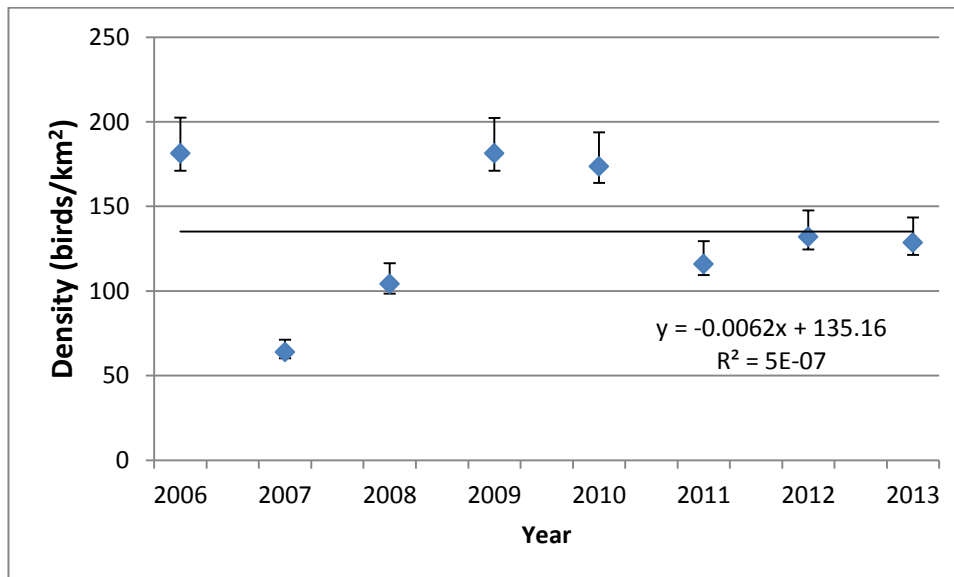


Figure 5 : Horned Lark density in Prairie Dog Colony Habitat (PDCH) in the Mountains to Plains (MTP) area from 2006 – 2013.

Vegetation

Grass was consistently the dominant ground cover type in the study area, followed by bare ground, except in 2007 where percent cover of bare ground exceeded the percent grass cover (Fig 5). In 2011 'Other' cover was the second dominant ground cover type; 'Other' cover consisted of litter, lichen, dead woody material, etc. Blue grama (*Bouteloua gracilis*) was the

dominant grass species on over 90% of the sites in PDCH, followed by Buffalograss (*Bouteloua dactyloides*).

Although the prairie dog colonies have almost returned to their pre-plague extent, the vegetation has not necessarily returned to its pre-plague degree. The amount of bare ground necessary for nesting habitat for the Mountain plover was over 30% in 2006, and was less than 20% in 2013 (Fig 5).

