Density and Distribution of Breeding Birds on Meadow Springs Ranch, Round Butte Ranch, and Soapstone Prairie Natural Area in northern Colorado

Final Report
January 31, 2009

Rocky Mountain Bird Observatory
PO Box 1232
Brighton, CO 80601
303.659.4348
www.rmbo.org

Technical Report: I-MSR-08-02

ROCKY MOUNTAIN BIRD OBSERVATORY

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

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2. ***Education** is critical to the success of bird conservation.*
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Suggested Citation:

Panjabi, A.O. and L.J. Beyer. 2009. *Density and distribution of breeding birds on Meadow Springs Ranch, Round Butte Ranch, and Soapstone Prairie Natural Area in northern Colorado: Final Report. RMBO technical report I-MSR-08-02.* Rocky Mountain Bird Observatory, Brighton, CO, 138 pp.

***Cover Photo**:* Meadow Springs Ranch, Larimer County, Colorado, by Loni Beyer.

Contact Information:
Arvind Panjabi
RMBO Fort Collins Office
230 Cherry Street Suite 150
Fort Collins, CO 80521
arvind.panjabi@rmbo.org
970-482-1707

EXECUTIVE SUMMARY

Grassland bird populations have declined more than any other guild of North American birds and are among the highest of conservation priorities for state, federal and non-governmental natural resource conservation organizations. In effort to aid conservation and management of grasslands in Colorado, the Rocky Mountain Bird Observatory has partnered with the City of Fort Collins to inventory and monitor grassland birds on city-owned properties in Larimer and Weld counties. This project, which began in 2006 on Soapstone Prairie Natural Area, expanded significantly in 2008-2009 with the incorporation of Meadow Springs Ranch and Round Butte Ranch.

We conducted avian point count surveys at 1773 stations across roughly 28,000 acres on Meadow Springs Ranch, Round Butte Ranch, and prairie dog colonies on Soapstone Prairie Natural Area, during the 2008 and 2009 nesting seasons. We also surveyed vegetation at each station and recorded observations of other wildlife. We estimated densities of all common breeding bird species across the study area, and post-stratified estimates by property, pasture, and in some cases, prairie dog colony habitat.

During 68 survey days in 2008 and 2009, we observed nearly 19,500 individual birds of 98 species. We confirmed or suspected breeding for 58 bird species within the study area, including 24 that are recognized as high priorities by state or federal wildlife agencies or major bird conservation initiatives. We present results, including abundance maps, for all 58 summer resident breeding bird species, and 19 other transient migrant species, in Appendix A.

The most common birds within the study area were Horned Lark, McCown's Longspur, Lark Bunting and Western Meadowlark, which together accounted for 83% of all individual birds observed. We documented active nests of these species plus Ferruginous Hawk, American Kestrel, Prairie Falcon, Golden Eagle, Red-tailed Hawk, Swainson's Hawk, Mountain Plover, and Loggerhead Shrike, among others. We observed eight mammalian and reptilian species in the study area including active dens of Coyote, Swift Fox, and Badger.

Mountain Plover and Burrowing Owl had significantly higher densities within prairie dog colonies than outside, and Burrowing Owls had higher densities in active prairie dog colonies than in those where prairie dogs had recently been exterminated due to plague. Both of these species appear to be highly dependent on prairie dogs to create suitable habitat for them within the study area.

The roughly 45,000 acres of Meadow Springs Ranch, Round Butte Ranch, and Soapstone Prairie Natural Area include some of the most significant grasslands in northern Colorado, and present an excellent opportunity to conserve vulnerable wildlife while deriving many other valuable ecosystem services. These properties support nearly all of the breeding and migratory grassland bird species expected for this region, including 20 high-priority grassland-dependent species, in addition to other prairie wildlife. Of special note, these properties support a breeding population of 40-67 Mountain Plovers, a species of high conservation concern. In order to sustain populations of this and other shortgrass prairie species, including Ferruginous Hawk, Burrowing Owl, and Long-billed Curlew, management should strive to conserve and augment prairie dog populations, protect and restore wetlands, and maintain a low-level of human intrusion in this landscape.

ACKNOWLEDGEMENTS

This project was funded by the City of Fort Collins Utilities Department and the Neotropical Migratory Bird Conservation Act (NMBCA #3891 and #4138). The City of Fort Collins Natural Resources Department also provided valuable in-kind assistance and matching support for this project. We thank Daylan Figgs and Erica Saunders for technical assistance and guidance on this project. We also thank our field assistants Beth Dillon, Matt Webb, and Miguel Angel Grageda García. We also thank Greg Levandoski, Rob Sparks, Jennifer Blakesley, and David Pavlacky for technical guidance and Nancy Drilling for edits and feedback on this report.

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INTRODUCTION

North American prairies are the most endangered and anthropogenically altered ecosystem on the continent (Samson et al. 2004; Brennan et al. 2005). The primary threat to extant prairies is conversion to agriculture and development (Samson et al. 2004). Birds are the most abundant vertebrates in grasslands (Kennedy et al. 2008), and grassland birds have shown more significant declines in the last three decades than any other guild of birds (Smith and Lomolino 2004). Breeding grassland birds are environmental indicators, as individual bird species are associated with specific habitat components within the larger grassland ecosystem (Browder et al. 2002). Monitoring avian populations in remaining North American prairies is important to understanding the overall health of grassland ecosystems and directly contributes to the conservation management of these habitats and the species that depend on them.

The goal of this project is to help managers conserve bird species and their habitats on City of Fort Collins (CFC) properties in northern Colorado by helping them better understand the abundance, distribution and habitat requirements of breeding birds on the properties. These properties support breeding populations of more than 20 high-priority bird species, primarily grassland species, recognized by the Colorado Division of Wildlife, the U.S. Fish and Wildlife Service, Partners in Flight, the U.S. Shorebird Conservation Plan, The Nature Conservancy, and other conservation groups. These properties comprise the southern end of the largest remaining contiguous prairie in North America, stretching from here to Alberta and Saskatchewan and east into Nebraska and the Dakotas, and thus present an incredible opportunity for grassland conservation. This is the final report for the 2008-2009 period.

METHODS

Study Area

We conducted this study on three City of Fort Collins properties in Larimer and Weld counties of northern Colorado that comprise roughly 44,000 acres of short grass prairie and rolling foothills: Soapstone Prairie Natural Area (SPNA), Meadow Springs Ranch (MSR), and Round Butte Ranch (RBR). We surveyed all of MSR and RBR during this study, but limited surveys on SPNA to areas of prairie dog colony habitat (PDCH). Together, these areas represent the study area.

We used spatial data provided by CFC Natural Resources Department on active prairie dog colonies in 2007 (hereafter referred to as 2007-PDCH) to delineate areas of PDCH. Although the plague appeared to wipe out 70% or more of the prairie dogs on SPNA and adjacent MSR between 2007 and 2008, we documented four small, but active prairie dog colonies outside of 2007-PDCH on MSR (Appendix B); one each on middle and north Lonetree pastures in 2008, and one each on upper southwest and upper north Barton pastures in 2009. In 2009, prairie dogs were still absent from more than 50% of the total 2007-PDCH area.

Avian Surveys

In 2007, the Rocky Mountain Bird Observatory (RMBO) completed a two-year avian inventory and monitoring project on SPNA that utilized a grid of 1183 point count stations

spaced 250 meters apart (Sparks et al. 2007). In 2008-2009, we expanded this grid to cover MSR and RBR, adding 1673 and 93 stations on each property, respectively.

We surveyed 1,773 point count stations across the study area, including 730 stations in 2008 and 1,169 stations in 2009 (Figure 1). Most stations were surveyed only once in either 2008 or 2009, but some stations were surveyed in both years or twice in one year (Table 1). These included all stations in PDCH on SPNA, western MSR, and southern RBR that were surveyed in both 2008 and 2009, and 49 points in a section in north and east Butte pastures on MSR with potential for oil and gas development, which we surveyed twice in 2008 to yield more precise baseline estimates of bird densities in this section.

We conducted surveys between April 20 and July 3 in each year, although we conducted surveys in PDCH slightly earlier in 2009 than in 2008 to improve detectability of some early nesting species in this habitat and extend the overall survey period. Birds that typically use prairie dog colonies include Mountain Plover, Long-billed Curlew, Burrowing Owl, Horned Lark and McCown's Longspur, which all tend to commence breeding earlier than other species. Few later-arriving species (e.g., Lark Bunting) nest commonly within prairie dog colonies, so by surveying earlier in PDCH we likely did not miss many other breeding birds that weren't already there by late April. Some species nesting in PDCH (e.g., Mountain Plover, Burrowing Owl) are also more detectable in late April than in late May or June as courtship behaviors and territorial vocalizations are more common at this time. For areas outside of PDCH, the commencement of field surveys in 2009 began on May 18th.

Table 1. Number of point count stations surveyed in 2008 & 2009.

Stratum	2008 (May 19-July 3)	2009* (April 20-June 17)	Total
All Stations	730	1169	1773
Stations on SPNA	65	68	68
Stations on MSR	622	1046	1612
Stations on RBR	49	55	93
Stations in PDCH	130	307	307

* A subset of stations surveyed in 2008 was re-surveyed in 2009.

We started point count surveys no earlier than one half-hour before sunrise and ended no later than 11 a.m., often earlier. We navigated on foot to each point count station 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 day's point counts. We logged all GPS data 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, and the 1-minute interval in which it was detected. Whenever possible, we measured distances using laser rangefinders. When it was not possible to directly measure the distance to a bird, we measured distance to a nearby object and then gauged our estimate to the bird.

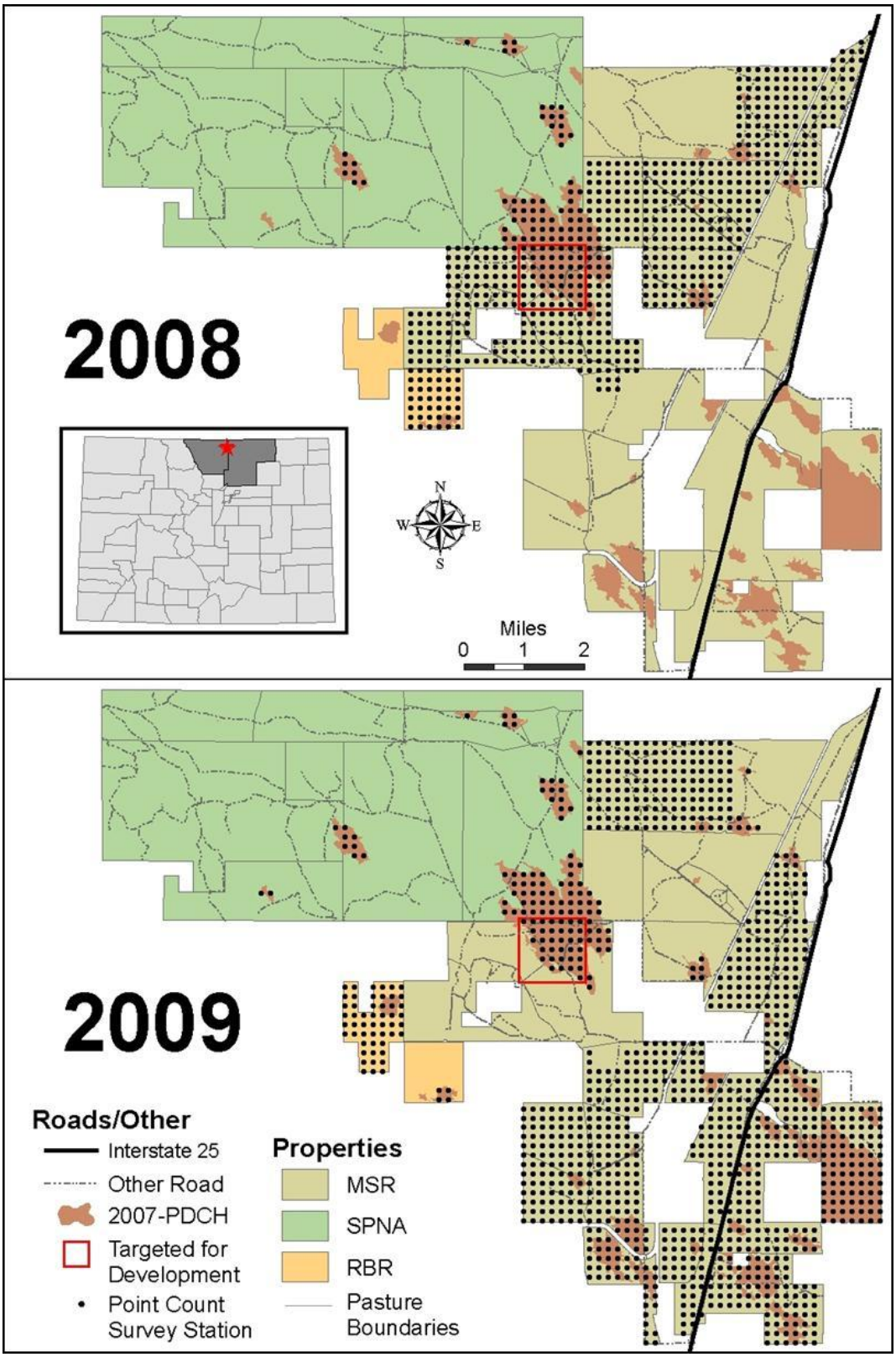


Figure 1: Point count stations surveyed in 2008 and 2009 on Meadow Springs Ranch, Soapstone Prairie Natural Area, and Round Butte Ranch in Larimer and Weld counties, Colorado.

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 other wildlife present including mammals and reptiles.

Habitat Surveys

After completing each point count survey we performed a rapid habitat survey at each point by estimating several vegetation parameters. Within 25 m of each point we visually estimated percent cover of grasses, forbs, bare ground, exotic plants, and 'other cover' to the nearest 1%. 'Other cover' included cactus, low woody plants, rock, and other minor ground cover types. Also within this radius we estimated average grass height by assigning it to one of five categories: (1) ≤ shoe sole height, (2) ankle height, (3) mid-calf height, (4) knee height, and (5) mid-thigh height. Within 100 m of each station we documented shrub and overstory tree species and estimated percent cover (to nearest 1%) and average height of each.

In late May of 2008, it became apparent that the prairie dogs in nearly all of the study area were experiencing an episode of sylvatic plague. Although only one dead prairie dog was found, prairie dogs were suddenly absent or greatly reduced throughout most of the prairie dog towns on SNPA, MSR and RBR. We recorded whether prairie dog colonies at survey stations were 'active' or 'inactive' based on the detection of at least one prairie dog within 100 m.

Analyses

We estimated bird species density using Program Distance 6.0 release 2 (Thomas et al. in press). We used AICc to select among competing models of detectability of each species (across all strata), and post-stratified estimates by property, pasture and/or PDCH. We used Goodness-of-fit tests to determine truncation points in each species dataset to eliminate outliers (generally the furthest 5-15% of observations) and improve model performance, as recommended by Buckland et al. 2001. In this report, n reflects the total number of detections observed in the field and n_t reflects the truncated number of detections used to estimate density.

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≥ 30, and for high-priority species with fewer observations. Many species with relatively few observations are low-density species of high conservation interest, 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.

Burrowing Owl, Mountain Plover, McCown's Longspur and Horned Lark are strongly associated with prairie dog colonies (Smith and Lomolino 2004;Tipton et al. 2008). Since PDCH made up 21% of the area surveyed, we calculated PDCH-specific density estimates for these four species. For each species we calculated a global PDCH density estimate and post-stratified estimates by property, active PDCH and inactive 2007-PDCH.

We created species accounts for each species detected during point count surveys to present all species-specific results in a single location. In each account we include distribution and abundance maps and brief ecological descriptions. All maps were created using ArcMap 9.1 and projected in North American Datum 1927. For each species analyzed in Program Distance, we present pasture-level, property-level and global density estimates in the species accounts section of this report.

To classify breeding status within the study area we use the terms 'confirmed' for those species for which we documented active nests or nesting behaviors (e.g., carrying food, nesting materials), 'probable' for those we strongly suspect to have nested, and 'possible' for those that may be nesting but for which we did not observe any strong evidence of nesting.

RESULTS

Bird Surveys

We detected 19,486 birds during point count surveys, and observed 98 species within the study area (Table 2). We confirmed or strongly suspected breeding for 58 bird species, including 20 high-priority species. Forty other species were possibly breeding or using the study area mainly during migration. We detected 15 species within the study area outside of our formal survey efforts. In the section of land on MSR with potential for oil and gas development, we detected 28 species, including 12 priority species.

Table 2: Density and distribution of bird species observed on Meadow Springs Ranch (MSR), Round Butte Ranch (RBR) and Soapstone Prairie Natural Area (SPNA), April-July, 2008-2009, including conservation priority status and local breeding status.

		Distribution	Density (birds/km^2)				
Species	n	Index (%)	MSR	RBR	SPNA	Global	%CV
American White Pelican	18	0.2					
Double Crested Cormorant	20	0.2					
Great Blue Heron	26	0.6					
White-faced Ibis ˚							
Canada Goose	13	0.1					
Mallard*	20	0.6					
Blue-winged Teal ˚							
Northern Shoveler	2	0.1					
Turkey Vulture	7	0.3					
Northern Harrier *	15	0.8	0.08	0.00	0.29	0.09	36.79
Sharp-shinned Hawk ˚							
Swainson's Hawk *	64	2.5	0.37	0.00	0.40	0.35	33.09
Red-tailed Hawk *	35	1.5	0.23	0.00	0.00	0.20	79.09
Ferruginous Hawk *	20	0.9	0.06	0.00	0.10	0.05	29.10
Golden Eagle *	11	0.6	0.02	0.00	0.00	0.02	18.42
Merlin	1	0.1					
American Kestrel *	37	1.7	0.26	0.00	0.12	0.24	22.09
Prairie Falcon *	19	1.0	0.26	0.35	0.77	0.30	171.69
Peregrine Falcon ˚							
Killdeer *	140	5.1	3.48	0.51	0.00	3.10	28.07
Mountain Plover *	74	3.1	0.36	0.00	2.09	0.46	13.25

Species	n	Distribution Index (%)	Density (birds/km^2)				
			MSR	RBR	SPNA	Global	%CV
American Avocet	4	0.1					
Greater Yellowlegs	1	0.1					
Willet˚							
Upland Sandpiper	1	0.1					
Long-billed Curlew	12	0.4	0.10	0.00	0.08	0.07	187.38
Wilson's Snipe *	22	1.0					
Wilson's Phalarope *	7	0.3					
Red-necked Phalarope	7	0.3					
Mourning Dove *	161	5.5	2.32	0.25	0.18	2.05	18.96
Eurasian Collared-Dove *	2	0.1					
Rock Pigeon *	10	0.3					
Barn Owl ˚*							
Short-eared Owl ˚							
Great Horned Owl ˚*							
Burrowing Owl *	32	1.3	0.14	0.62	0.87	0.22	46.82
Common Poorwill ˚ *							
Common Nighthawk *	57	2.2	0.98	0.61	0.00	0.92	22.53
Broad-tailed Hummingbird	3	0.2					
Northern Flicker *	1	0.1					
Western Wood-Pewee *	6	0.3					
Say's Phoebe *	42	1.9	0.82	0.00	0.29	0.74	68.12
Eastern Kingbird *	24	1.1					
Cassin's Kingbird ˚							
Western Kingbird *	85	3.2	1.71	0.00	0.32	1.53	51.00
Loggerhead Shrike *	21	1.0	0.38	0.30	0.00	0.35	25.44
Warbling Vireo	1	0.1					
Common Raven	12	0.5					
American Crow	2	0.1					
Horned Lark *	6638	85.3	217.76	232.31	203.99	217.46	5.79
N. Rough-winged Swallow *	16	0.6	0.34	0.00	0.00	0.30	43.39
Bank Swallow	1	0.1					
Violet-green Swallow	5	0.3					
Tree Swallow	10	0.5					
Cliff Swallow *	253	5.5	20.19	0.00	6.31	17.98	14.59
Barn Swallow *	56	2.5	2.53	0.00	8.85	2.83	19.45
House Wren ˚							
Rock Wren *	81	3.7	0.93	1.23	0.18	0.90	18.74
Blue-gray Gnatcatcher *	1	0.1					
Western Bluebird	1	0.1					
American Robin *	16	0.8					
Gray Catbird ˚							
Swainson's Thrush ˚							
Northern Mockingbird *	2	0.1					
Brown Thrasher ˚							
Sage Thrasher	1	0.1					
Yellow Warbler*	6	0.3					
Western Tanager ˚							
European Starling *	237	3.3	2.48	0.00	0.00	2.19	18.58

Species	n	Distribution Index (%)	Density (birds/km^2)				
			MSR	RBR	SPNA	Global	%CV
Black-headed Grosbeak ˚							
Blue Grosbeak *	2	0.1					
Spotted Towhee *	2	0.1					
Green-tailed Towhee ˚ *							
Cassin's Sparrow *	77	3.2	0.28	5.01	0.00	0.50	15.68
Brewer's Sparrow *	375	9.9	15.34	23.22	2.03	14.82	21.45
Clay-colored Sparrow	14	0.7					
Chipping Sparrow	10	0.3					
Grasshopper Sparrow *	184	6.8	4.83	28.05	0.00	5.65	8.79
Savannah Sparrow *	34	1.6	1.38	0.00	0.56	1.25	24.14
Vesper Sparrow *	231	8.9	5.25	12.41	6.57	5.73	16.71
Lark Bunting *	3476	42.2	72.47	206.25	3.07	74.40	4.36
Lark Sparrow *	84	3.4	2.85	1.82	0.66	2.69	15.58
White-crowned Sparrow ˚							
Song Sparrow *	1	0.1					
McCown's Longspur *	3641	47.8	139.69	14.86	250.69	140.62	4.22
Chestnut-collared Longspur *	30	1.0	1.70	0.00	0.00	1.50	35.32
Western Meadowlark *	2392	69.5	14.84	20.01	9.15	14.70	4.44
Eastern Meadowlark *	2	0.1					
Brown-headed Cowbird *	68	2.2	3.98	0.00	1.86	3.76	18.36
Yellow-headed Blackbird	5	0.1					
Red-winged Blackbird *	245	5.9	7.66	0.00	0.00	6.76	31.07
Brewer's Blackbird *	143	2.9	3.50	0.00	4.78	3.81	45.71
Common Grackle	12	0.2					
Bullock's Oriole *	16	0.8					
House Finch *	4	0.2					
American Goldfinch *	4	0.2					
House Sparrow *	75	0.5	1.83	0.00	0.00	1.61	62.17

Bold face type reflects conservation priority status as determined by Colorado Division of Wildlife, U.S. Fish and Wildlife Service and/or Partners in Flight.
n= total number of individuals observed; Distribution Index=% of stations on which species was observed; Global=entire study area; %CV =coefficient of variation for global density estimate;
˚ detected outside of point count surveys
* probable or confirmed breeder inside the study area

Bird Density in Prairie Dog Colonies

We detected 55 bird species in prairie dog colony habitat (PDCH), but only four in sufficient numbers to estimate density. Of the four species analyzed, Horned Lark and McCown's Longspur were most abundant. Mountain Plover and Burrowing Owl were uncommon in PDCH, but nonetheless had densities that were 100-200 times higher inside PDCH than outside (Table 3). Within PDCH, Burrowing Owl was significantly more abundant in areas of active prairie dog colonies than in areas with inactive colonies, perhaps due to a requirement for newer burrows for nesting.

Table 3: Densities of four breeding bird species within and outside of prairie dog colonies, in active vs. inactive colonies, and within prairie dog colonies on each City of Fort Collins property.

Species		Stratum	D	%CV	LCI	UCI	n_t
Mountain Plover	Outside	Meadow Springs	0.01	80.60	0.00	0.23	3
		Round Butte	0.00				0
		Soapstone	0.00				0
		Pooled	0.01	80.60	0.00	0.21	3
	Within	Active	2.17	16.70	1.56	3.02	17
		Inactive	1.71	15.34	1.26	2.32	36
		Meadow Springs	1.72	15.64	1.26	2.34	33
		Round Butte	0.00				0
		Soapstone	2.40	15.65	1.76	3.27	20
		Pooled	1.86	15.41	1.37	2.52	53
Burrowing Owl	Outside	Meadow Springs	0.01	38.35	0.00	0.04	3
		Round Butte	0.06	38.37	0.02	0.21	1
		Soapstone	0.00				0
		Pooled	0.01	38.35	0.00	0.05	4
	Within	Active	1.68	9.49	1.38	2.04	14
		Inactive	0.71	12.05	0.56	0.91	11
		Meadow Springs	0.85	9.44	0.70	1.03	14
		Round Butte	5.76	11.21	4.59	7.22	4
		Soapstone	0.95	16.54	0.66	1.37	7
		Pooled	1.01	10.25	0.82	1.25	25
Horned Lark	Outside	Meadow Springs	202.35	6.74	177.31	230.92	2803
		Round Butte	236.73	7.35	204.99	273.38	183
		Soapstone	78.53	6.71	68.86	89.55	1
		Pooled	204.10	6.74	178.86	232.92	2987
	Within	Active	295.70	6.26	261.58	334.27	469
		Inactive	273.46	6.10	242.64	308.19	789
		Meadow Springs	320.19	6.07	284.26	360.67	933
		Round Butte	338.07	11.37	269.60	423.93	37
		Soapstone	189.89	6.37	167.61	215.13	288
		Pooled	280.22	6.00	249.15	315.18	1258
McCown's Longspur	Outside	Meadow Springs	117.53	5.06	106.43	129.79	1754
		Round Butte	11.22	5.40	10.10	12.47	12
		Soapstone	125.76	46.18	0.64	24894.00	3
		Pooled	111.60	5.06	101.06	123.24	1769
	Within	Active	161.18	9.21	134.57	193.04	235
		Inactive	174.63	8.80	146.97	207.49	544
		Meadow Springs	166.84	8.84	140.32	198.37	511
		Round Butte	32.86	11.46	26.14	41.30	6
		Soapstone	190.18	9.03	159.34	226.99	262
		Pooled	170.38	8.73	143.58	202.17	779

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D;

Vegetation

Grass was the predominant ground cover type in the study area (total cover = 68.5% ± 19.9) followed by bare ground (total cover = 18.1% ± 12.7), other (total cover = 11.7% ± 12.5), exotic plants (total cover = 1.9% ± 8.2), and shrubs (total cover = 0.8% ± 3.5), Figure 2. Total cover of overstory trees was less than 0.05% ± 0.6 cover. Average shrub height was 0.6 m ± 0.2. Median grass height was category 2 (ankle height) with a minimum of 1 and a maximum of 5.

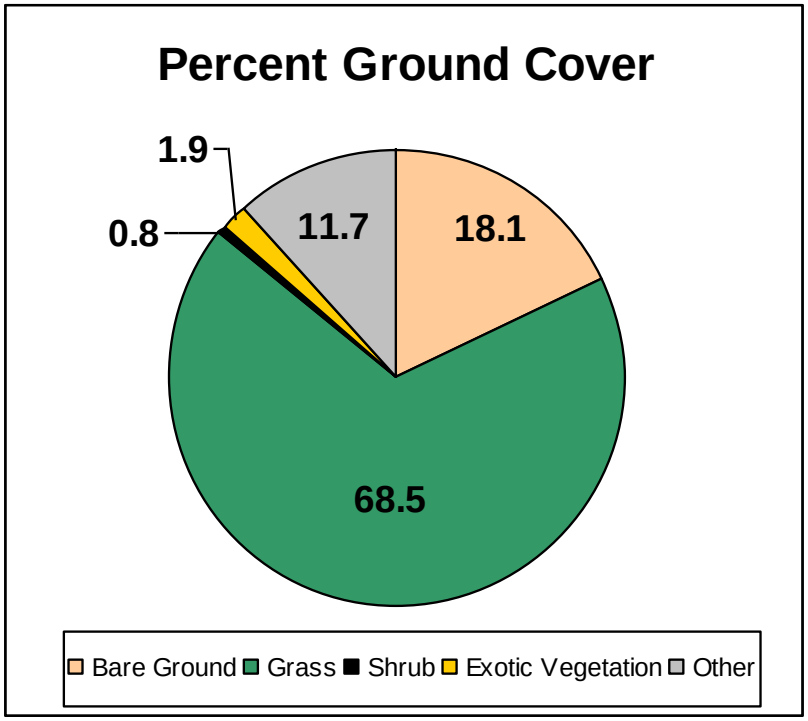


Figure 2: Average percent ground cover sampled at point count survey stations.

Additional Wildlife Species

We observed several mammal and reptile species in the study area (Table 4). Pronghorn Antelope (*Antilocapra americana*) were the most common native ungulate (Figure 5) and were observed daily. Mule Deer (*Odocoileus hemionus*) were also present in hilly scrubland areas of SPNA, and in a canyon of west Butte pasture on MSR. We documented active Coyote (C*anis latrans*) and Swift Fox (*Vulpes velox*) dens. A Badger (*Taxidea taxus*) was seen carrying a dead rabbit on Carr pasture of MSR and another was seen in a den on south Lonetree pasture of MSR. We regularly observed Black-tailed Jackrabbits (*Lepus californicus*), and observed a White-tailed Jackrabbit (*L. townsendii*) on north Butte pasture of MSR. We encountered a Horned Lizard (*Phrynosoma sp.*) on upper east Barton pasture of MSR and observed Prairie Rattlesnakes (*Crotalus viridis*) along access roads to SPNA and in Barton upper c-300 pasture of MSR.

Table 4: Additional wildlife sightings on Meadow Springs Ranch (MSR), Round Butte Ranch (RBR) and Soapstone Prairie Natural Area (SPNA) in Larimer and Weld counties, Colorado, 2008 and 2009.

Property	Pasture	Date	Wildlife Sighting
MSR	Carr	5/4/2009	Badger with prey
MSR	Lonetree south	6/12/2009	Badger den
MSR	Bulger north	5/14/2009	Coyote
MSR	Lewis south	5/14/2009	Coyote
MSR	Lewis south	5/14/2009	Coyote
MSR	Barton upper c-300	5/25/2009	Coyote
MSR	Carr	5/28/2009	Coyote
RBR	RBR	6/17/2009	Coyote den
MSR	Butte north	6/3/2008	White-tailed Jackrabbit
MSR	Butte west	6/17/2008	Mule Deer
SPNA	Roman Inholding	5/31/2009	Mule Deer
MSR	Barton upper c-300	5/20/2009	Prairie Rattlesnake
SPNA	Jack Springs	5/7/2009	Fox den
MSR	North Benson south	6/5/2009	Fox and pups

Figure 5: Pronghorn Antelope on Meadow Springs Ranch, Larimer County, Colorado, 2009. Photo by Mike Forsberg.

DISCUSSION

Soapstone Prairie Natural Area, Meadow Springs Ranch, and Round Butte Ranch support a rich and diverse shortgrass prairie avifauna, complete with many grassland bird species that are declining or extirpated in much of their range. These properties support more than 20 bird species that have been identified as high concern for conservation due primarily to well-documented long-term population declines and high threats. The properties surveyed provide not only high-quality breeding habitat these species, but also migratory stopover habitat for these species and many more. Appropriate conservation and management of these areas can play an important role in sustaining regional populations of grassland birds and other wildlife as well as a broad range of ecosystem services.

Of particular importance, MSR and SPNA appear to support a breeding population of 40-67 Mountain Plovers, virtually all of which depend on prairie dog colonies for habitat within the study area. This estimate may even be conservative, given some surveys in PDCH in 2008 were conducted past the peak detectability period for Mountain Plover (late April-mid May) and thus may be drawing down estimates. Mountain Plovers nest only in areas with very short vegetation and extensive bare ground, and their close relationship with prairie dogs is well-known. The plague event that nearly wiped out prairie dogs from the study area most likely began in 2007 on the east side of MSR, and spread west and northward in 2008. Small pockets of prairie dogs did persist, especially around the US Fish and Wildlife Service Black-footed Ferret Center. Recovery and maintenance of the prairie dog population is essential to sustaining populations of Mountain Plover and other prairie dog dependent bird species on these properties. Allowing prairie dog populations to expand would provide additional habitat for these species and could help to halt or reverse regional population declines.

Prairie dogs are keystone species in prairie ecosystems, meaning their presence and activity is essential to sustaining other species. Prairie dogs maintain areas with exceptionally short grass and extensive bare ground, essential characteristics for landscape heterogeneity in grassland ecosystems (Smith and Lomolino 2004. Prairie dogs are an important food source to predatory birds such as Ferruginous Hawk and Golden Eagle (Giovanni et al. 2007). Prairie dogs are also known to provide nesting habitat to several shortgrass obligate species such as Burrowing Owl, Mountain Plover, McCown's Longspur and others (Tipton et al. 2008; Kennedy et al. 2008). We observed nests and juveniles of Lark Bunting, McCown's Longspur, Horned Lark, Common Night Hawk, and Mountain Plover in prairie dog colonies. However, we found that bird species had varying degrees of dependence on this habitat. Our data show that Mountain Plover and Burrowing Owl rarely occurred outside of prairie dog colonies, whereas McCown's Longspur and Horned Lark were found across a much broader area. Only Burrowing Owls had significantly lower densities in inactive prairie dog colonies than in active ones, likely due to their need for recently excavated burrows for nest sites. However, without active prairie dogs, habitat suitability for other prairie dog associated bird species, including Mountain Plover, will eventually decline too. Regular monitoring of prairie dog dependent bird species within the study are would allow managers to identify and respond to conservation concerns, and guide management actions, in a time-sensitive manner that would increase the probability of success of conservation and management actions.

Figure 6: Black-tailed Prairie Dogs (*Cynomys ludovicianus*) on Meadow Springs Ranch, Larimer County, Colorado. Photo by Mike Forsberg.

Bird density, abundance, and distribution data can help illuminate spatial patterns of species-habitat associations. For example, Savannah Sparrows were always detected near wetlands, an important characteristic of their preferred prairie habitat (Wheelwright and Rising 1993). These wetlands also supported a variety of other species not found more widely across the study area, including Chestnut-collared Longspurs, Grasshopper Sparrows, Common Snipe, Killdeer, in addition to wide array of migratory birds that utilized these areas during spring stopover. Lark Bunting densities were highest in areas with high shrub cover, especially Saltbush (*Atriplex sp.*), although it was highly influenced by the exceptionally wet conditions in 2009, when density skyrocketed across the study area. Thus, spatial differences in our survey effort in 2008 and 2009 may confound some of these spatial distribution and abundance patterns, particularly in species that may have responded to the unusual conditions in 2009. In addition to Lark Bunting, we also observed an apparent increase in 2009 in the distribution and density of Grasshopper and Cassin's Sparrows starting in mid-June and continuing past the date end of our bird survey period. Both these species prefer tall dense grasses (Davis 2004; Dieni and Jones 2003), and these conditions were unusually widespread later in the summer due to the increased seasonal moisture. Together, the heterogeneity of habitats, including the various wetlands, shrublands, different grassland types, and woodlands, is what supports the diversity of bird life found in the study area. Although prairie dog towns may be important for some of the most vulnerable and sensitive bird species in the region, conservation and management in this area should also strive to incorporate and protect these other unique ecological elements.

Seasonal timing of surveys is an important consideration and variable in grassland bird surveys. We began bird surveys earlier in 2009 than in 2008 to take advantage of

higher detectability of certain prairie dog associated bird species earlier in the spring. While this change in protocol may be an improvement in the study design for detecting breeding Mountain Plover and Burrowing Owl, it may have also influenced the results of our analyses. Due to lower detectability in 2008 samples taken in that year may have underestimated density these early breeders. On the other hand, species arriving to their breeding territories in late spring or early summer, like Common Nighthawk, may have been underrepresented in our samples. Additionally, early spring surveys may have included individual birds that were still in migration. These variances, although not major influences in our study, should be considered in interpreting results.

Management Recommendations

Grassland birds have varied habitat requirements and are sensitive to environmental conditions (Ribic et al. 2009). The shortgrass prairie habitats of Meadow Springs Ranch, Round Butte Ranch, and Soapstone Prairie Natural Area were historically maintained by a combination of ungulate grazing (e.g. bison), small herbivore activity (e.g. prairie dogs), and fire, combined with climate. These ecological conditions resulted in mosaic of vegetation structures, composition, and ecosystem dynamics (Winter et al 2002; Smith and Lomolino 2004). Such natural disturbances create heterogeneity in grassland habitats which in turn support avian species diversity (Fuhlendorf et al. 2006). Management actions should strive to create conditions mimicking those created by natural disturbance regimes, and should allow for natural processes that maintain variation within native short grass prairies, especially prairie dogs, which serve a keystone role in this ecosystem by creating a unique habitat that sustains a suite of other species (Smith and Lomolino 2004).

APPENDIX A: SPECIES ACCOUNTS

This section presents individual accounts of the abundance and distribution of each bird species detected during point count surveys. Where possible, we include property-level (for SPNA this reflects PDCH only) and global (i.e., across all areas surveyed) density estimates, as well as pasture-level estimates for MSR (Figure 6). We report densities (birds/km^2) for 36 species, including all those with n≥30 and all high-priority species. Density estimates with high measures of error, as well as those based on fewer than 60 detections, and especially those based on fewer than 30 detections, should be interpreted with caution. We offer a color-coded system to help determine when extra caution should be used in interpreting density estimates with high uncertainty or poor reliability (red=extremely poor precision, estimate unreliable; orange=moderately poor precision and reliability, caution urged; yellow=moderately good precision and certainty; and green=good precision and reliability).

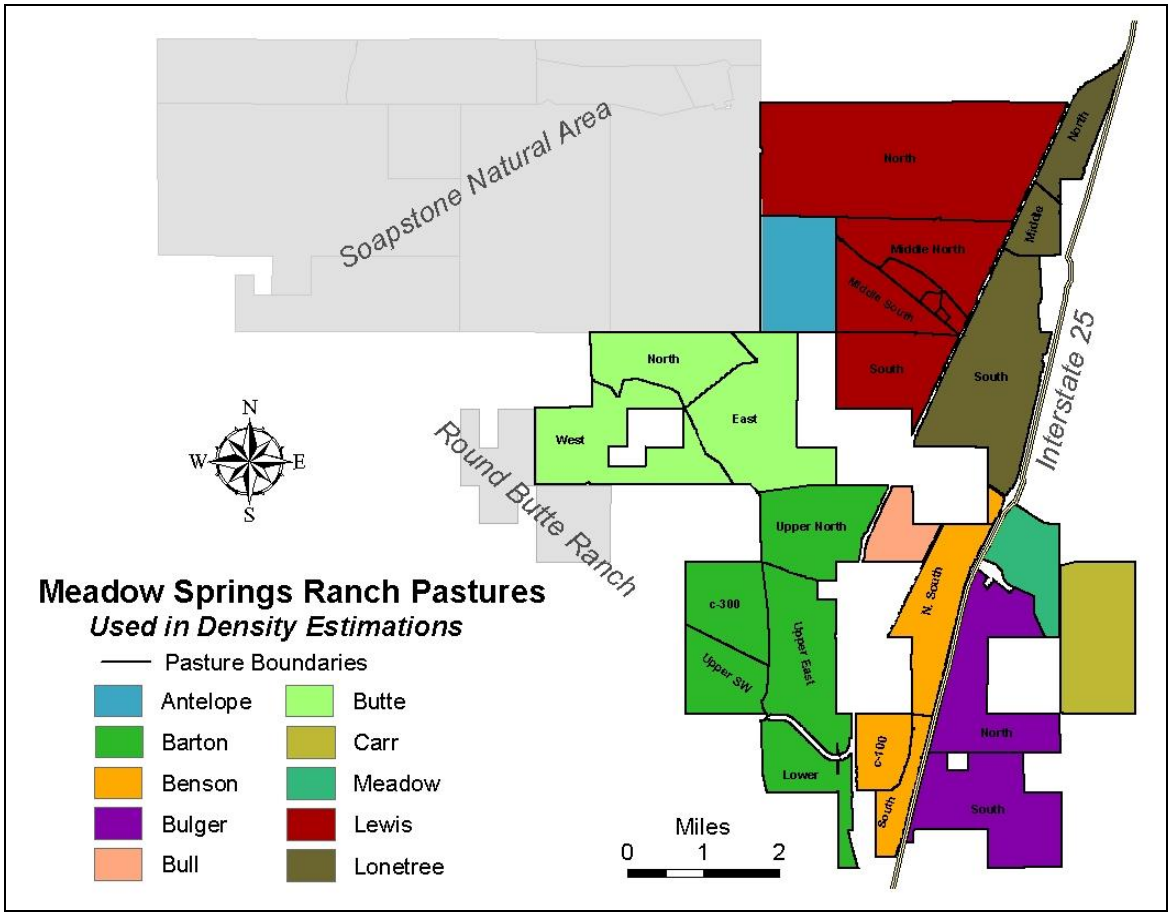


Figure 6: Meadow Springs Ranch pastures.

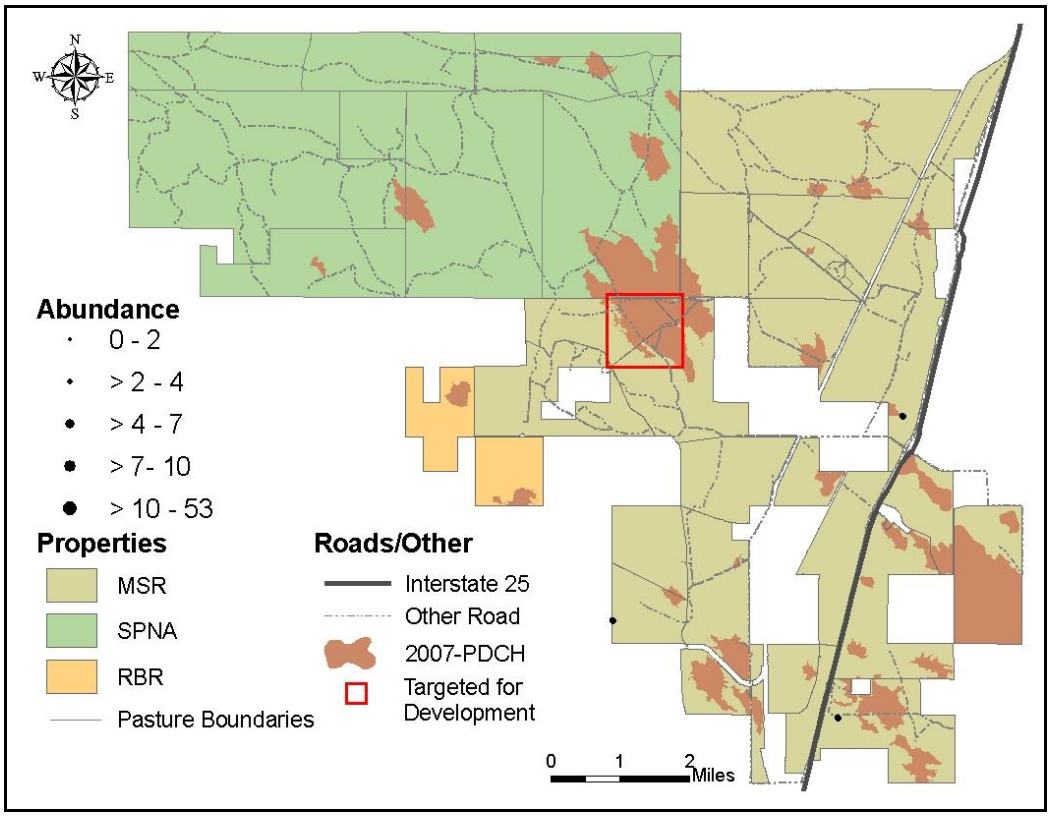
Species that are high priorities for conservation are identified along with the organizations that recognize them: Partners in Flight (PIF), Colorado Division of Wildlife (CDOW), and U.S. Fish and Wildlife Service (USFWS). We classify breeding status as 'confirmed', 'probable' or 'possible', based on observational evidence use the term 'probable breeding' for species that are most likely breeding in the study area, based on repeated observations in the study area during the appropriate season and their known breeding range and habitat associations (BNA 2002; Sibley 2000). We use the term

'possible breeder' to reflect species that are expected to breed in the region, and may be breeding within the study area, but for which we did not observe strong evidence of breeding. 'Confirmed breeders' are species we observed attending nests, feeding young, or performing courtship behaviors or territorial displays.