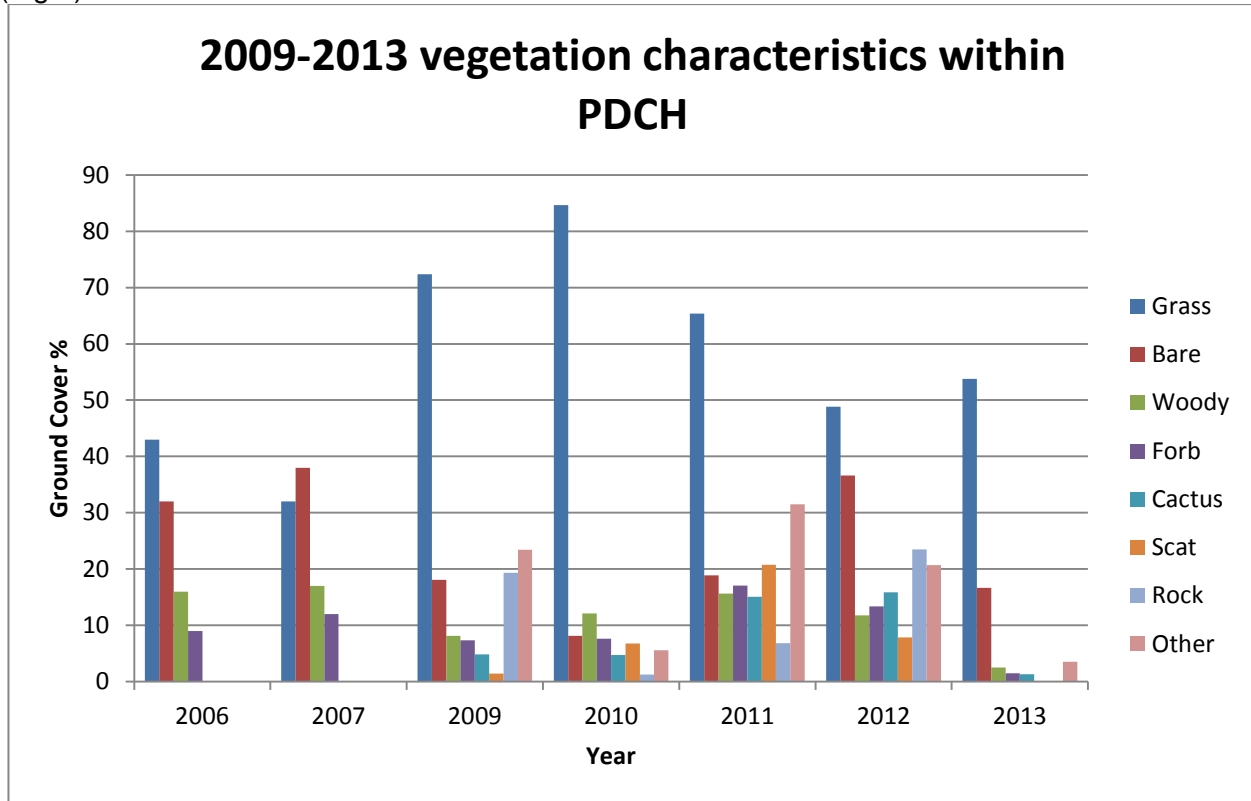


Figure 6: Average ground cover types recorded at survey points in prairie dog colony habitat (PDCH) on City of Fort Collins Properties in the Mountains to Plains (MTP) area from 2006 - 2013.

DISCUSSION AND MANAGEMENT RECOMMENDATIONS

RMBO has monitored grassland birds in the MTP area annually since 2006. Since the sylvatic plague event in 2008 (Panjabi and Beyer 2009), we have focused our survey effort on prairie dog colony habitat (PDCH) to monitor the impacts on the sensitive shortgrass prairie birds that prefer this habitat. Our data indicate that Mountain Plover densities in PDCH declined significantly from 1.72 birds/km² in 2008 to .41 birds/km² in 2010 (Youngberg et al. 2010), and have since increased only slightly to .64 birds/km², despite that prairie dogs have recovered 72% of the extent of former colonies. Burrowing Owl density dropped from .71 birds/km² in 2006 to .42 birds/km² in 2010 and then .33 birds/km² in 2013. Thus it is clear these species have not yet recovered from the effects of the plague-driven loss of suitable PDCH, and remain at historic low population levels in the MTP area.

The prescribed burn conducted in Jack Springs pasture of Soapstone Prairie Natural Area (SPNA) in 2011 has been successful in accelerating the recolonization of this area by prairie dogs

and restoring at least two pairs of Mountain Plover to the area. Jack Springs pasture had one of the highest densities of Mountain Plovers (2.4 birds/km²) in 2008 and 2009 (Panjabi and Beyer 2009), but zero plovers by 2010 (Youngberg et al. 2010). Prescribed burns have been shown to attract Mountain Plovers elsewhere (Augustine and Derner 2012). The positive response by Mountain Plovers (and McCown's Longspur, see Youngberg and Panjabi 2011) to the prescribed burns in Jack Springs is testament to the importance of targeted and well-timed management efforts by City of Fort Collins Natural Areas Program staff in response to the loss of prairie dogs and the collapse of Mountain Plover populations, especially since the plovers do not appear to be recolonizing other expanding prairie dog colonies elsewhere in the MTP region. However, Mountain Plover populations in the Jack Springs pasture area of Soapstone Prairie have still not recovered to 2008 levels. Since the 2008 plague event, the PDCH around the USFWS ferret center has hosted the largest and most stable population of Mountain Plovers within the MTP area.