We provide abundance and distribution maps (average # birds/point count survey) for every species observed during standardized surveys. *Note: Abundance values are calculated by the number of birds detected at each station divided by the number of visits to that station. Only stations where the species was detected are displayed. Some stations were surveyed three times so that the lowest possible mapped value is 0.33 birds per station (displayed as 0-2 in the legend) for a bird that was detected at a point on only 1 of 3 visits.*

American White Pelican

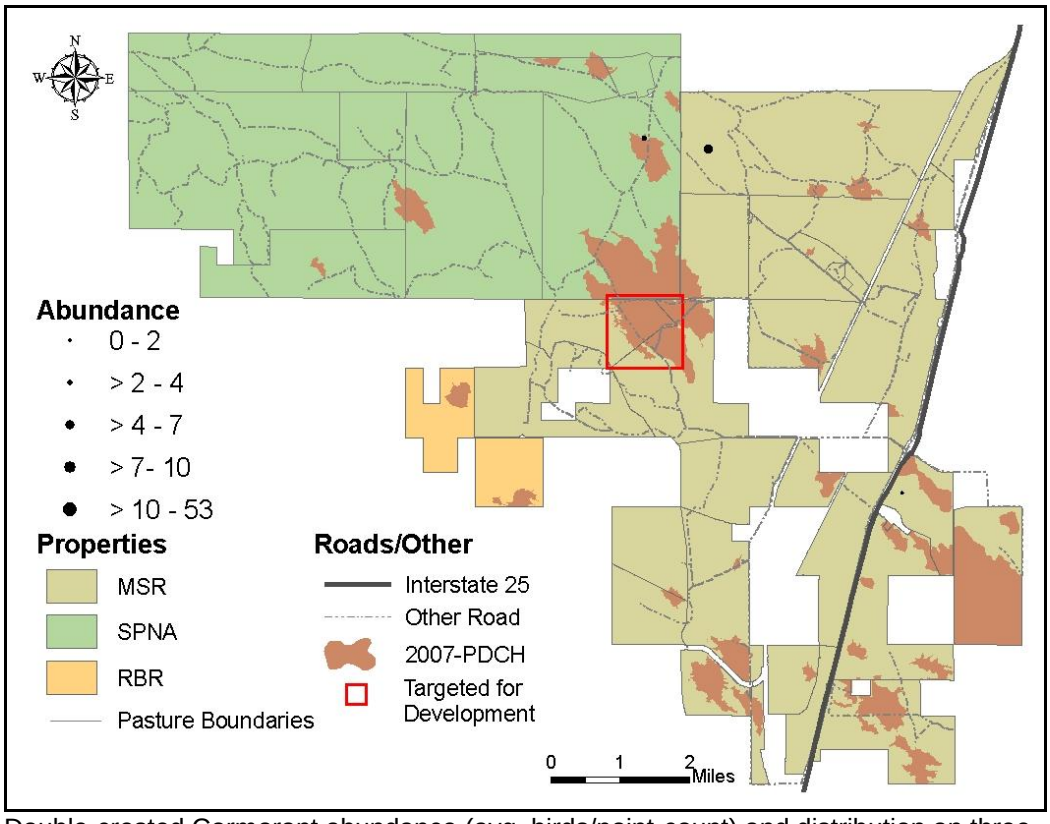
American White Pelican migrates through the study area, and sometimes over-summers on nearby lakes, but does not breed within the study area. Pelicans utilize ponds, reservoirs, and intermittent wetlands in short grass prairies for foraging and resting, and were most often seen soaring overhead.



American White Pelican abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Double-crested Cormorant

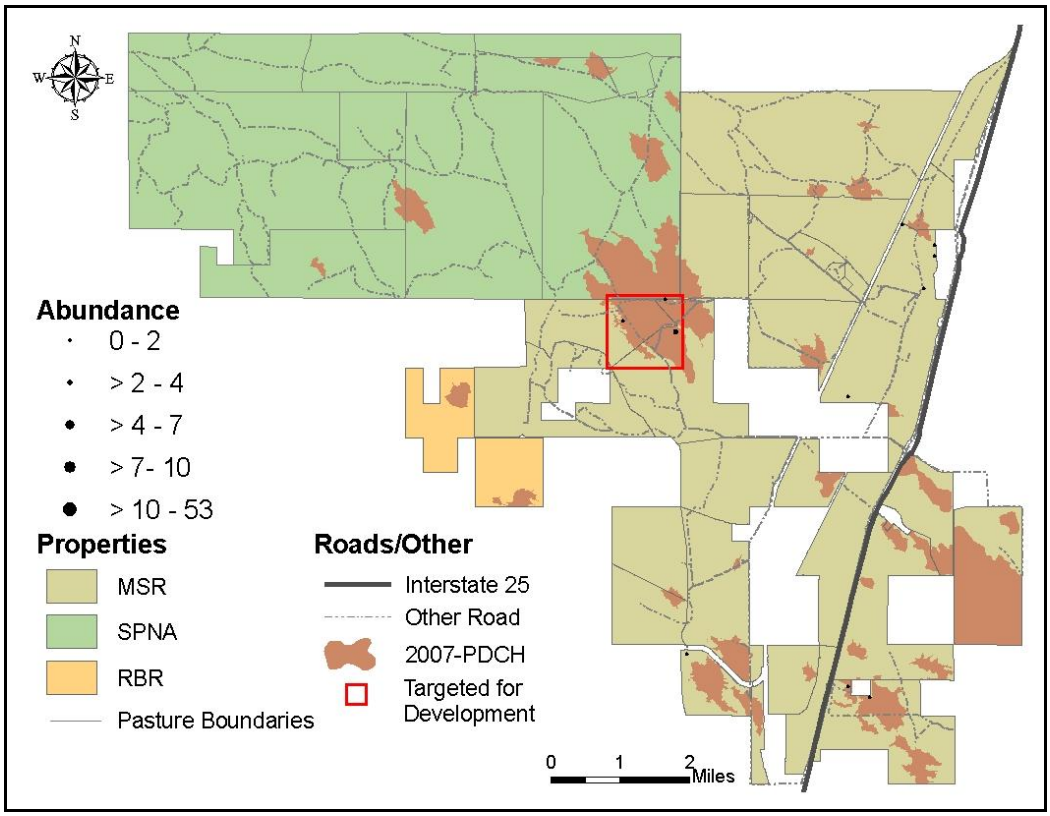
Double-crested Cormorant breeds locally near lakes, rivers, and other wetlands, but not within the study area due to lack of suitable habitat such as reservoirs with islands and isolated woodlands for nesting.



Double-crested Cormorant abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Great Blue Heron

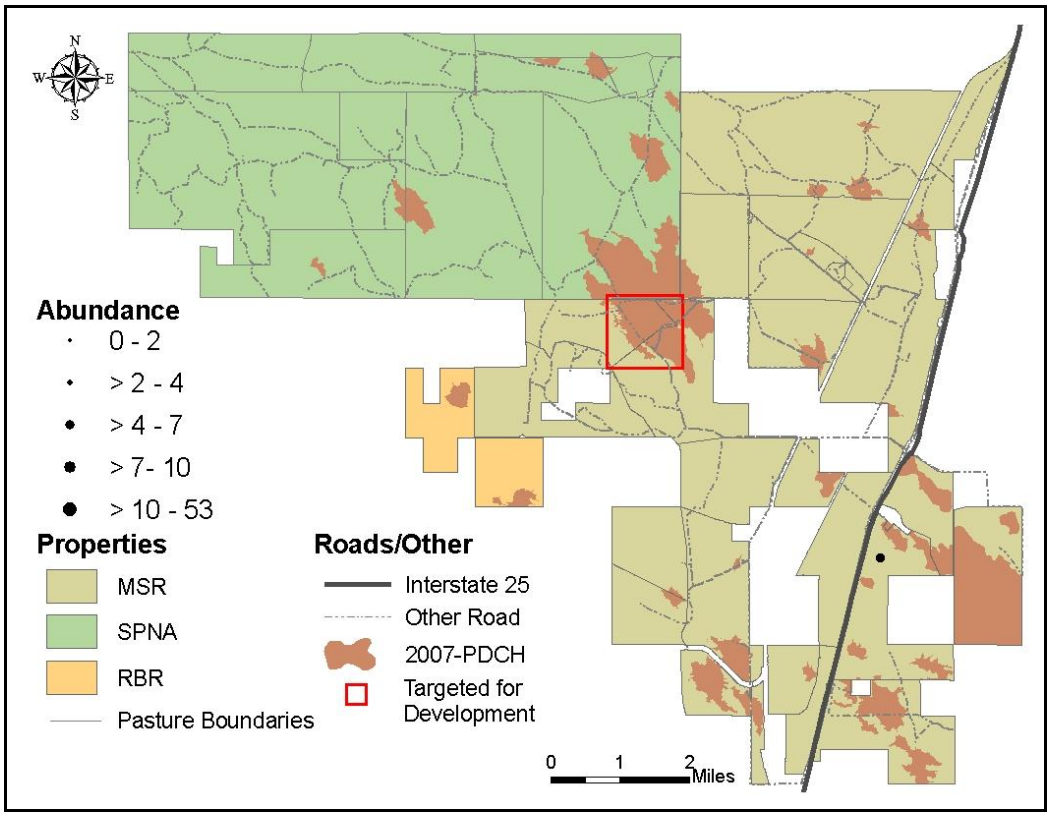
Great Blue Heron was observed actively foraging in shallow wetlands and ponds within the study area and flying overhead. Although their primary diet consists of fish and amphibians, they are also known to feed on rodents. This species breeds locally, but is an unlikely breeder in the study area due to lack of suitable nesting habitat such as islands or in wooded swamps.



Great Blue Heron abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Canada Goose

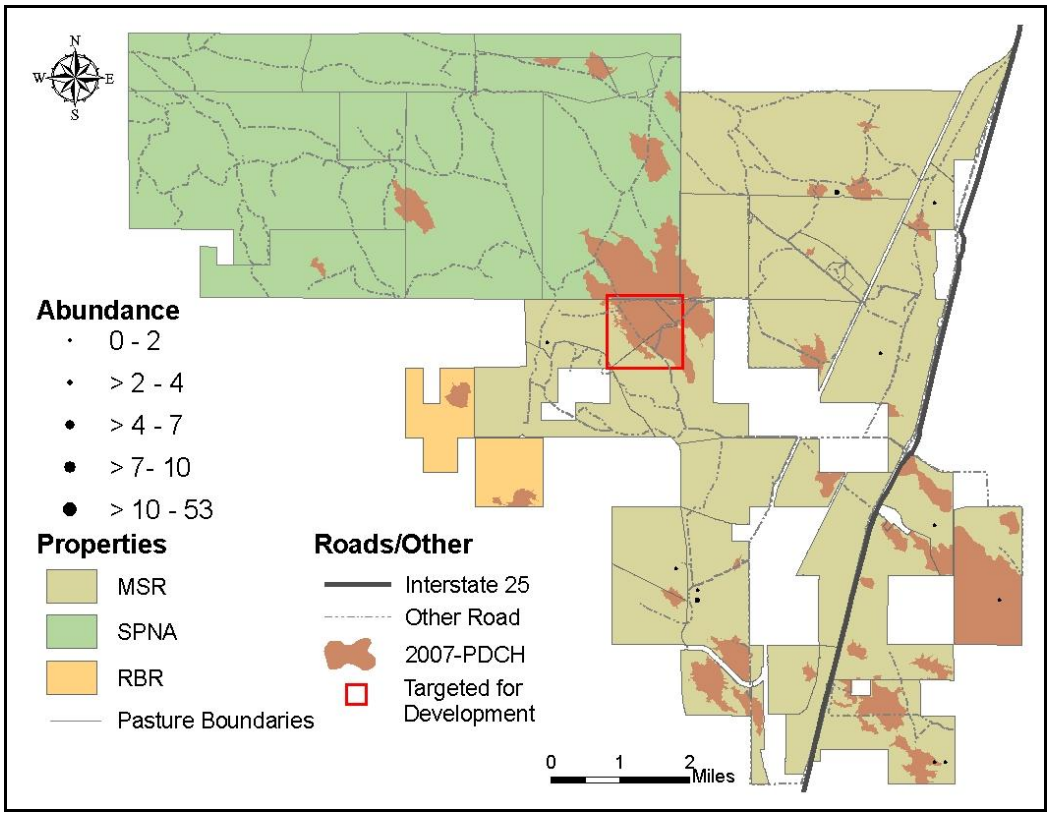
Canada Goose may use short grass prairie habitat and associated wetlands for foraging, brood-rearing, and nesting. Canada Goose breeds locally, but it is an unlikely breeder in the study area, as they require lakes and ponds for nesting.



Canada Goose abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Mallard

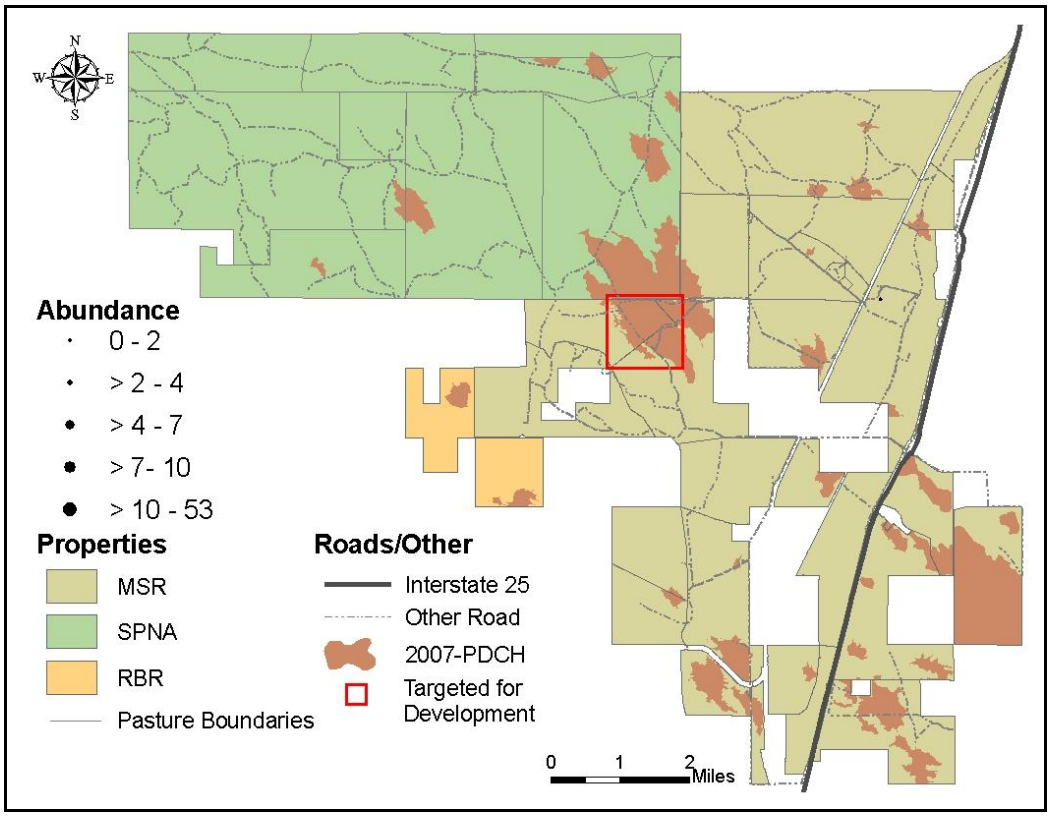
Mallard pairs were seen utilizing shallow intermittent wetlands within the study area, and are probable breeders in the study area in tall grasslands near water.



Mallard abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Northern Shoveler

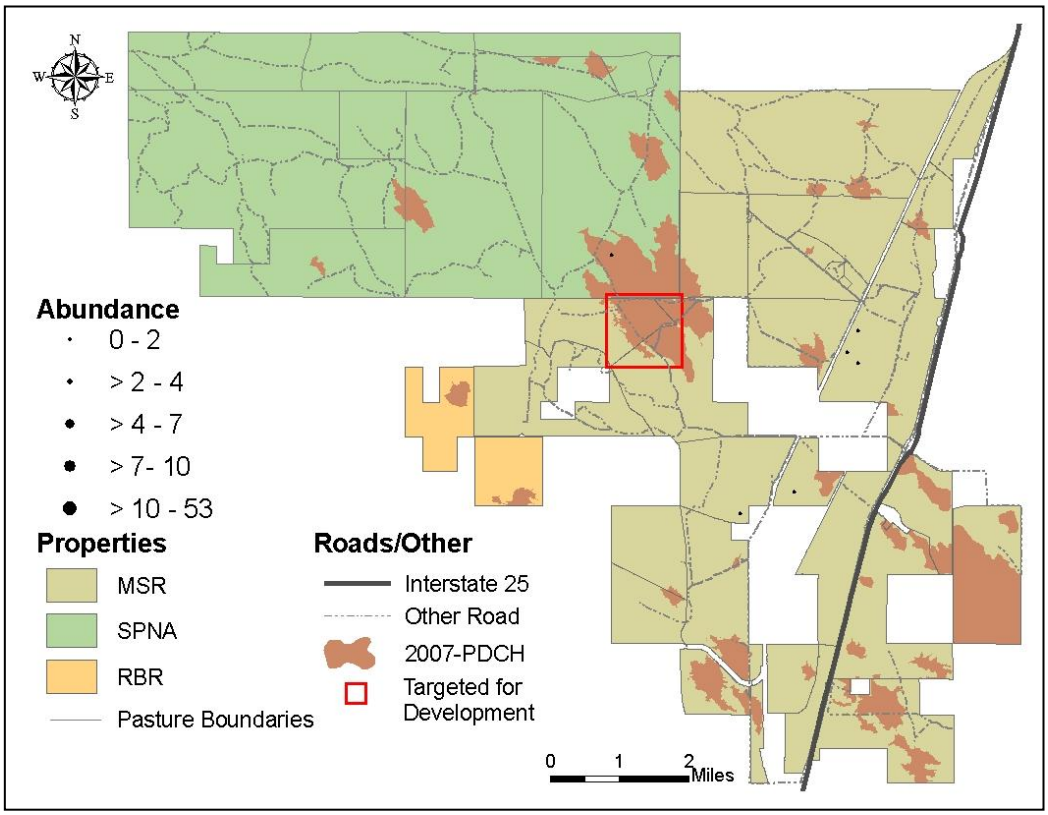
Northern Shoveler breeds locally but is not likely to breed in the study area due to the lack of ponds and other suitable habitat.



Northern Shoveler abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Turkey Vulture

Turkey Vulture is breeds locally and may use rock outcrops or cliffs within the study area for nesting or roosting, and is therefore a possible breeder. Turkey Vultures were most often seen soaring over MSR and SPNA.



Turkey Vulture abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Northern Harrier

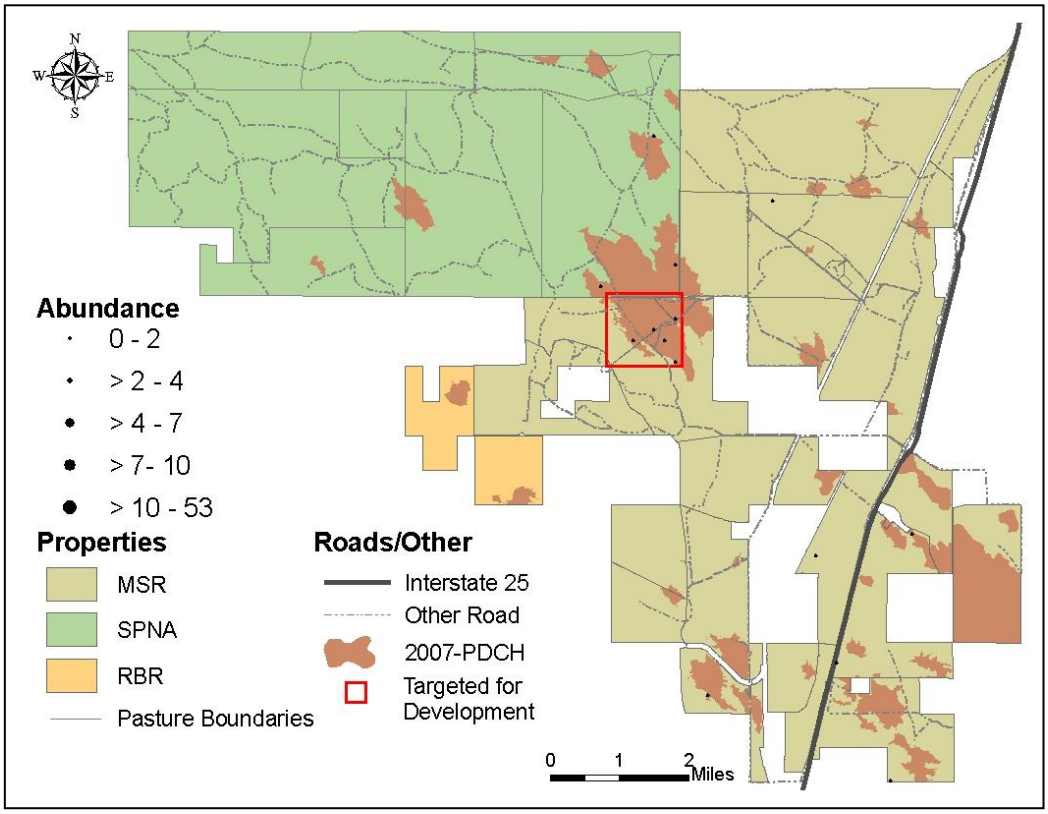
Priority species (PIF, CDOW)

Northern Harrier was observed actively foraging on MSR and SPNA and is a possible breeder there in areas of tall grass, such as in and near wetlands. Northern Harriers utilize a variety of open habitats including wetlands and prairies. Eighty percent of Northern Harrier detections were within PDCH.

Northern Harrier density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area (global) in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.32	36.88	0.15	0.69	1
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.23	36.84	0.10	0.49	1
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.47	36.85	0.22	1.02	3
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.17	36.80	0.08	0.36	2
Butte north	0.24	36.80	0.11	0.53	2
Butte west	0.00				0
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.20	36.83	0.09	0.43	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Soapstone	0.29	36.80	0.13	0.63	3
Round Butte	0.00				0
Meadow Springs	0.08	36.79	0.03	0.16	10
Global	**0.09**	**36.79**	**0.04**	**0.19**	**13**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D



Northern Harrier abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Swainson's Hawk

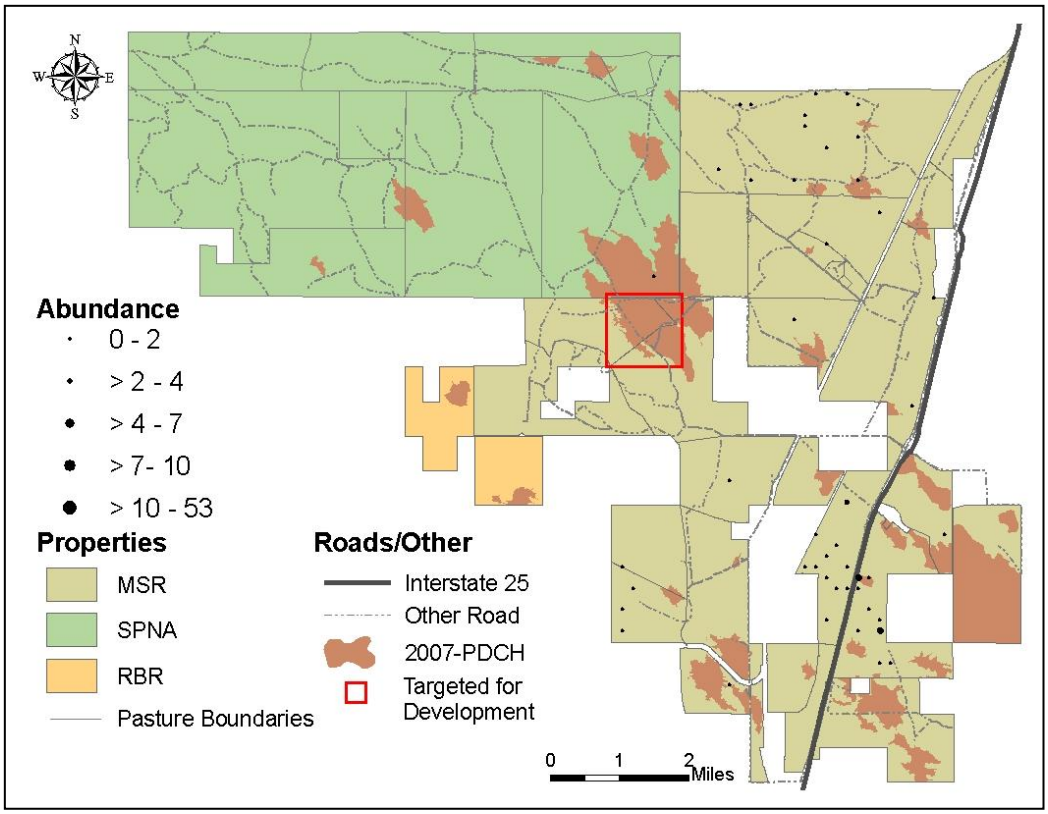
Priority species (PIF, CDOW, USFWS)

Swainson's Hawk was the most frequently observed raptor within the study area. This long-distance migratory hawk, which winters primarily in Argentina, forages on insects, birds, and small mammals in native grasslands during the breeding season. In 2009 we observed territorial calls (associated with reproductive territories) on the western portion of Barton upper southwest pasture. In 2008 we observed an active nest in north Lewis pasture of MSR.

Swainson's Hawk density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	1.14	32.62	0.57	2.27	1
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	2.43	32.62	1.22	4.86	2
Benson north north	0.00				0
Benson north south	3.82	48.66	1.23	11.83	4
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	1.29	32.57	0.65	2.57	2
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.00				0
Butte north	0.00				0
Butte west	0.00				0
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.67	32.55	0.33	1.34	3
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Soapstone	0.40	32.55	0.20	0.80	1
Round Butte	0.00				0
Meadow Springs	0.37	33.23	0.18	0.74	12
Global	**0.35**	**33.09**	**0.18**	**0.71**	**13**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Swainson's Hawk abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

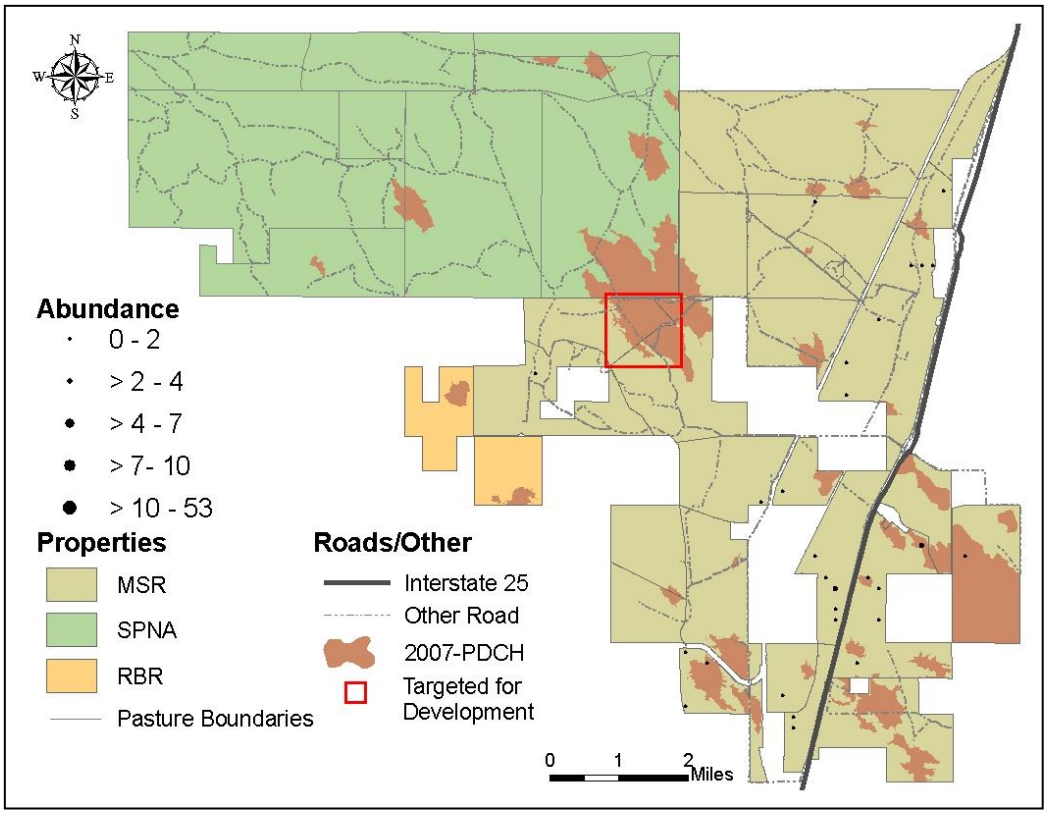
Red-tailed Hawk

Red-tailed Hawk is a fairly common breeding species in the study area, in open prairie and woodland habitats. It increases in abundance with sufficient high perches for foraging. Red-tailed Hawks were predominately observed in the eastern portion of MSR where roads and telephone poles were more common. In 2008 we found a nest with two young in Lonetree pasture.

Red-tailed Hawk density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	1.19	78.95	0.28	5.05	3
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.25	78.93	0.06	1.05	1
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	1.20	102.42	0.14	9.93	3
Benson south	2.58	79.36	0.61	10.95	3
Benson south c-100	0.63	79.01	0.15	2.66	1
Bulger north	0.59	78.93	0.14	2.50	3
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.00				0
Butte north	0.00				0
Butte west	0.20	78.93	0.05	0.84	1
Carr	0.18	78.92	0.04	0.77	1
Lewis middle east	0.00				0
Lewis middle north	0.25	78.93	0.06	1.06	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	1.55	79.77	0.36	6.63	2
Lonetree north	0.00				0
Lonetree south	0.65	78.92	0.15	2.76	5
Meadow	0.00				0
Soapstone	0.00				0
Round Butte	0.00				0
Meadow Springs	0.23	79.09	0.05	0.96	24
Global	**0.20**	**79.09**	**0.05**	**0.84**	**24**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Red-tailed Hawk abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Ferruginous Hawk

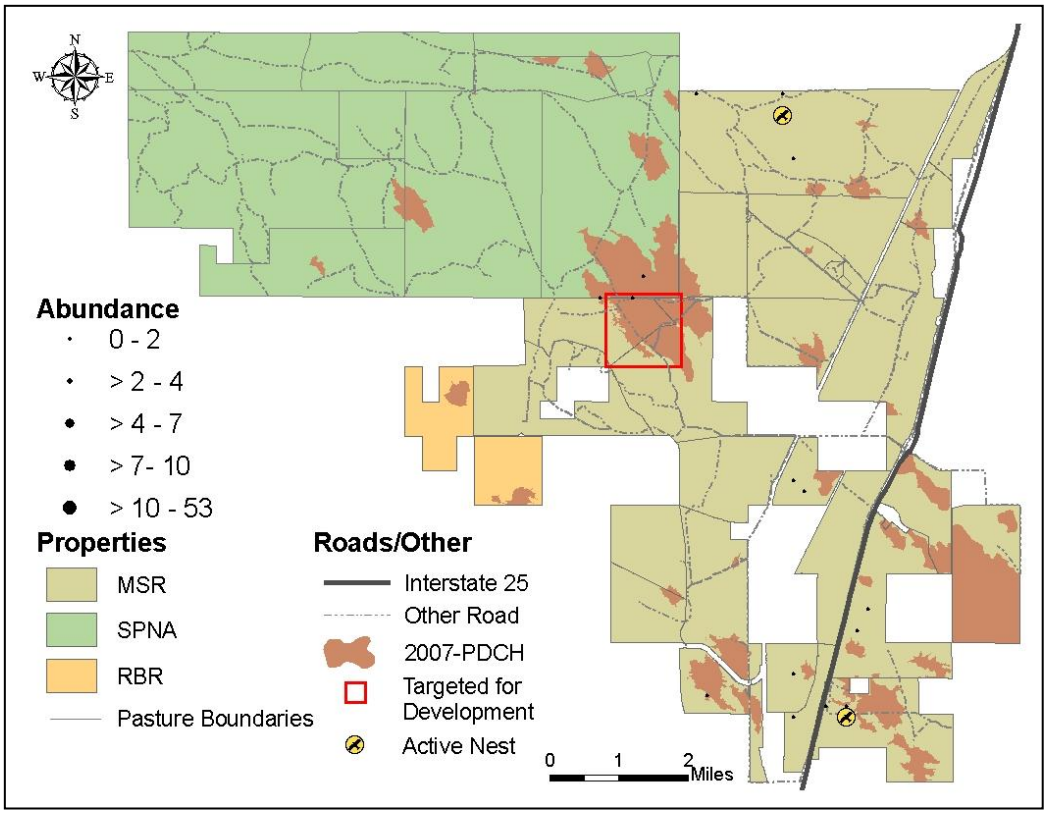
Priority species (PIF, CDOW)

Ferruginous Hawk is grassland obligate that nests mainly in isolated trees within the study area. Primary prey consists of prairie dogs, ground squirrels, rabbits and other small mammals. Twenty-nine percent of all Ferruginous Hawk observations were within PDCH. Two active nests were located on MSR property; one south of the Black-footed Ferret breeding facility in south Bulger pasture within PDCH, and another in north Lewis pasture. A third active nest was located just off of MSR, on the inholding surrounded mostly by north Bulger pasture, and at least one other active nest is known on SPNA.

Ferruginous Hawk density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.16	28.90	0.09	0.29	1
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.34	29.27	0.18	0.62	1
Benson south c-100	0.25	29.05	0.14	0.45	1
Bulger north	0.15	28.82	0.08	0.28	2
Bulger south	0.31	28.85	0.17	0.56	4
Bull	0.48	29.02	0.26	0.87	2
Butte east	0.00				0
Butte north	0.06	28.91	0.03	0.11	1
Butte west	0.00				0
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.11	28.80	0.06	0.19	4
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.06	28.80	0.03	0.11	16
Round Butte	0.00				0
Soapstone	0.10	28.80	0.05	0.18	1
Global	**0.05**	**29.10**	**0.03**	**0.10**	**17**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Ferruginous Hawk abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Golden Eagle

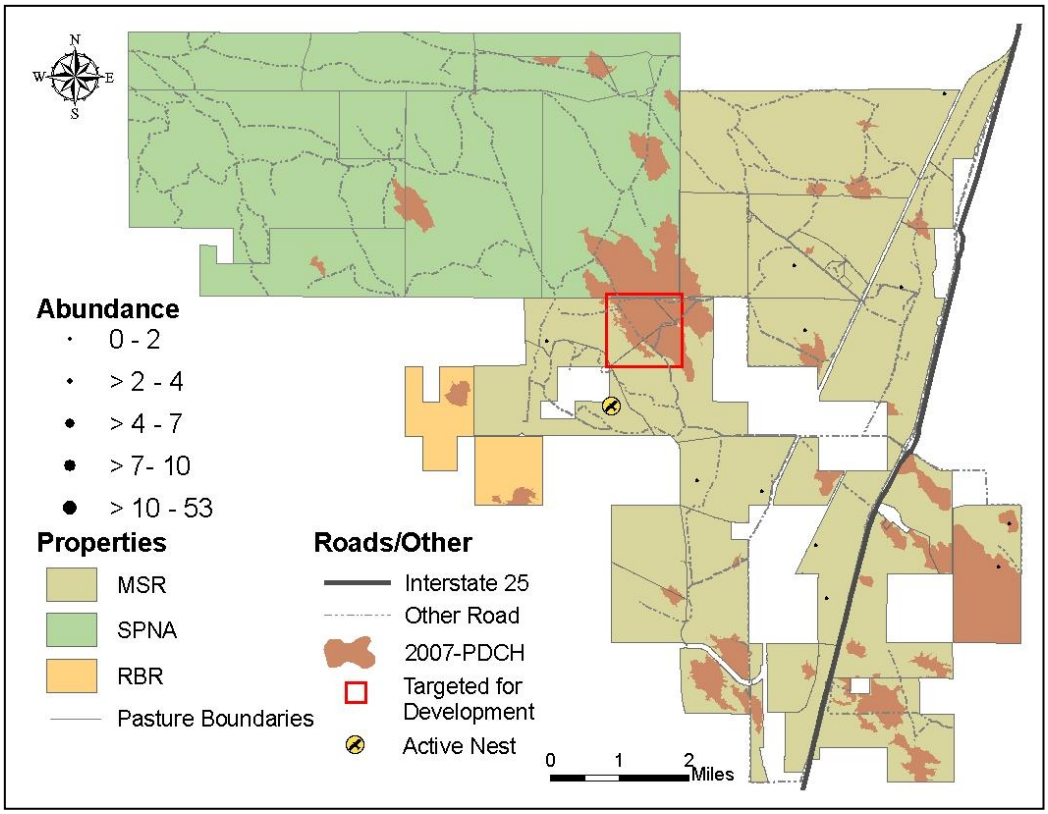
Priority species (CDOW, USFWS)

Golden Eagle is a regular breeder in the study area, although uncommon throughout. Golden Eagles forage in open habitats and use cliffs for nesting. In 2008 an active nest was located in Butte west pasture of MSR.

Golden Eagle density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.10	18.48	0.07	0.15	2
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.12	18.50	0.08	0.18	2
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.00				0
Butte north	0.03	18.61	0.02	0.05	1
Butte west	0.00				0
Carr	0.07	18.45	0.05	0.11	2
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.08	18.57	0.05	0.12	1
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.05	18.51	0.03	0.08	1
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.03	18.44	0.02	0.04	1
Meadow	0.00				0
Meadow Springs	0.02	18.42	0.01	0.03	10
Round Butte	0.00				0
Soapstone	0.00				0
Global	**0.02**	**18.42**	**0.01**	**0.03**	**10**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Golden Eagle abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.


Golden Eagles on Meadow Springs Ranch, Larimer County, Colorado. Photo by Mike Forsberg.

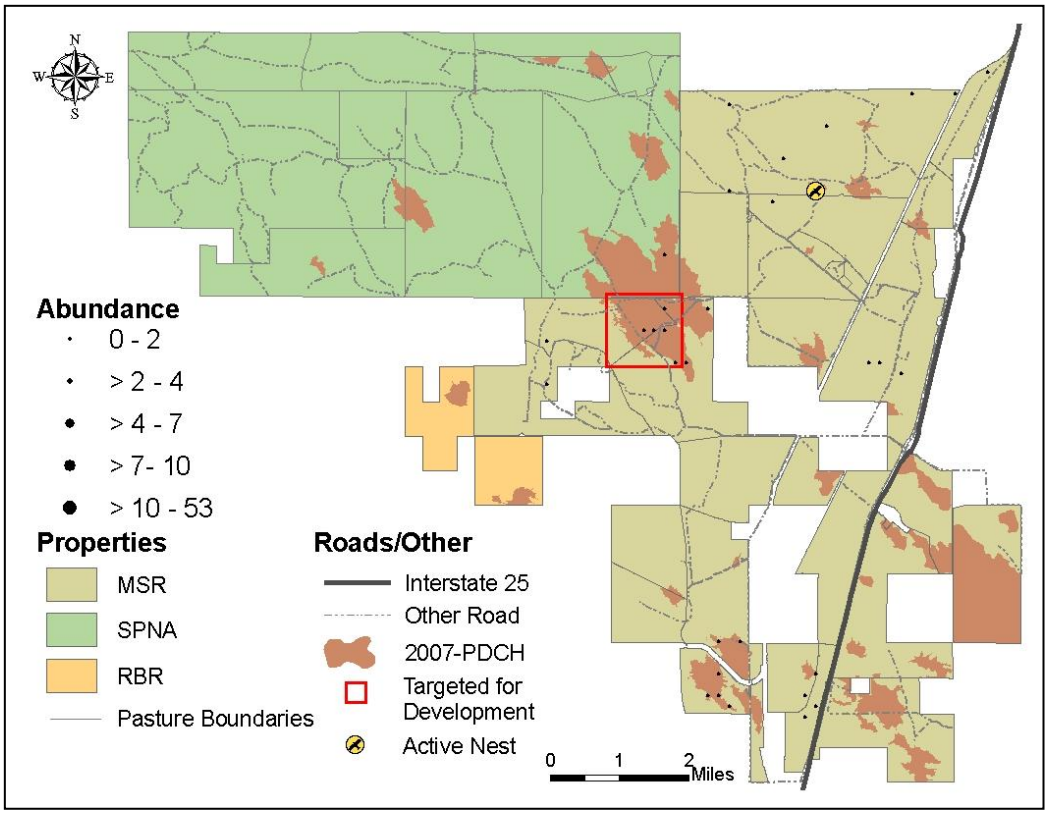
American Kestrel

American Kestrel is a common falcon that utilizes open and semi-open habitats with short vegetation. We found American Kestrels nesting in a nest box on a stock-tank windmill in north Lewis pasture on Meadow Springs Ranch. Sixty-three percent of Kestrel detections were in PDCH, suggesting a probably link to this habitat type, likely for hunting. Two Kestrel bodies were removed from a stock tank near Carr road during the study; such deaths may be prevented by use of stock tank ladders. Please contact RMBO to find out how to obtain free stock tank ladders.

American Kestrel density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	1.29	26.53	0.74	2.25	4
Barton upper c-300	0.00				0
Barton upper east	0.38	21.76	0.25	0.59	2
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	2.44	40.10	0.49	12.08	2
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.60	21.73	0.38	0.93	6
Butte north	0.45	42.86	0.06	3.20	3
Butte west	0.19	21.76	0.12	0.29	1
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.24	21.78	0.15	0.37	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.39	21.73	0.25	0.60	6
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.47	21.94	0.30	0.73	1
Lonetree south	0.37	21.74	0.24	0.57	3
Meadow	0.00				0
Meadow Springs	0.26	22.12	0.17	0.41	29
Round Butte	0.00				0
Soapstone	0.12	21.74	0.07	0.18	1
Global	**0.24**	**22.09**	**0.15**	**0.37**	**30**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



American Kestrel abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Prairie Falcon

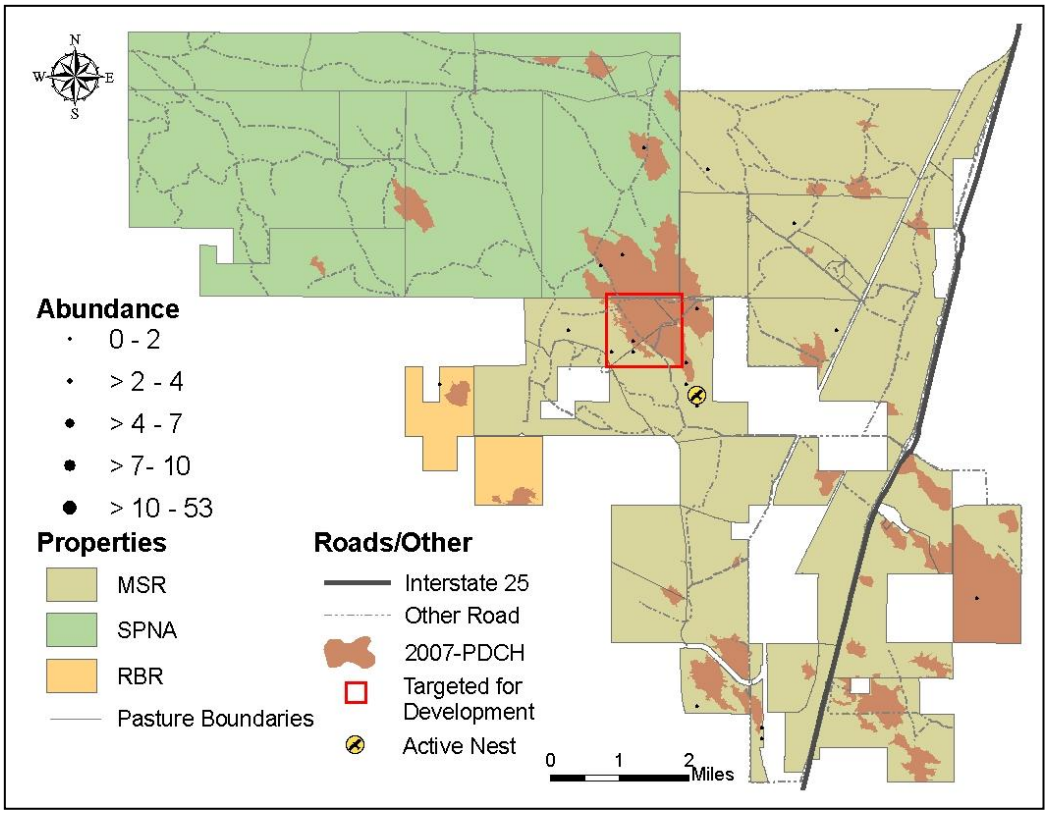
Priority species (PIF, CDOW, USFWS)

Prairie Falcon is an uncommon but confirmed breeder in the study area, preferring open habitats near cliffs and bluffs. We observed one nest in Butte east pasture of MSR, possibly the only nest on MSR. Another nest is known from SPNA. Prairie Falcons feed on ground squirrels, small birds, and reptiles.