Of more recent concern however is the significant decline in McCown's Longspur density in PDCH since 2006. McCown's Longspur is an endemic breeder in the dry shortgrass prairies of the western Great Plains, from southern Alberta and Saskatchewan to northern Colorado. According to the North American Breeding Bird Survey (Sauer et al. 2012) its population has declined by 5.3% annually, resulting in a loss of 91% of its global population since 1966. It is recognized as a species of conservation concern by the U.S. Fish and Wildlife Service, U.S. Forest Service, Partners in Flight, the state of Colorado and other wildlife conservation organizations. In contrast to the overall distribution and trend, northern Colorado and southeast Wyoming support one of the densest and most stable populations of McCown's Longspur in the world (Fig. 9). Although the decline in McCown's Longspur density within PDCH in the MTP area seems indisputable, it is not known whether this species is declining only within areas of PDCH or across the entire MTP area. However, McCown's Longspur density was significantly higher in PDCH than in other grasslands on SPNA, MSR and RBR in 2008-2009 (Panjabi and Beyer 2009), and therefore PDCH may represent the most important habitat for the species in the MTP area. It is not clear whether the McCown's Longspur population decline in PDCH is related to the plague event of 2008, but if so the response is not similar to that of Mountain Plover or Burrowing Owl, which crashed shortly after the event and have since been slowly recovering. According to our data, McCown's Longspurs declined annually in PDCH from 2009-2013, with no recovery. McCown's Longspurs prefer areas of extensive and well-cropped blue grama and buffalograss turf. Because of their requirement for relatively short grass, they can be sensitive to grazing management. Given the significant and ongoing declines in this species and the importance of the MTP area for this and other shortgrass prairie obligates, City of Fort Collins managers should evaluate current management practices in the MTP area, particularly within areas of prairie dog colonies, to determine whether changes in management since 2006 may be contributing to this decline. Changes in grazing pressure, prairie dog population dynamics and consequent vegetation structure, or increased human activity/disturbance in PDCH areas are a few possible factors that should be considered. Continued monitoring of the population and incorporation of research questions into a monitoring design could allow managers to identify conservation concerns and their drivers, and respond in a time-sensitive manner that would increase the probability of success in conserving this highly vulnerable species in the MTP area.