Prairie Falcon density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	2.49	171.71	0.20	30.24	3
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.88	171.69	0.07	10.66	4
Butte north	0.95	171.70	0.08	11.59	3
Butte west	0.00				0
Carr	0.38	171.70	0.03	4.59	1
Lewis middle east	0.00				0
Lewis middle north	0.52	171.70	0.04	6.36	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.52	171.70	0.04	6.36	1
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.26	171.69	0.02	3.13	13
Round Butte	0.35	171.70	0.03	4.26	1
Soapstone	0.77	171.69	0.06	9.32	3
Global	**0.30**	**171.69**	**0.02**	**3.61**	**17**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Prairie Falcon abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.


Prairie Falcon at nest on Meadow Springs Ranch, Larimer County, Colorado. Photo by Mike Forsberg.

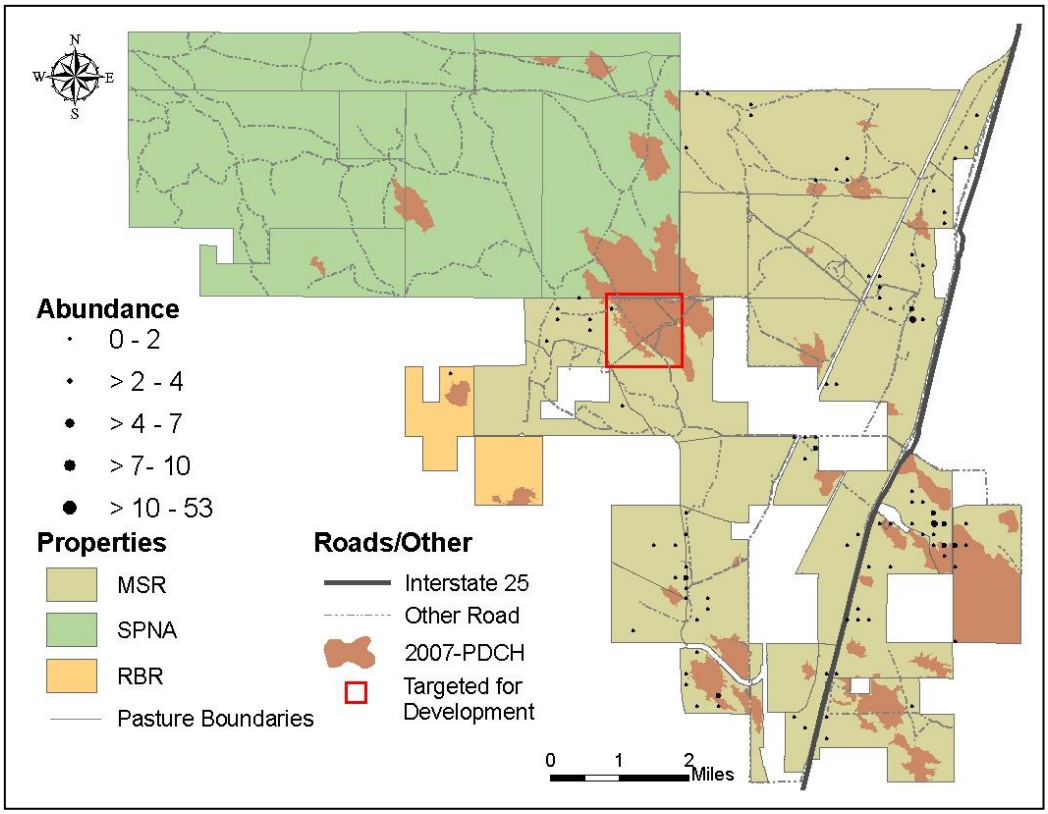
Killdeer

Killdeer breeds in open areas with bare ground or gravel, such as around stock tanks and windmills. They forage typically around wet areas. Killdeer is a probable breeder in the study area.

Killdeer density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	8.08	41.12	3.45	18.90	6
Barton upper c-300	4.17	37.36	1.87	9.31	4
Barton upper east	11.04	28.98	6.29	19.38	12
Barton upper north	0.75	27.93	0.43	1.29	1
Barton upper southwest	1.12	27.98	0.65	1.94	1
Benson north north	0.00				0
Benson north south	1.73	27.94	1.01	2.99	2
Benson south	16.84	28.35	9.71	29.23	3
Benson south c-100	0.00				0
Bulger north	7.74	27.94	4.49	13.33	13
Bulger south	1.76	27.91	1.02	3.04	3
Bull	12.84	32.53	6.79	24.26	6
Butte east	0.00				0
Butte north	2.31	27.96	1.34	3.98	5
Butte west	0.00				0
Carr	1.65	27.91	0.96	2.83	3
Lewis middle east	0.00				0
Lewis middle north	0.76	27.93	0.44	1.31	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	1.65	27.89	0.96	2.83	8
Lewis south	0.00				0
Lonetree middle	7.06	28.36	4.07	12.25	3
Lonetree north	7.38	125.38	0.00	138490.00	3
Lonetree south	3.73	58.12	1.15	12.11	9
Meadow	29.82	29.61	16.80	52.93	19
Meadow Springs	3.48	28.08	2.01	6.01	102
Round Butte	0.51	27.91	0.30	0.88	1
Soapstone	0.00				0
Global	**3.10**	**28.07**	**1.80**	**5.35**	**103**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Killdeer abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Mountain Plover

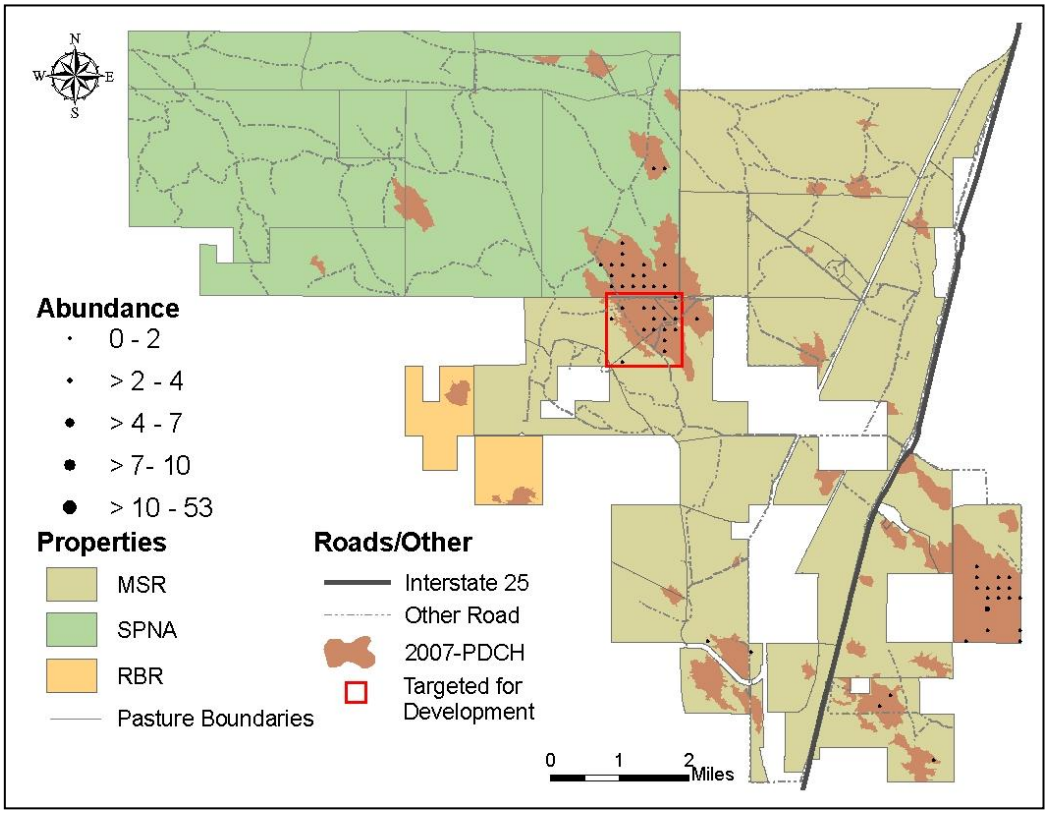
Priority species (CDOW, USFWS)

Mountain Plover is an uncommon to rare shorebird that nests only in the Great Plains, primarily in shortgrass prairie with extensive bare ground, especially prairie dog towns. Meadow Springs Ranch and Soapstone Prairie together appear to support a breeding population of approximately 50 individuals, which is significant given an estimated global population of 12,000-18,000 individuals. Ninety-eight percent of all Mountain Plover detections in this study were in PDCH, demonstrating the close association between prairie dogs and Mountain Plovers within the study area (Table 3).

Mountain Plover density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	0.00				0
Barton upper east	0.42	35.77	0.03	5.18	2
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.40	12.97	0.31	0.52	3
Bull	0.00				0
Butte east	0.80	12.92	0.62	1.03	11
Butte north	1.28	21.65	0.82	2.00	11
Butte west	0.00				0
Carr	2.86	14.09	2.17	3.78	19
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.36	13.54	0.28	0.48	46
Round Butte	0.00				0
Soapstone	2.09	13.44	1.60	2.74	20
Global	**0.46**	**13.25**	**0.36**	**0.60**	**66**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.

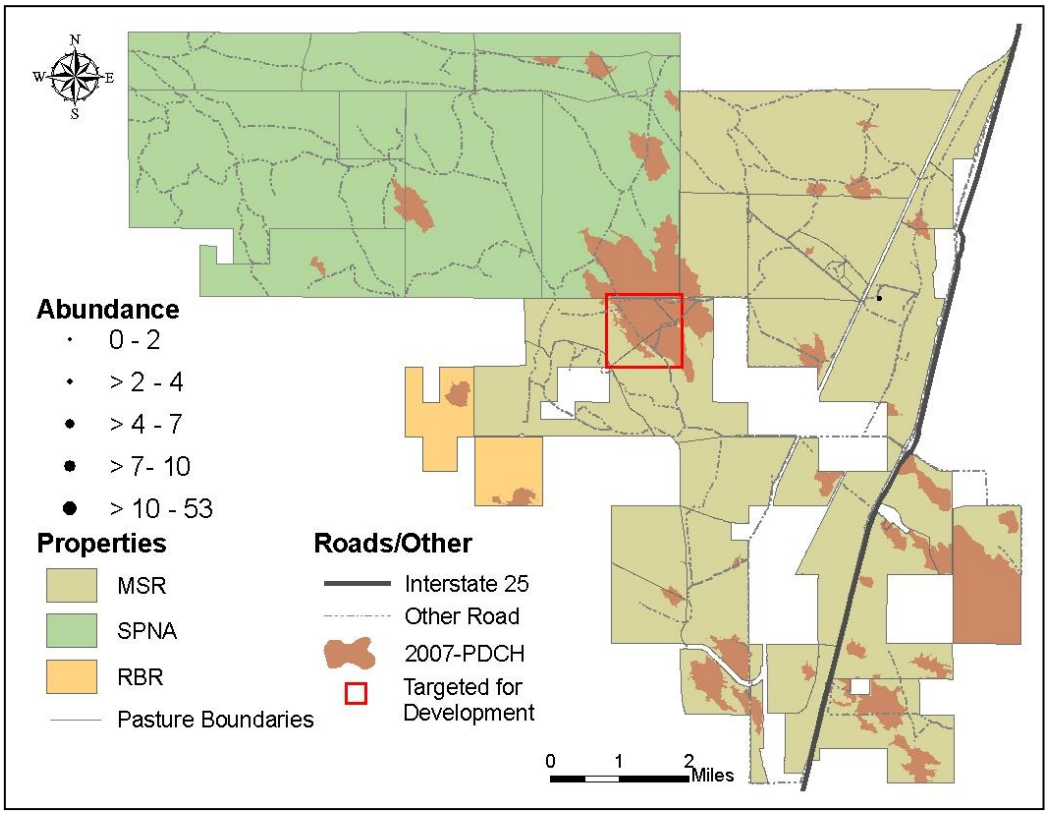


Mountain Plover abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.


Mountain Plover and young on Meadow Springs Ranch, Larimer County, Colorado. Photo by Mike Forsberg.

American Avocet

American Avocet breeds within the region, but we do no suspect breeding within the study area. Four American Avocets, likely transient migrants, were detected during one point-count survey in 2009. These birds were using an artificial pond belonging to the City of Fort Collins waste treatment facility, located on MSR property in Lonetree south pasture.

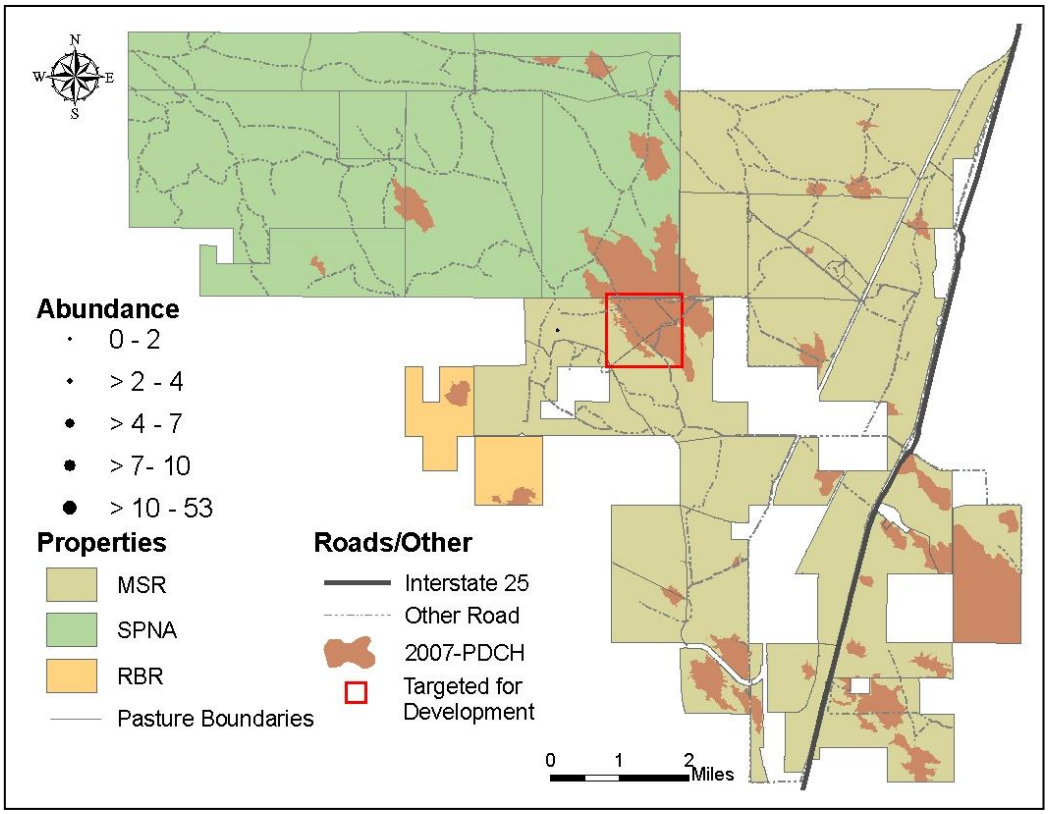


American Avocet abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Upland Sandpiper

Priority Species (CDOW, USFWS)

One Upland Sandpiper, likely a transient migrant, was detected in 2008 in Butte north pasture. The species is not known to breed locally; nearest known breeding sites are in northeastern Colorado.



Upland Sandpiper abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Long-billed Curlew

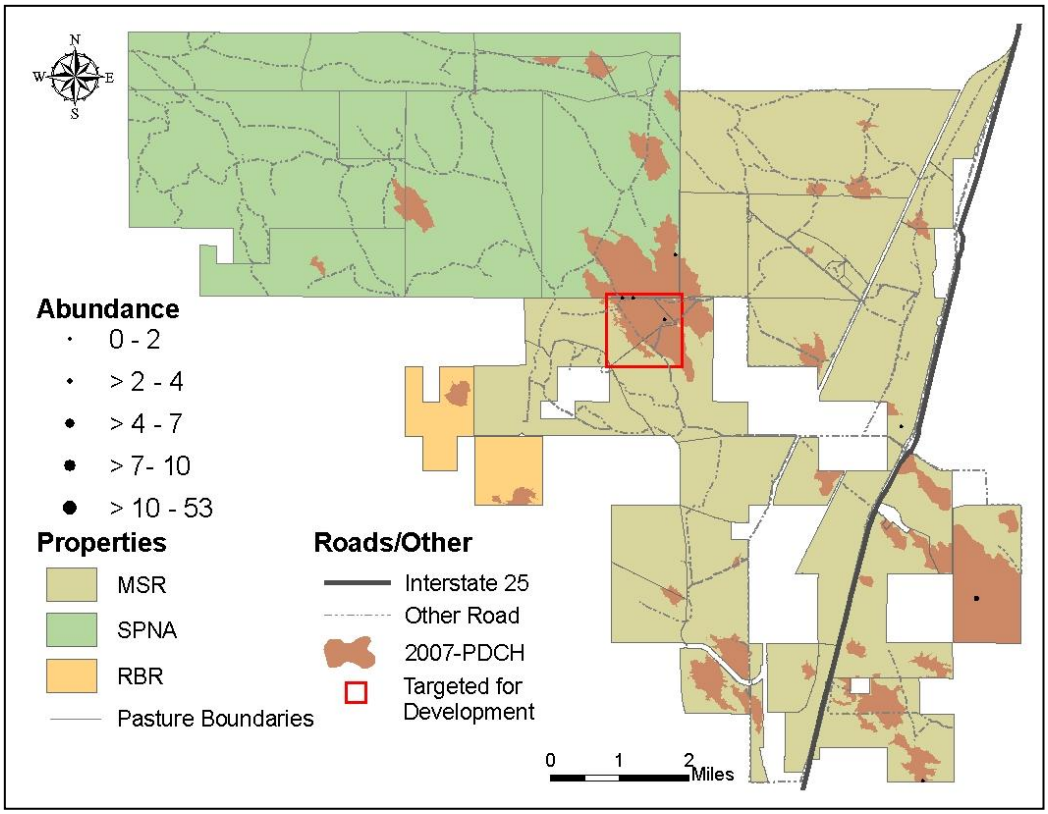
Priority species (CDOW, USFWS)

Long-billed Curlew is rare but possible breeder in the region, and a more regular transient migrant. We observed Long-billed Curlews only in PDCH, particularly in early spring. Long-billed Curlew is a species of conservation concern due to long term declines in the Great Plains breeding population.

Long-billed Curlew density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.26	183.50	0.01	7.66	1
Bull	0.00				0
Butte east	0.00				0
Butte north	0.31	183.49	0.01	9.02	3
Butte west	0.00				0
Carr	0.49	183.49	0.02	14.29	1
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.10	190.00	0.00	2.60	5
Round Butte	0.00				0
Soapstone	0.08	183.49	0.00	2.42	1
Global	**0.07**	**187.38**	**0.00**	**2.03**	**6**

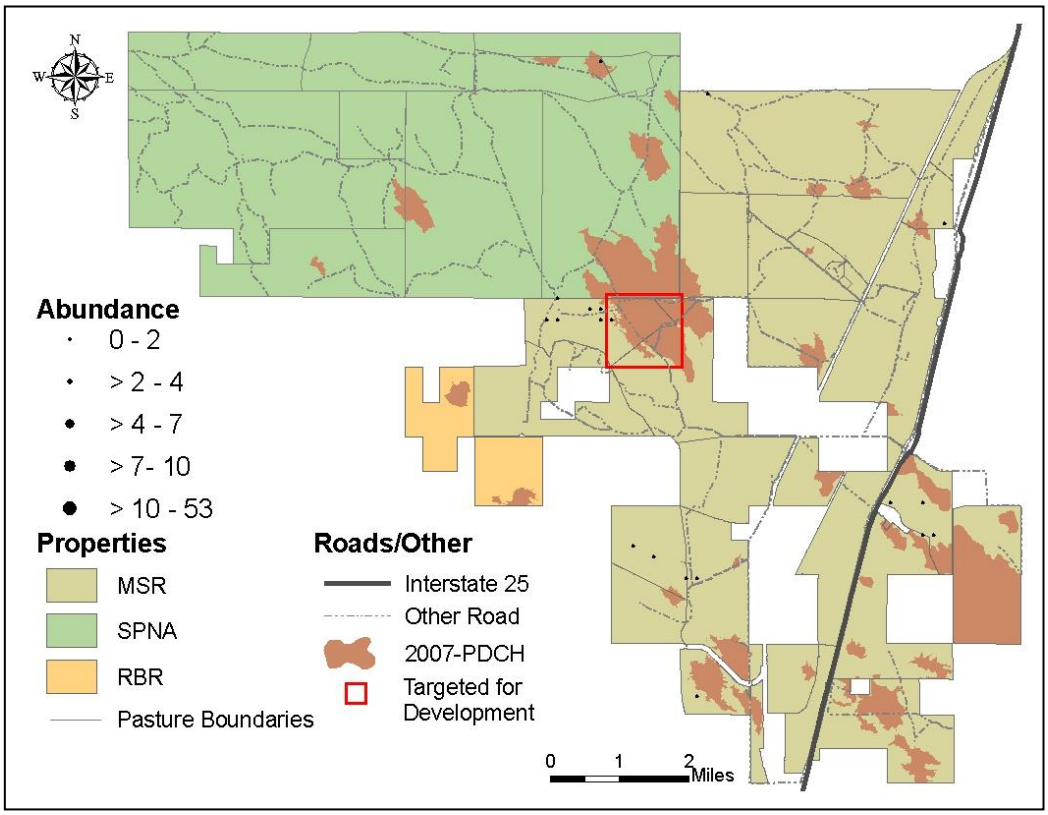
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate.



Long-billed Curlew abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Wilson's Snipe

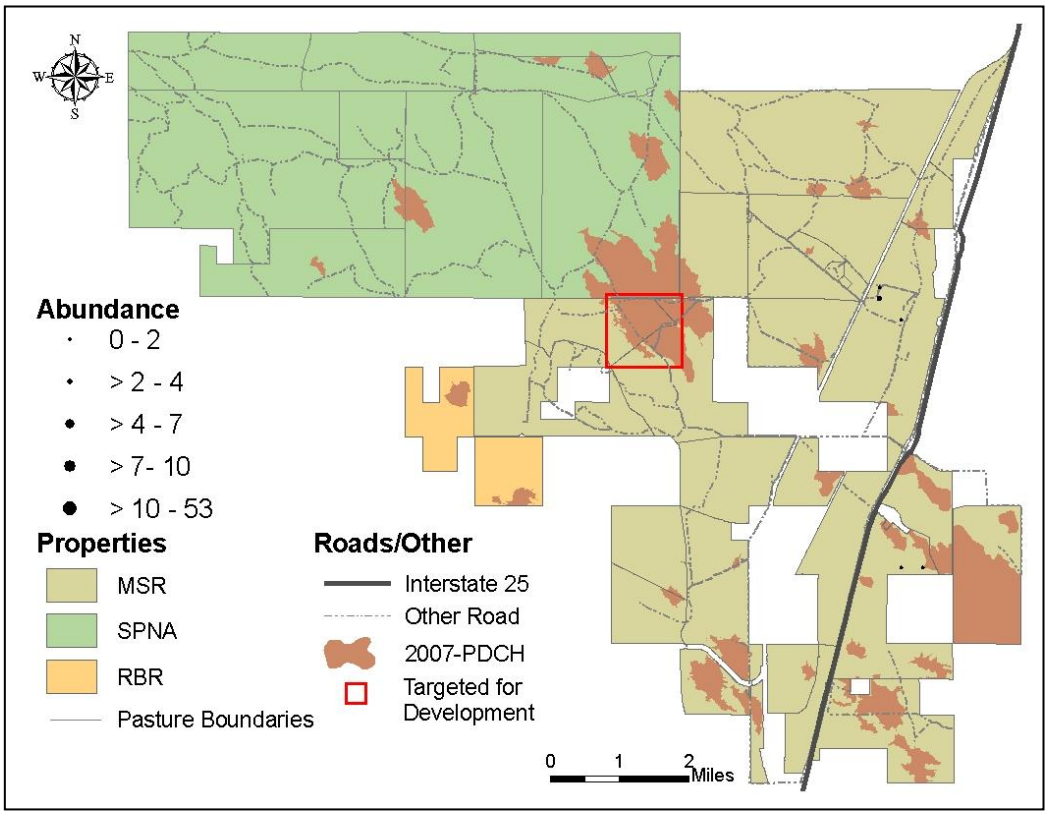
Wilson's Snipe is common in wetlands and wet meadows within the study area, where it is a probable breeder. Although the species both breeds and winters in Colorado, populations are highly migratory. Wilson Snipe breeds on marsh edges and in grassy meadows, and is entirely dependent on shallow wetlands in the region.



Wilson's Snipe abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Wilson's Phalarope

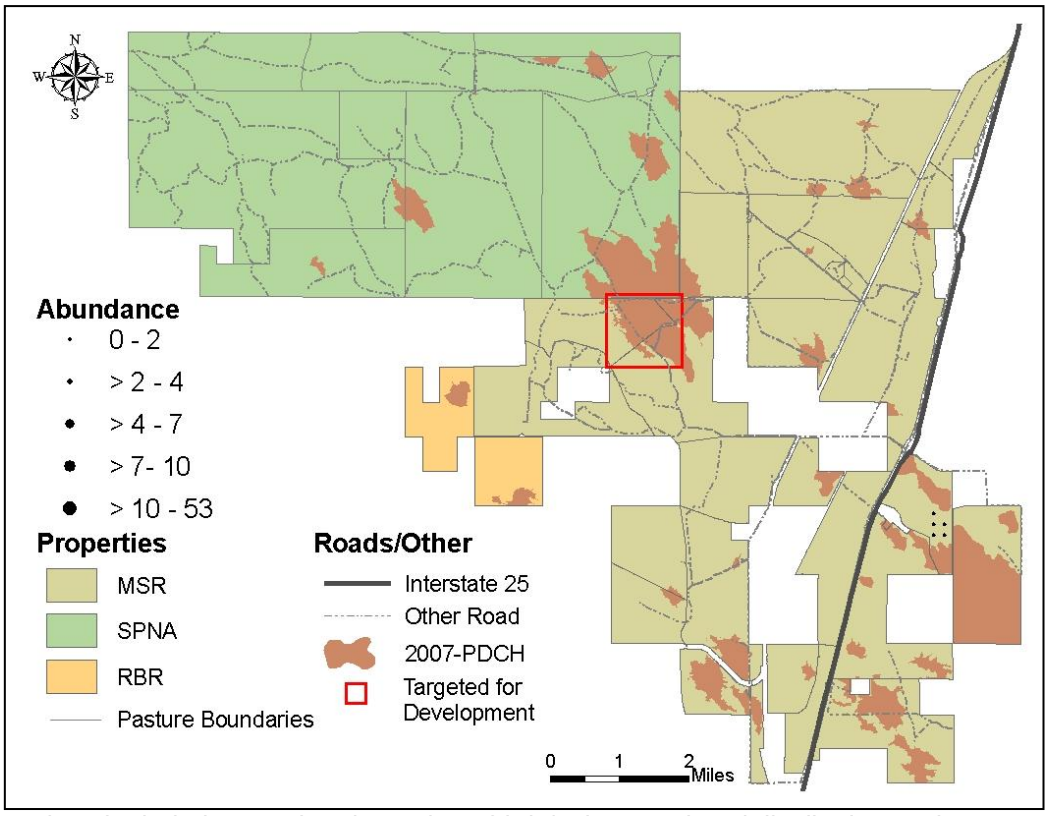
Wilson's Phalarope is a fairly common breeder in the region on shallow lakes and ponds. A small group of males and one female were seen using a pond on Lonetree south pasture for over two weeks in late June, indicating they could be possible breeders within the study area. This species exhibits reversed sex roles where males provide all parental care to the young, and females compete for mates.



Wilson's Phalarope abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Red-necked Phalarope

Red-necked Phalarope breeds in arctic tundra, and occurs only as an uncommon transient migrant in the study area. Much like Wilson's Phalaropes, Red-necked Phalaropes feed in shallow ponds on small aquatic invertebrates. Seven individuals were detected utilizing a pond on Meadow pasture of MSR in 2009.



Red-necked Phalarope abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

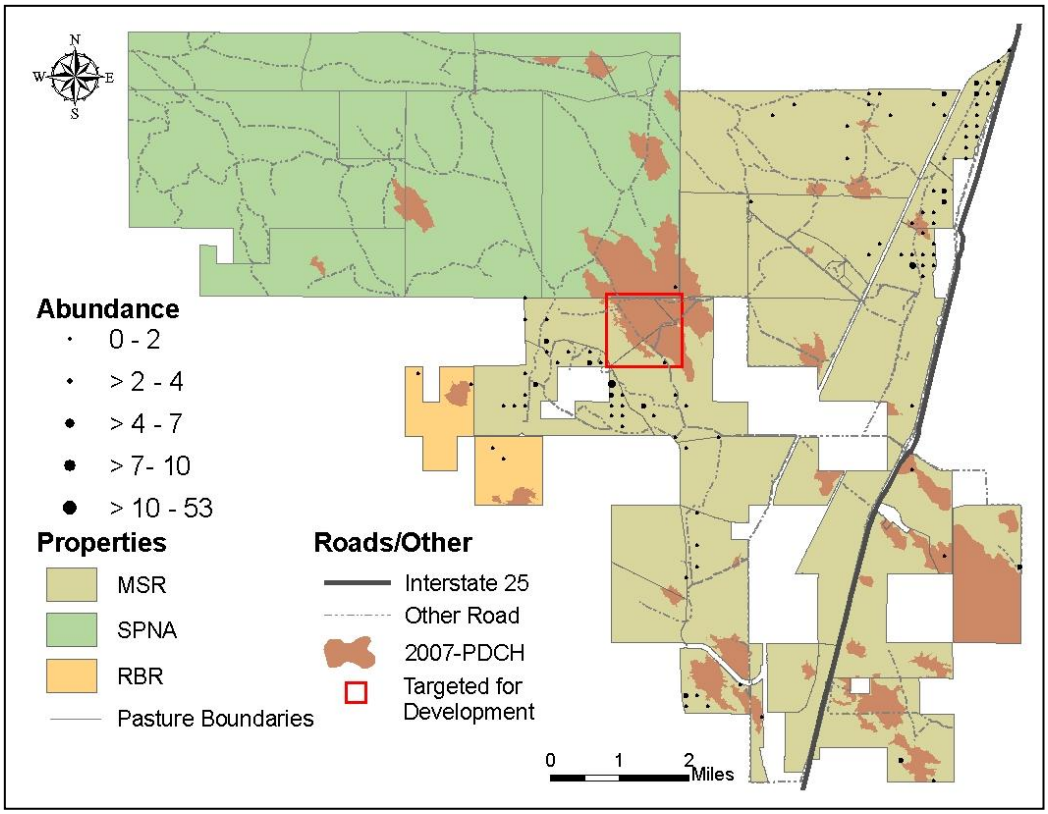
Mourning Dove

Mourning Dove is a common breeder in a variety of habitats within the study area. We observed Mourning Doves nesting in shrubs in open grassland habitat.

Mourning Dove density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	6.75	19.34	4.62	9.87	5
Barton upper c-300	0.00				0
Barton upper east	3.08	45.34	0.76	12.52	4
Barton upper north	1.11	18.84	0.77	1.60	3
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	1.66	37.75	0.28	9.94	3
Bull	0.00				0
Butte east	1.09	23.47	0.68	1.74	7
Butte north	1.32	32.11	0.58	3.00	4
Butte west	15.35	22.87	9.81	24.01	22
Carr	0.81	18.97	0.56	1.18	3
Lewis middle east	0.00				0
Lewis middle north	0.75	18.74	0.52	1.08	2
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	1.02	18.68	0.70	1.47	10
Lewis south	0.00				0
Lonetree middle	12.78	22.63	8.20	19.91	10
Lonetree north	19.36	19.79	13.14	28.52	24
Lonetree south	4.14	24.13	2.57	6.66	13
Meadow	1.25	18.84	0.86	1.81	2
Meadow Springs	2.32	18.97	1.60	3.36	112
Round Butte	0.25	18.71	0.17	0.36	1
Soapstone	0.18	18.69	0.13	0.26	1
Global	**2.05**	**18.96**	**1.41**	**2.97**	**114**

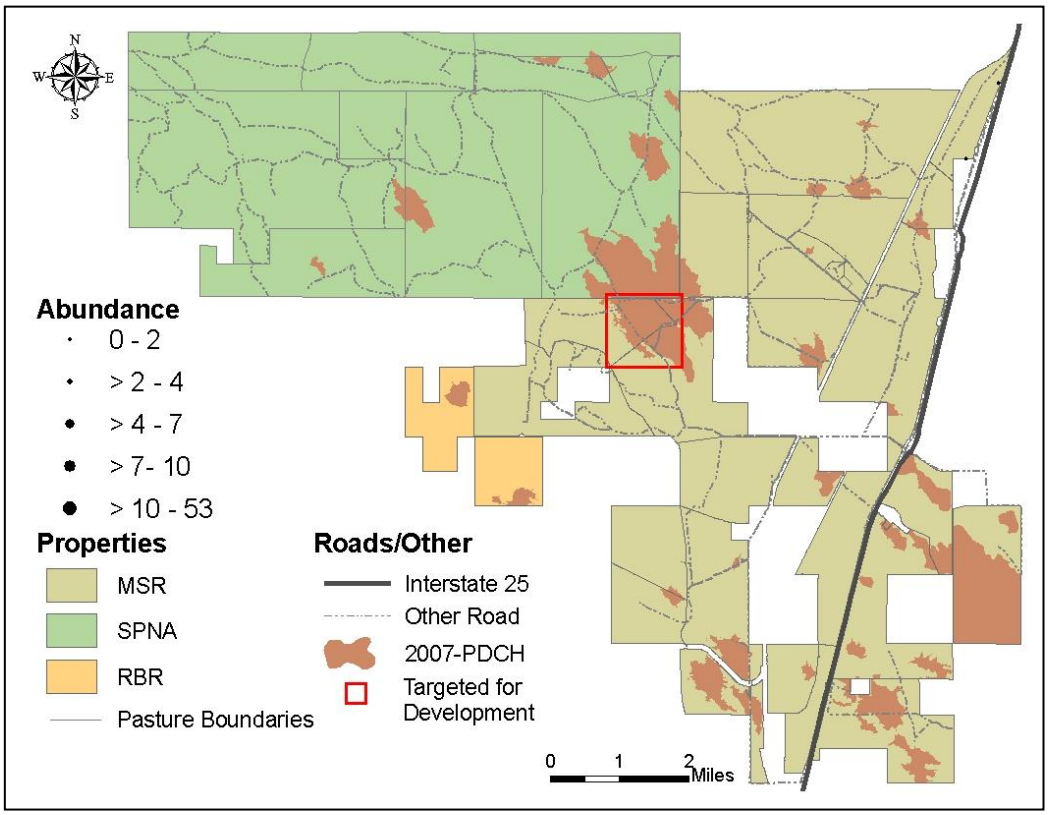
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate.



Mourning Dove abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Eurasian Collared-Dove

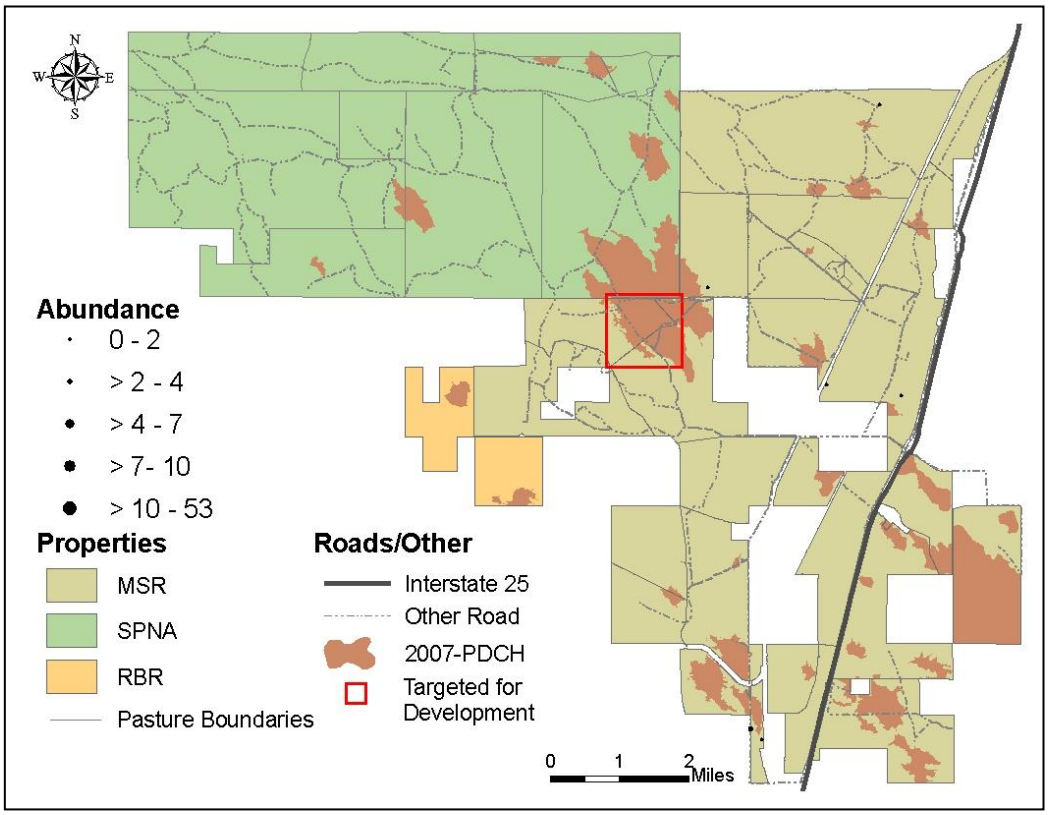
Eurasian Collared-Dove is a recent arrival to the Colorado Front Range region, where it currently breeds in semi-wooded to open habitats, mainly around human habitations and farms. We detected Eurasian Collared-Doves only in north Lonetree pasture, although it likely occurs elsewhere. This non-native species is rapidly expanding its range in North America.



Eurasian Collared-Dove abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld Counties, 2008 & 2009.

Rock Pigeon

Rock Pigeon is a non-native species with established breeding populations across the United States. It is typically found around man-made structures, but also breeds at natural cliff sites.



Rock Pigeon abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Burrowing Owl

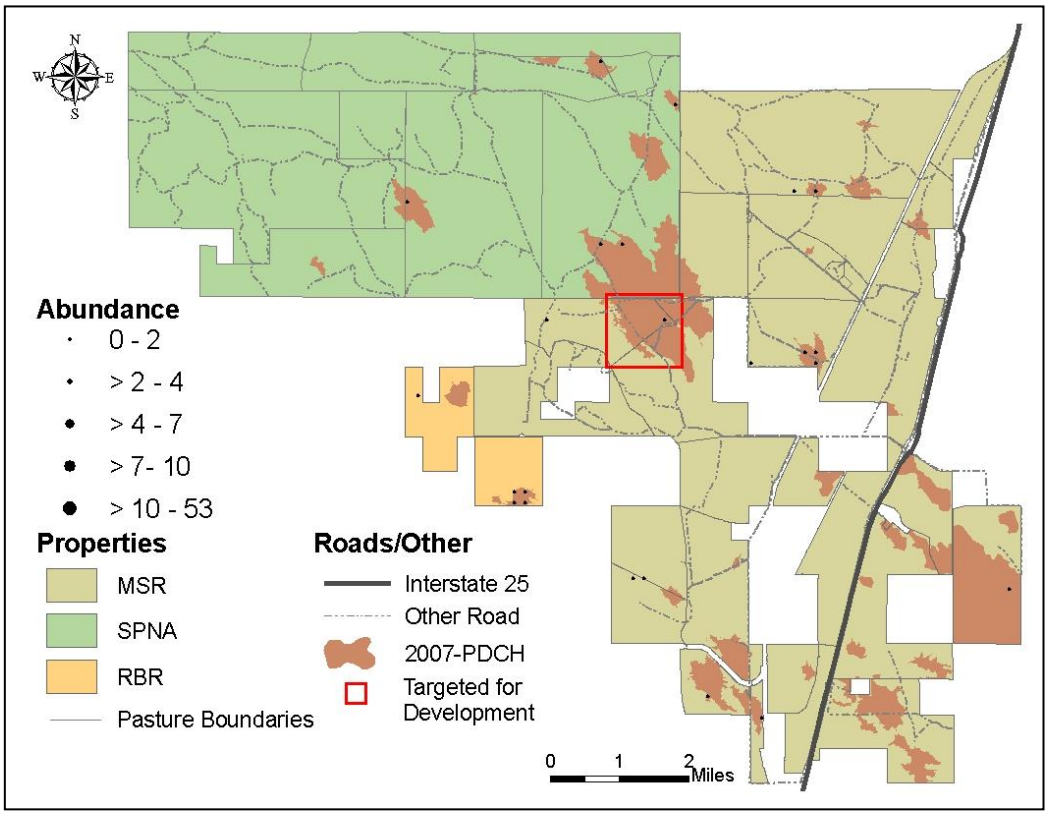
Priority species (PIF, CDOW, USFWS)

Burrowing Owl is a small migratory owl that nests and roosts in underground burrows of prairie dog and other fossorial mammals. In some parts of their range Burrowing Owls may excavate their own burrows, but this behavior is largely unknown from the Great Plains population. We observed Burrowing Owls solitarily and in pairs at the end of June suggesting they are breeding within the study area. Ninety-three percent of Burrowing Owls we detected were in prairie dog colonies, suggesting a strong reliance on prairie dogs for suitable habitat. Densities were higher in active prairie dog colonies than in inactive colonies (see results on pg. 14), likely due to their preference for recently excavated burrows, which may be more structurally sound than older abandoned burrows. Because of this reliance on active prairie dog colonies, Burrowing Owls may be particularly sensitive to declines or local extirpations of prairie dogs.

Burrowing Owl density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.74	46.80	0.30	1.85	2
Barton upper c-300	0.32	46.79	0.13	0.80	1
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.69	46.96	0.27	1.72	2
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.00				0
Butte north	0.14	46.74	0.06	0.35	1
Butte west	0.00				0
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.19	46.75	0.08	0.47	3
Lewis south	1.63	46.76	0.65	4.07	7
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.14	46.74	0.06	0.35	16
Round Butte	0.62	46.75	0.25	1.56	4
Soapstone	0.87	48.41	0.34	2.23	7
Global	**0.22**	**46.82**	**0.09**	**0.54**	**27**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D**.**



Burrowing Owl abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Common Nighthawk

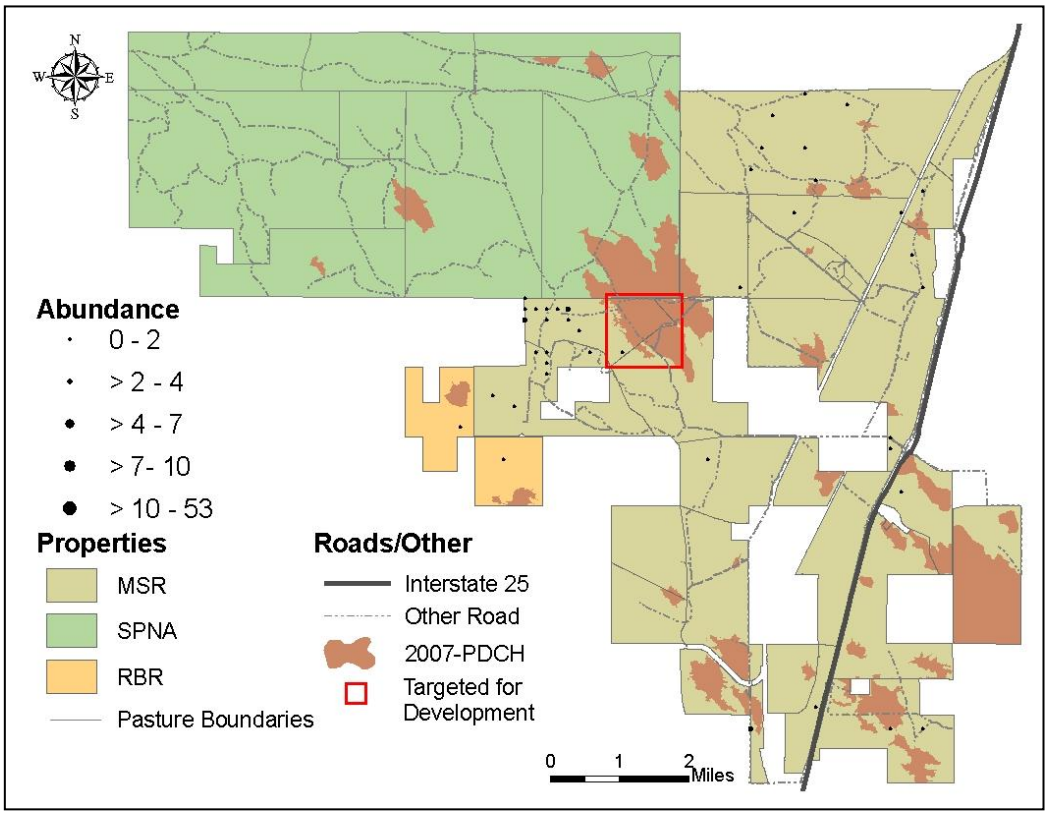
Priority species (PIF)

Common Nighthawk is a long-distance migrant that is declining across much of North America. In Colorado, it is perhaps most common in the shortgrass prairie, although it breeds in a variety of open habitats. It nests on the ground and builds no nest, instead laying a clutch of two eggs directly on the ground amongst gravel, especially on ridges and even old prairie dog mounds. It is one of the last migratory species to arrive in Colorado in spring, typically arriving during the last few days of May. We observed Common Nighthawk nests on both RBR and SPNA. Because of this species' late arrival, it may be underrepresented in some of our samples, particularly in prairie dog colonies and other points surveyed before June 1.