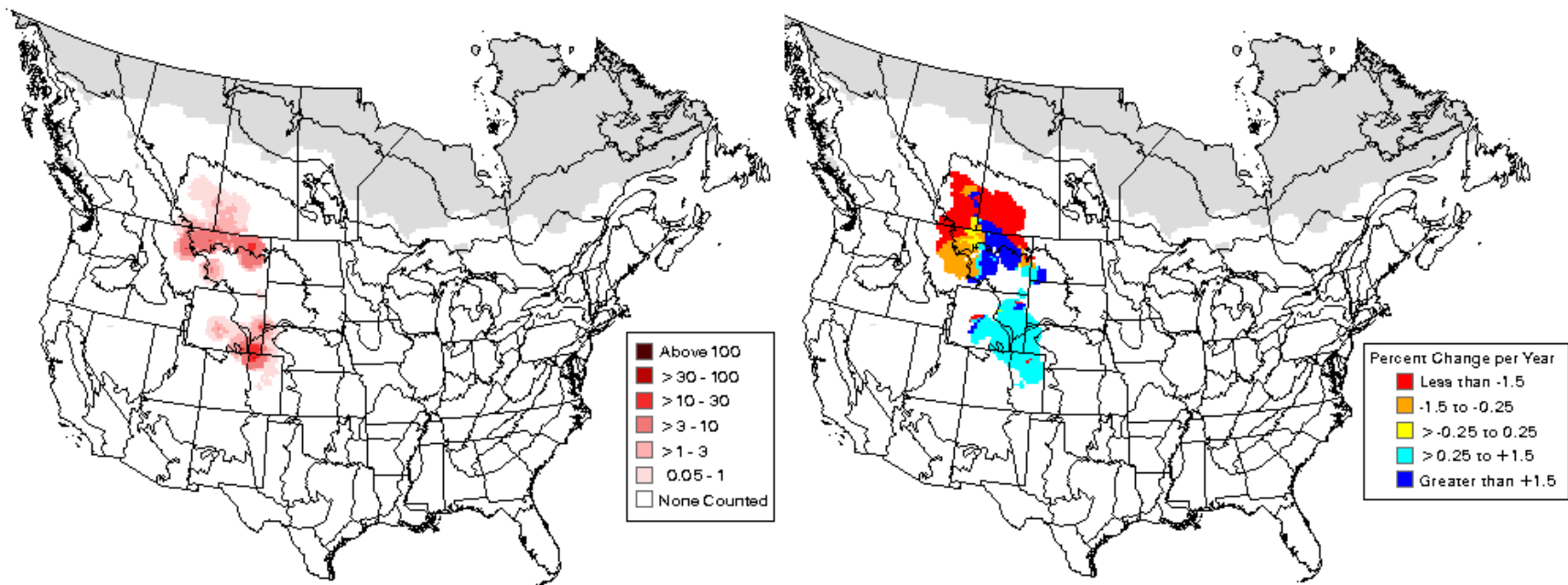


Figure 7: McCown's Longspur relative abundance from 2006-2012 (left) and population change from 1966-2012 (right) (from Sauer et al. 2012).

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Appendix A

Common Name	Scientific Name	2006 (64 pts)	2007 (58 pts)	2008 (165 pts) ⁺	2009 (307 pts)	2010 (296 pts)	2011 (482 pts) ⁺	2012 (388 pts) ⁺	2013 (611 pts) ⁺	Total (1462)
Canada Goose	<i>Branta canadensis</i>					11				11
Mallard	<i>Anas platyrhynchos</i>				3	3	1		5	12
Double-crested Cormorant	<i>Phalacrocorax auritus</i>				7	6				13
Great Blue Heron	<i>Ardea herodias</i>				19	4				23
Turkey Vulture	<i>Cathartes aura</i>		1						1	2
Bald Eagle	<i>Haliaeetus leucocephalus</i>								1	1
Northern Harrier *	<i>Circus cyaneus</i>				8	7	2	4	5	26
Sharp-shinned Hawk	<i>Accipiter striatus</i>						1			1
Cooper's Hawk	<i>Accipiter cooperii</i>					2				2
Swainson's Hawk *	<i>Buteo swainsoni</i>		1		8	8	6	2	6	31
Red-tailed Hawk	<i>Buteo jamaicensis</i>				5		4	2	2	13
Ferruginous Hawk *	<i>Buteo regalis</i>	1			3	1	22	2	6	35
Golden Eagle *	<i>Aquila chrysaetos</i>				2	3	1	1		7
American Kestrel	<i>Falco sparverius</i>				17	12	25	6	11	71
Merlin	<i>Falco columbarius</i>				1					1
Peregrine Falcon	<i>Falco peregrinus</i>					1				1
Prairie Falcon *	<i>Falco mexicanus</i>	1			4	7	4	1	1	18
Sandhill Crane *	<i>Grus canadensis</i>					2			2	4
Killdeer	<i>Charadrius vociferus</i>				18	13	12	8	11	62
Mountain Plover *	<i>Charadrius montanus</i>	6	18		41	13	13	30	26	147
Greater Yellowlegs	<i>Tringa melanoleuca</i>				1					1
Long-billed Curlew *	<i>Numenius americanus</i>				9	3	56	11	2	81
Wilson's Snipe	<i>Gallinago delicata</i>	1			1		1	2	1	5
Wilson's Phalarope	<i>Phalaropus tricolor</i>					1				1
Rock Pigeon	<i>Columba livia</i>					3	9		6	18
Mourning Dove	<i>Zenaida macroura</i>	1			5	22	28	2	11	69
Burrowing Owl *	<i>Athene cunicularia</i>	3	2		19	10	43	30	17	124
Common Nighthawk	<i>Chordeiles minor</i>	4	1				3		3	11

Common Name	Scientific Name	2006 (64 pts)	2007 (58 pts)	2008 (165 pts) ⁺	2009 (307 pts)	2010 (296 pts)	2011 (482 pts) ⁺	2012 (388 pts) ⁺	2013 (611 pts) ⁺	Total (1462)
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>					1				1
Western Wood-Pewee	<i>Contopus sordidulus</i>								1	1
Say's Phoebe	<i>Sayornis saya</i>				11	3	15	6	7	42
Western Kingbird	<i>Tyrannus verticalis</i>		1		1	4	10	6	21	43
Eastern Kingbird	<i>Tyrannus tyrannus</i>					1				1
Loggerhead Shrike *	<i>Lanius ludovicianus</i>	1			6	1	14	3	14	39
Black-billed Magpie	<i>Pica hudsonia</i>								1	1
Common Raven	<i>Corvus corax</i>				3	7	9		16	35
Horned Lark	<i>Eremophila alpestris</i>	227	107	3	1714	1302	1812	1256	2155	8576
Tree Swallow	<i>Tachycineta bicolor</i>				3		1		2	6
Violet-green Swallow	<i>Tachycineta thalassina</i>	7			4					11
Northern Rough-winged Swallow	<i>Steligidopteryx serripennis</i>	1				4	2		3	10
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	3	1		3	12	47	2	3	71
Barn Swallow	<i>Hirundo rustica</i>	2			10	11	41	1	16	81
Rock Wren	<i>Salpinctes obsoletus</i>				7	10	8	2	12	39
Western Bluebird	<i>Sialia mexicana</i>				1				1	2
Swainson's Thrush	<i>Catharus ustulatus</i>						2			2
American Robin	<i>Turdus migratorius</i>					2			1	3
Northern Mockingbird	<i>Mimus polyglottos</i>				1					1
Sage Thrasher	<i>Oreoscoptes montanus</i>						1			1
European Starling	<i>Sturnus vulgaris</i>				2	11	13	1	1	28
Yellow Warbler	<i>Setophaga petechia</i>						1			1
Green-tailed Towhee	<i>Pipilo chlorurus</i>					2				2
Spotted Towhee	<i>Pipilo maculatus</i>								5	5
Cassin's Sparrow *	<i>Peucaea cassinii</i>			1			2			3
Chipping Sparrow	<i>Spizella passerina</i>				8	5	22		3	38
Clay-colored Sparrow	<i>Spizella pallida</i>				1	4	1		3	9
Brewer's Sparrow *	<i>Spizella breweri</i>				40	50	53	15	28	186
Vesper Sparrow *	<i>Pooecetes gramineus</i>	6	1		46	49	81	31	94	308
Lark Sparrow	<i>Chondestes grammacus</i>				2	3	46	3	15	69

Common Name	Scientific Name	2006 (64 pts)	2007 (58 pts)	2008 (165 pts) ⁺	2009 (307 pts)	2010 (296 pts)	2011 (482 pts) ⁺	2012 (388 pts) ⁺	2013 (611 pts) ⁺	Total (1462)
Lark Bunting *	<i>Calamospiza melanocorys</i>	4	21	2	95	91	534	110	809	1666
Savannah Sparrow	<i>Passerculus sandwichensis</i>				7	2			1	10
Grasshopper Sparrow *	<i>Ammodramus savannarum</i>				1	23	18		4	46
McCown's Longspur *	<i>Rhyncophanes mccownii</i>	324	163		891	733	1037	480	757	4385
Chestnut-collared Longspur *	<i>Calcarius ornatus</i>	4			6	65	9	12	17	113
Bobolink *	<i>Dolichonyx oryzivorus</i>					2				2
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1			30	20	32	15	51	149
Eastern Meadowlark	<i>Sturnella magna</i>					1		4		5
Western Meadowlark	<i>Sturnella neglecta</i>	182	9	5	357	631	1241	581	557	3563
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>				1					1
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	3			28	19	6	3	6	65
Common Grackle	<i>Quiscalus quiscula</i>				10		4		2	16
Great-tailed Grackle	<i>Quiscalus mexicanus</i>						43			43
Brown-headed Cowbird	<i>Molothrus ater</i>				14	7	5	2	7	35
House Finch	<i>Carpodacus mexicanus</i>				1				1	2
American Goldfinch	<i>Carduelis tristis</i>					1	1			2
House Sparrow	<i>Passer domesticus</i>				2		1		1	4
Totals	75 species	782	326	11	3477	3209	5343	2634	4732	20514