Common Nighthawk density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.99	21.72	0.64	1.54	1
Barton lower	2.86	21.76	1.85	4.43	1
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	7.34	33.05	3.53	15.25	1
Benson north south	0.00				0
Benson south	1.54	22.26	0.99	2.41	1
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.35	21.66	0.23	0.54	1
Bull	0.00				0
Butte east	0.00				0
Butte north	5.97	23.93	3.71	9.61	13
Butte west	4.11	28.18	2.30	7.33	6
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.90	21.68	0.58	1.40	2
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.60	30.84	0.30	1.22	4
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.47	21.64	0.30	0.73	1
Meadow	0.75	21.78	0.49	1.17	1
Meadow Springs	0.98	22.64	0.62	1.54	32
Round Butte	0.61	21.65	0.39	0.94	2
Soapstone	0.00				0
Global	**0.92**	**22.53**	**0.58**	**1.44**	**34**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D**.**

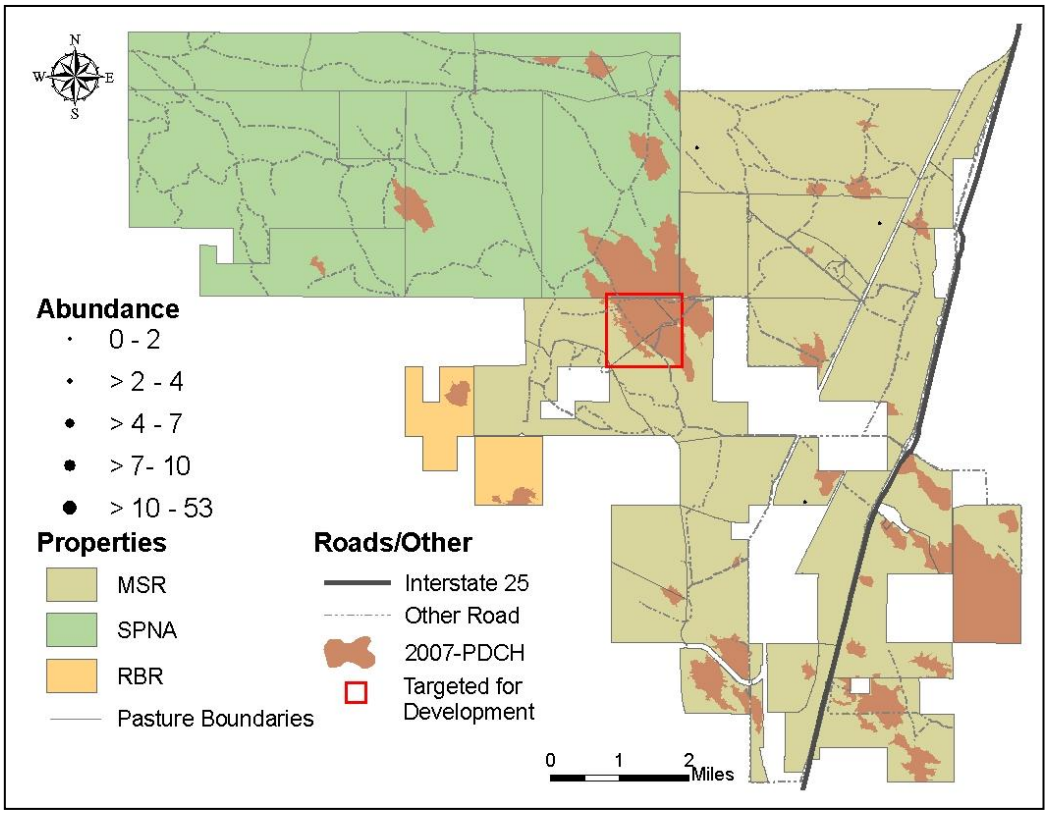


Common Nighthawk abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Broad-tailed Hummingbird

Priority species (PIF)

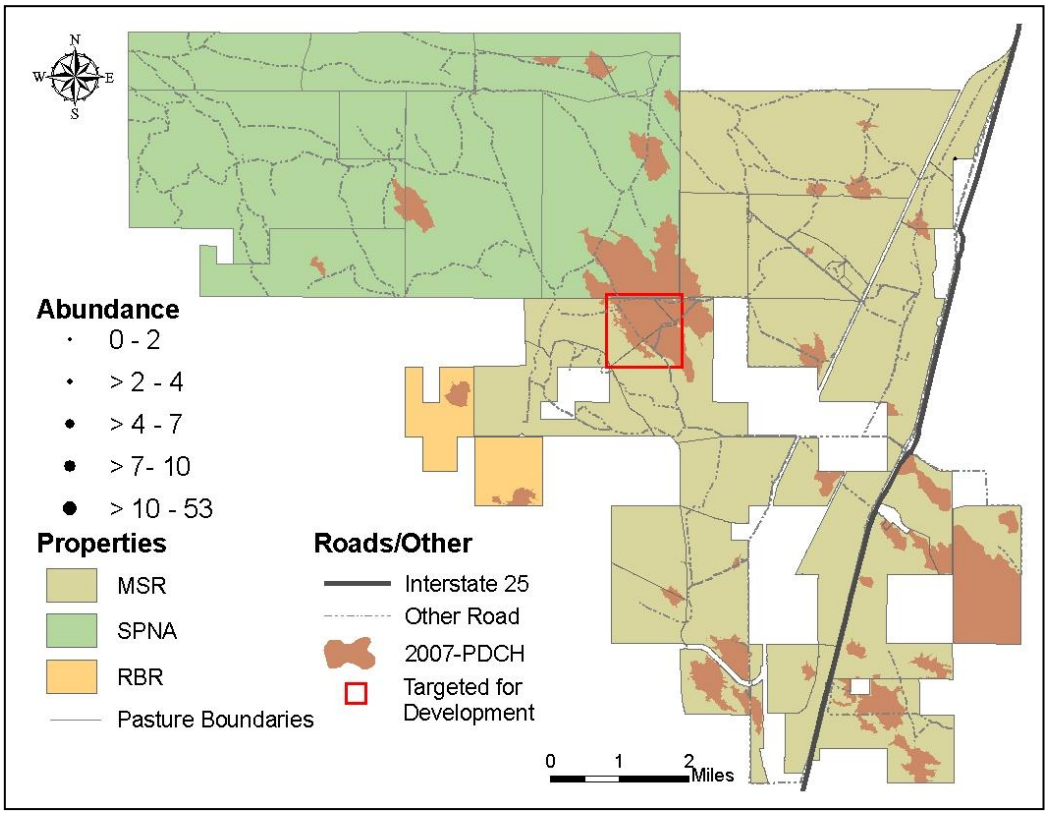
Broad-tailed Hummingbird breeds primarily in montane environments in Colorado where it feeds on nectar and small insects. This species occurs only as a migrant in the study area.



Broad-tailed Hummingbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Northern Flicker

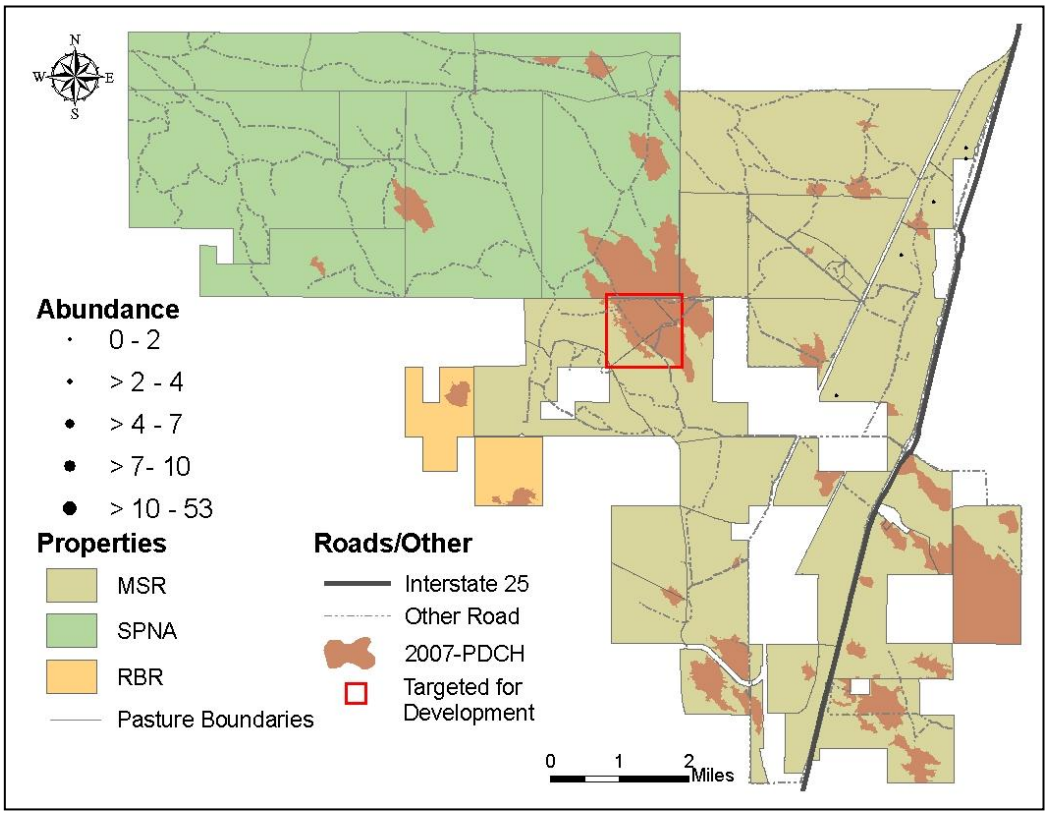
Northern Flicker, a common woodpecker of woodlands, forest edges and riparian areas, where it breeds in cavities excavated from dead or dying trees, or in nest boxes. One Flicker was observed in a riparian area of Lonetree north pasture of MSR, and is a probable breeder there.



Northern Flicker abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Western Wood-Pewee

Western Wood-Pewee is a small flycatcher and long-distant migrant that probably breeds in some woodlands and riparian areas within the study area. Three birds were detected each year in north, middle, and south Lonetree pastures of MSR. These pastures contain a few small cottonwood groves that may provide sufficient breeding habitat for this species. The species is also a common migrant throughout the study area, where it can sometimes be seen perched on fences far from any trees.



Western Wood-Pewee abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

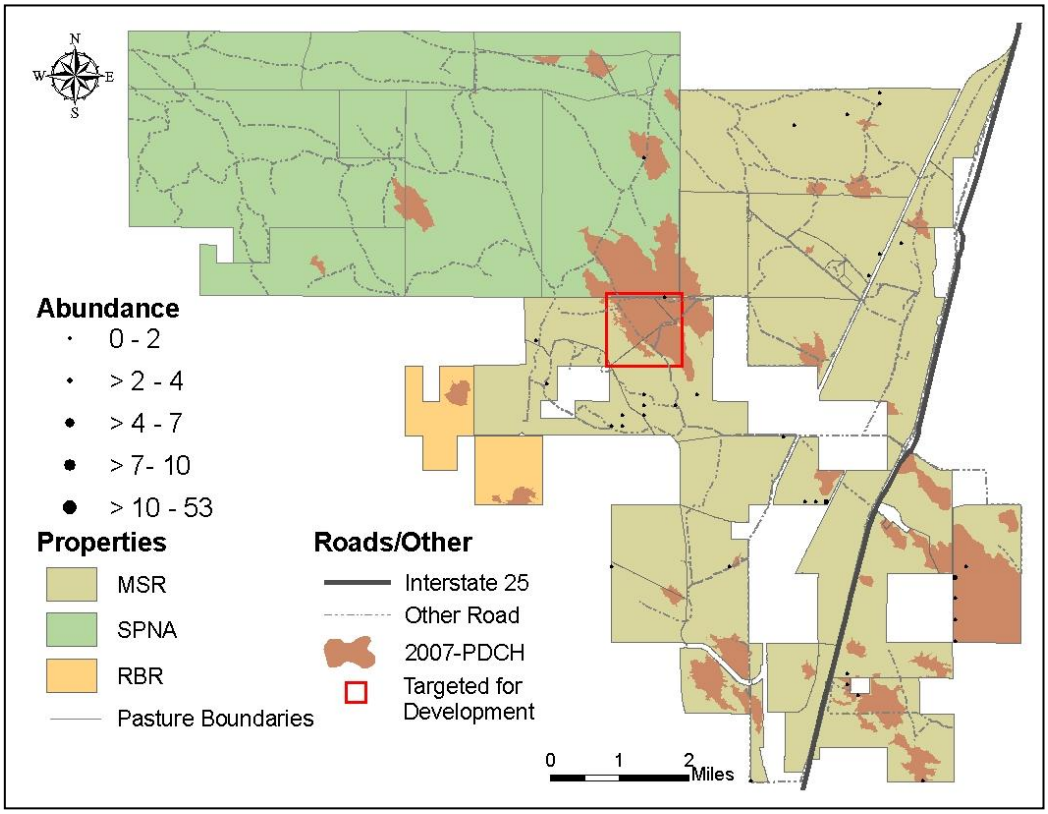
Say's Phoebe

Say's Phoebe is a fairly common flycatcher and probable breeder within the study area. It occurs wherever suitable nesting substrates such as cliffs, rock outcrops, and human structures are readily available, especially in hilly terrain and around human habitations.

Say's Phoebe density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.96	68.17	0.27	3.35	1
Barton upper c-300	0.00				0
Barton upper east	0.48	68.14	0.14	1.69	1
Barton upper north	0.59	68.14	0.17	2.08	1
Barton upper southwest	0.89	68.16	0.25	3.12	1
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.47	68.13	0.13	1.65	1
Bulger south	1.40	68.13	0.40	4.90	3
Bull	10.16	68.94	2.87	35.95	7
Butte east	1.52	68.14	0.43	5.31	6
Butte north	0.37	68.17	0.10	1.28	1
Butte west	1.91	68.13	0.55	6.70	4
Carr	2.61	68.14	0.75	9.15	6
Lewis middle east	0.00				0
Lewis middle north	0.60	68.14	0.17	2.11	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.49	68.13	0.14	1.72	3
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.82	68.12	0.23	2.88	36
Round Butte	0.00				0
Soapstone	0.29	68.13	0.08	1.03	1
Global	**0.74**	**68.12**	**0.21**	**2.61**	**37**

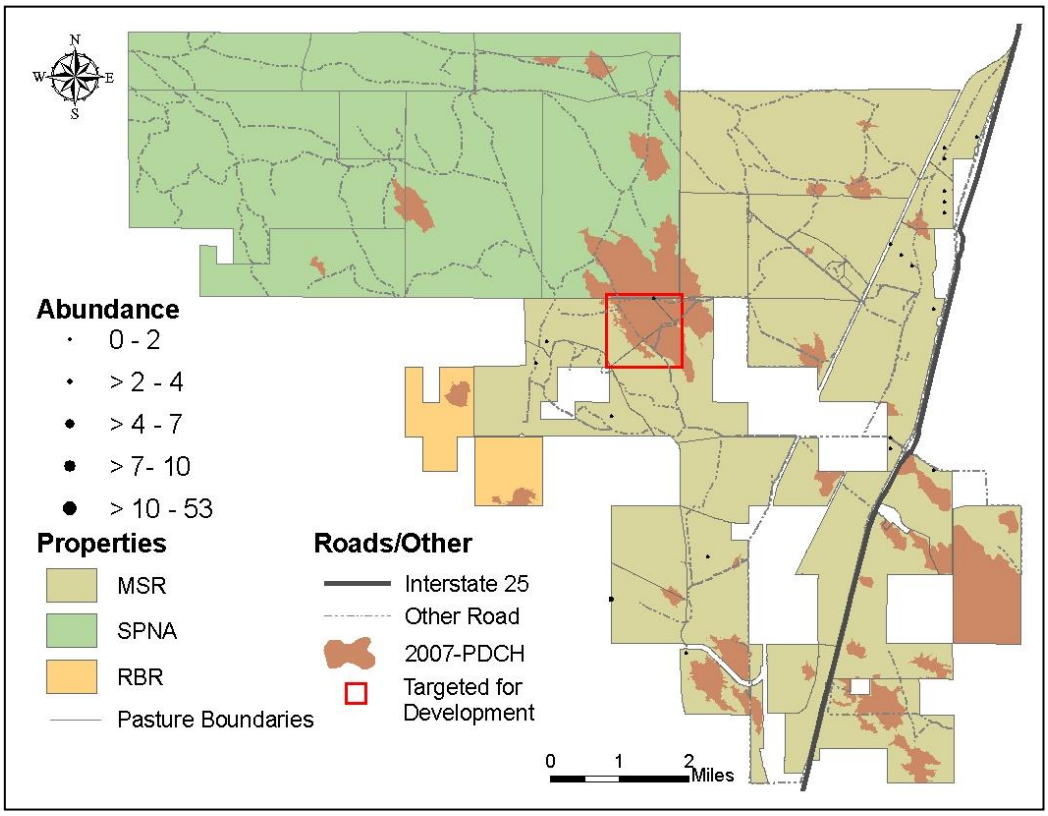
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Say's Phoebe abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Eastern Kingbird

Eastern Kingbird is a fairly common and widespread breeding species in the study area, where it uses open pastures near scattered trees. Eastern Kingbird was observed nesting in willow trees within the study area.



Eastern Kingbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

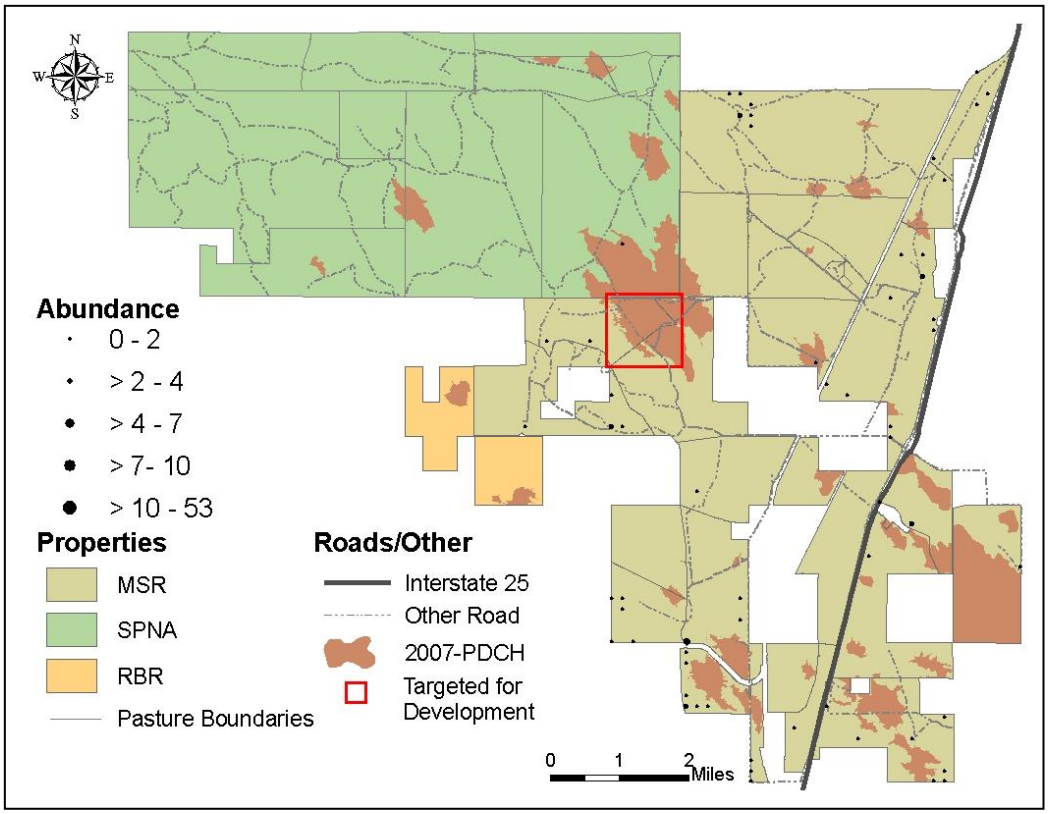
Western Kingbird

Western Kingbird is perhaps the most common flycatcher in the study area, and we observed several active nests in both years. It typically can be found around scattered trees, fence lines and other human structures in open country. Western Kingbird frequently uses telephone poles, fence posts, and other man-made structures, addition to trees, for nesting.

Western Kingbird density estimates stratified by 27 MSR pastures, by 3 CFC properties (MSR, RBR, and SPNA), and globally, 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	6.36	57.72	2.17	18.64	8
Barton upper c-300	0.00				0
Barton upper east	4.05	54.68	1.45	11.29	5
Barton upper north	0.64	50.80	0.24	1.67	1
Barton upper southwest	6.63	55.21	2.35	18.68	5
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	2.22	51.05	0.85	5.81	1
Benson south c-100	0.00				0
Bulger north	0.51	50.79	0.19	1.33	1
Bulger south	3.01	50.79	1.15	7.86	6
Bull	0.00				0
Butte east	0.00				0
Butte north	1.18	60.79	0.34	4.12	2
Butte west	0.12	292.07	0.00	53.49	4
Carr	0.94	50.79	0.36	2.44	1
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.99	63.18	0.30	3.32	5
Lewis south	0.65	50.78	0.25	1.69	1
Lonetree middle	2.01	51.11	0.77	5.26	1
Lonetree north	6.39	50.92	2.44	16.70	5
Lonetree south	5.38	52.41	2.01	14.39	12
Meadow	3.24	50.84	1.24	8.47	1
Meadow Springs	1.71	51.01	0.65	4.47	59
Round Butte	0.00				0
Soapstone	0.32	50.78	0.12	0.83	1
Global	**1.53**	**51.00**	**0.59**	**4.01**	**60**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Western Kingbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, 2008 & 2009.

Loggerhead Shrike

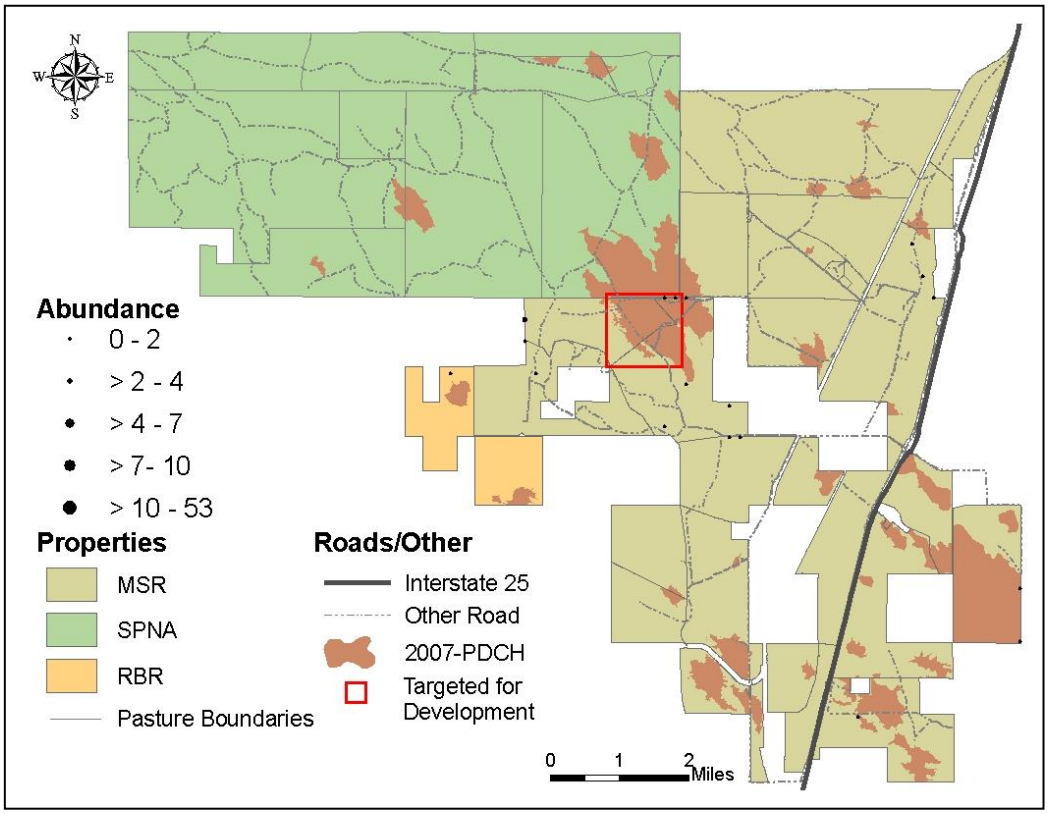
Priority species (PIF, CDOW, USFWS)

Loggerhead Shrike is low-density but widespread breeder within the study area. It can be found in both open grasslands and shrublands, although it requires trees or shrubs for nesting. Loggerhead Shrike is a species of conservation concern across much of its range due to steep and long-term population declines. Shrikes prey on insects, birds and small mammals and reptiles, and often display their captured prey. We found active nests of Loggerhead Shrikes along Spottlewood Creek in Butte pasture and along County Rd. 17 in Carr pasture.

Loggerhead Shrikes density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.88	24.90	0.52	1.47	2
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.35	24.89	0.21	0.58	1
Bull	0.00				0
Butte east	1.12	24.87	0.67	1.88	6
Butte north	0.81	41.91	0.19	3.49	2
Butte west	1.06	41.60	0.24	4.65	2
Carr	0.64	24.88	0.38	1.08	2
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.70	24.87	0.42	1.16	3
Meadow	0.00				0
Meadow Springs	0.38	25.52	0.22	0.64	18
Round Butte	0.30	24.89	0.18	0.50	1
Soapstone	0.00				0
Global	**0.35**	**25.44**	**0.21**	**0.59**	**19**

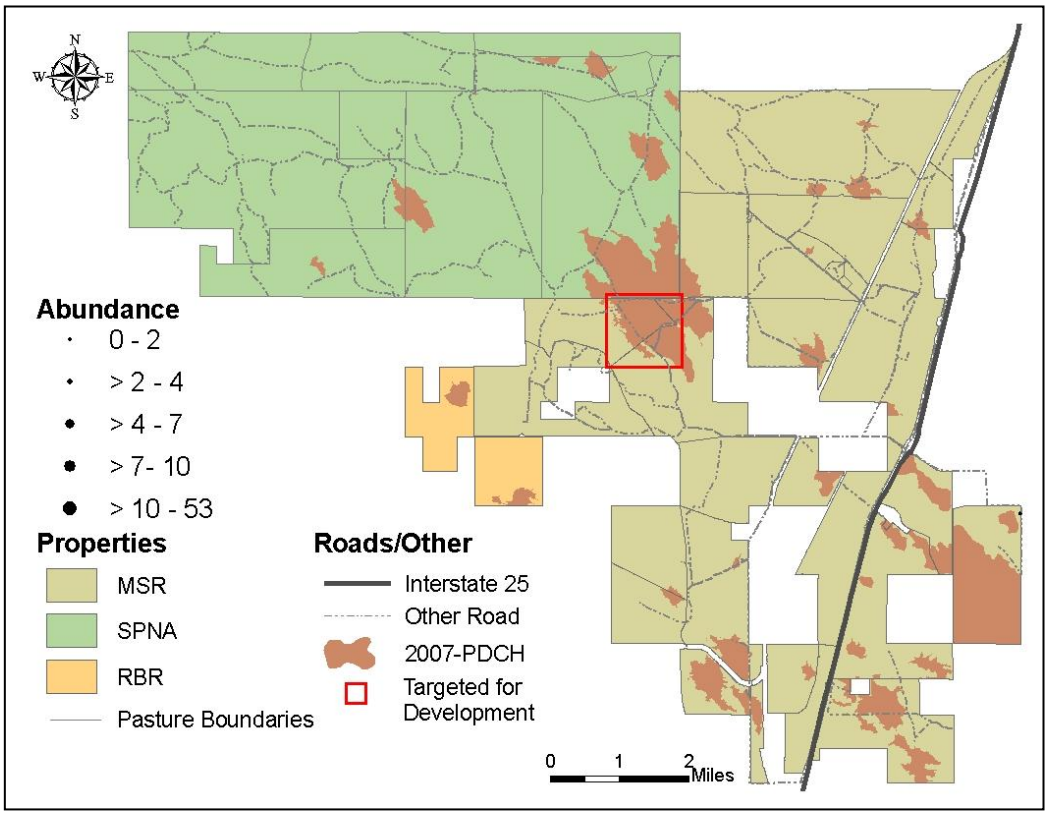
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Loggerhead Shrike abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Warbling Vireo

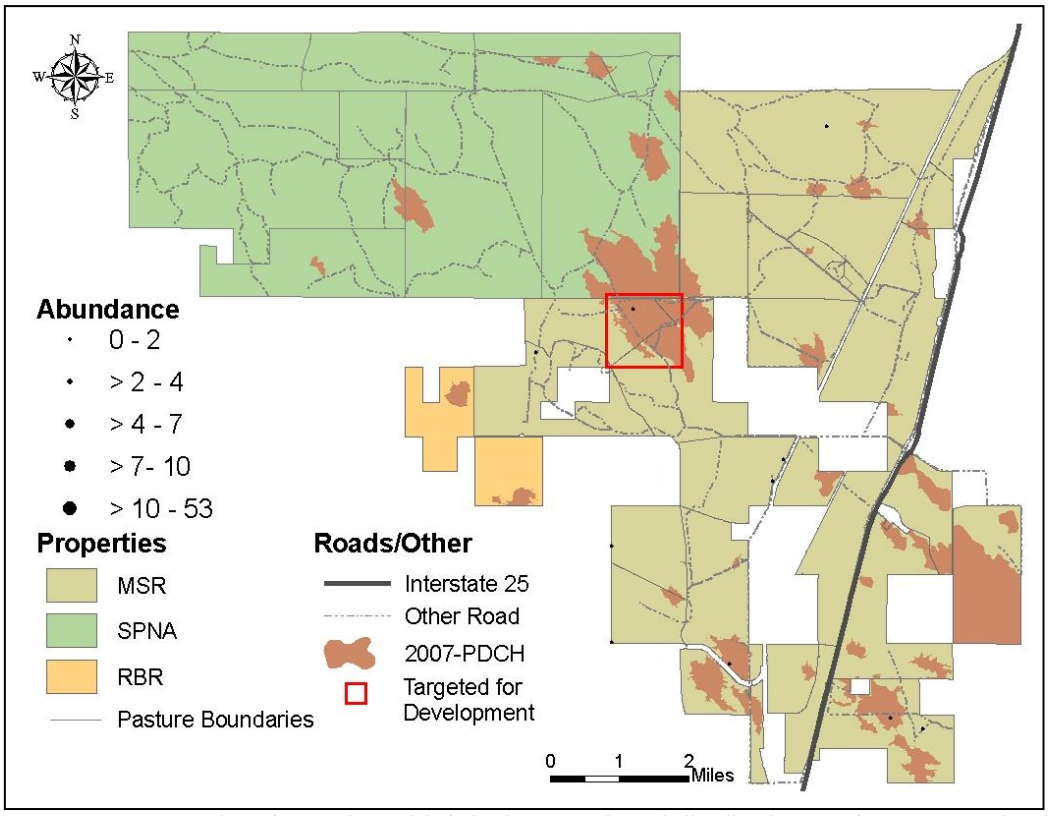
Warbling Vireo is a rare but possible breeder in the study area. It uses riparian woodland habitats and nests in trees. We observed one individual in cottonwoods on the east side of Carr pasture on MSR.



Warbling Vireo abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Common Raven

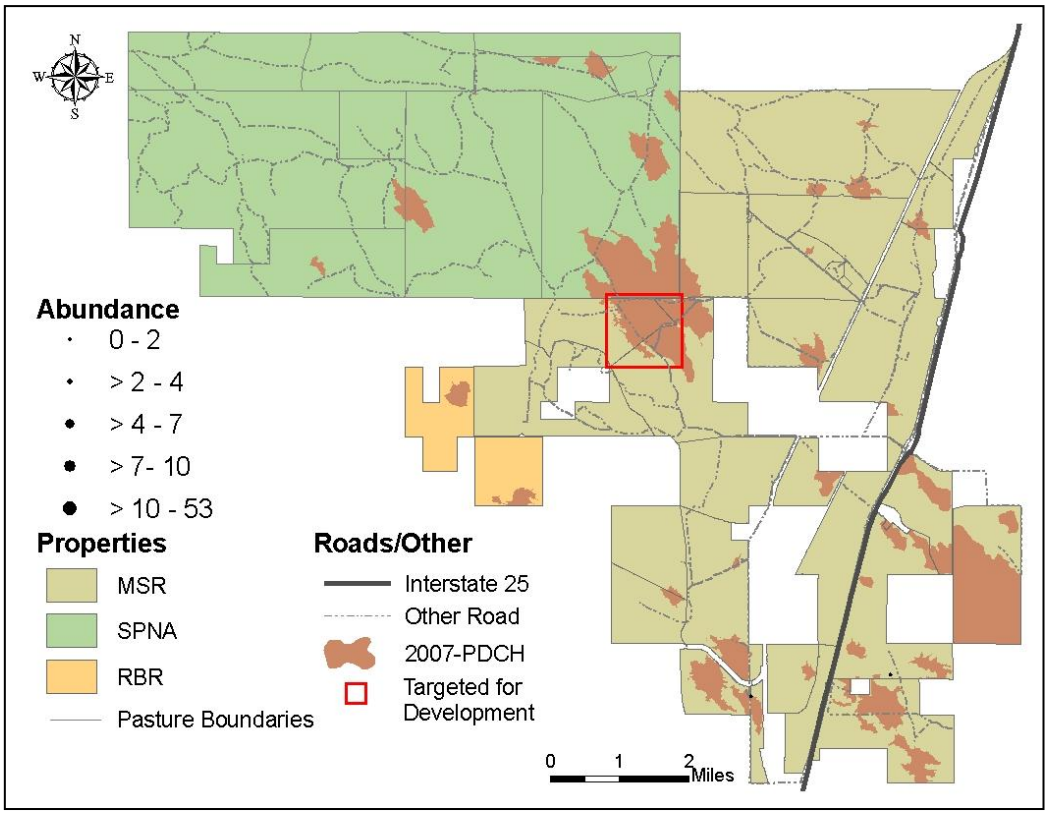
Common Raven is a wide-ranging and opportunistic forager and occurs in many habitat types. We did not observe any nests, and most birds were observed flying by. Nonetheless, it is a possible, although unlikely, breeder within the study area.



Common Raven abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

American Crow

American Crow is a common and widespread species, and like its larger cousin the Common Raven, ranges widely in search of food. We did not observe any nests, and it likely does not breed within the study area, although it probably does in nearby residential areas.



American Crow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

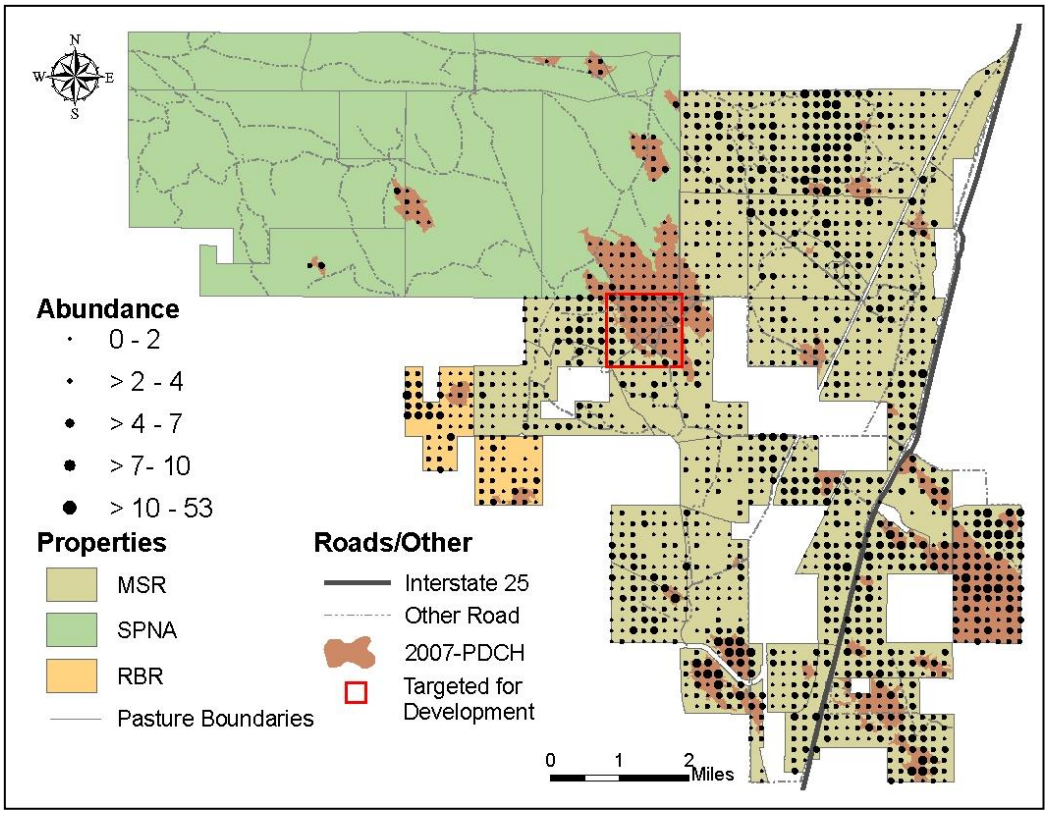
Horned Lark

Horned Lark is the most abundant and widespread bird within the study area, where it occurs year-round. It is unclear however, whether the same birds remain within the study area throughout the year, although it is possible. Horned Larks nest on the ground within the study area from mid-April through August.

Horned Lark density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	99.73	7.01	86.92	114.43	60
Barton lower	317.45	8.98	266.17	378.61	121
Barton upper c-300	168.33	7.25	146.03	194.04	91
Barton upper east	213.00	8.14	181.60	249.82	144
Barton upper north	170.41	7.26	147.81	196.46	110
Barton upper southwest	216.12	7.21	187.63	248.93	108
Benson north north	125.41	42.06	35.65	441.21	7
Benson north south	247.62	6.68	217.26	282.22	153
Benson south	276.26	9.16	230.66	330.89	53
Benson south c-100	175.91	8.79	147.97	209.12	51
Bulger north	323.32	6.44	284.99	366.82	258
Bulger south	299.84	6.48	264.11	340.40	242
Bull	306.10	7.93	261.98	357.65	90
Butte east	184.43	6.29	163.05	208.61	294
Butte north	301.39	6.35	266.16	341.28	344
Butte west	147.80	6.31	130.62	167.25	129
Carr	395.11	6.21	349.85	446.24	371
Lewis middle east	218.86	15.16	159.63	300.07	11
Lewis middle north	171.57	8.69	144.66	203.48	103
Lewis middle south	92.42	8.54	78.11	109.35	43
Lewis middle west	230.03	16.97	162.94	324.74	17
Lewis north	245.86	6.00	218.61	276.49	639
Lewis south	105.34	6.90	92.02	120.59	84
Lonetree middle	145.92	14.80	108.49	196.25	25
Lonetree north	7.00	89.36	1.08	45.43	8
Lonetree south	170.84	6.16	151.42	192.75	255
Meadow	179.53	8.99	150.42	214.27	78
Meadow Springs	217.76	5.80	194.38	243.95	3889
Round Butte	232.31	6.35	205.14	263.09	233
Soapstone	203.99	6.36	180.08	231.07	281
Global	**217.46**	**5.79**	**194.13**	**243.60**	**4403**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Horned Lark abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Horned Lark nestlings on Meadow Springs Ranch, Larimer County Colorado.
Photo by Loni Beyer.

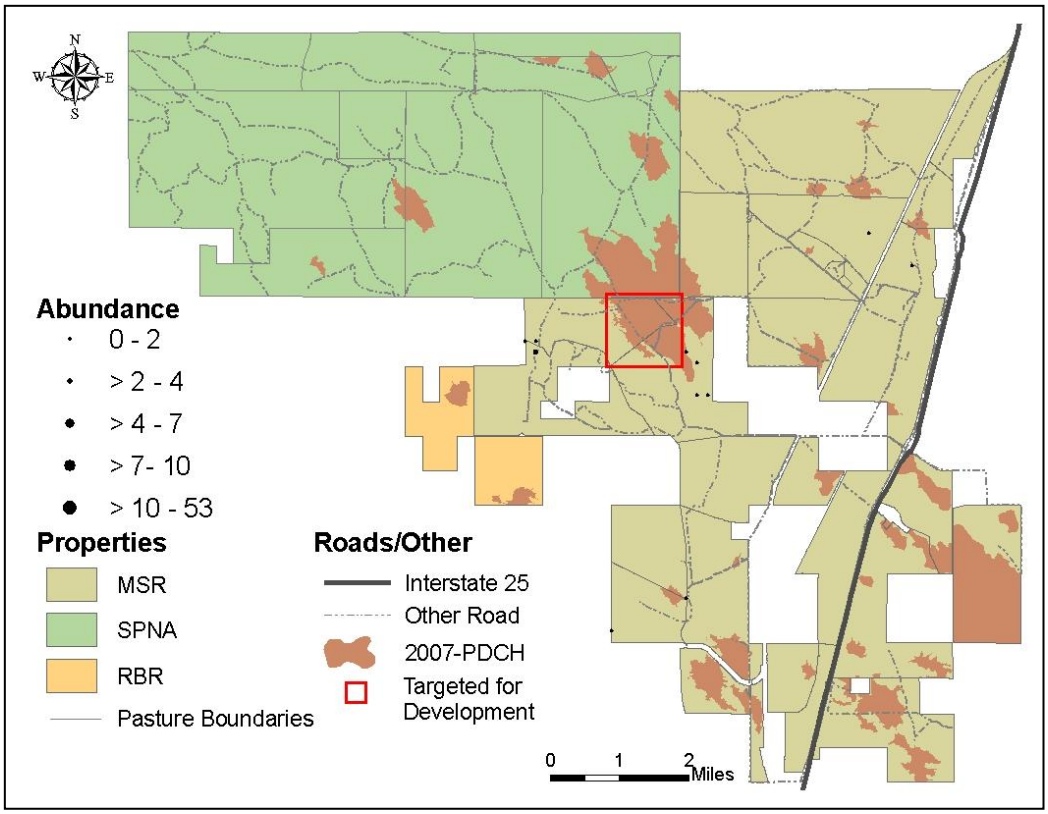
Northern Rough-winged Swallow

Northern Rough-winged Swallow is an uncommon breeder within the study area, where it nests in burrows in cut banks of intermittent stream beds. We observed a nesting pair in west Butte pasture.

Northern Rough-winged Swallow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	0.00				0
Barton upper east	0.59	40.59	0.25	1.40	1
Barton upper north	0.00				0
Barton upper southwest	1.08	40.63	0.45	2.57	1
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	0.00				0
Bull	0.00				0
Butte east	2.77	53.76	0.87	8.87	4
Butte north	0.44	40.65	0.19	1.06	1
Butte west	2.31	64.40	0.30	17.60	2
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.73	40.60	0.31	1.74	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.38	40.58	0.16	0.91	1
Meadow	0.00				0
Meadow Springs	0.34	43.39	0.14	0.84	11
Round Butte	0.00				0
Soapstone	0.00				0
Global	**0.30**	**43.39**	**0.12**	**0.74**	**11**

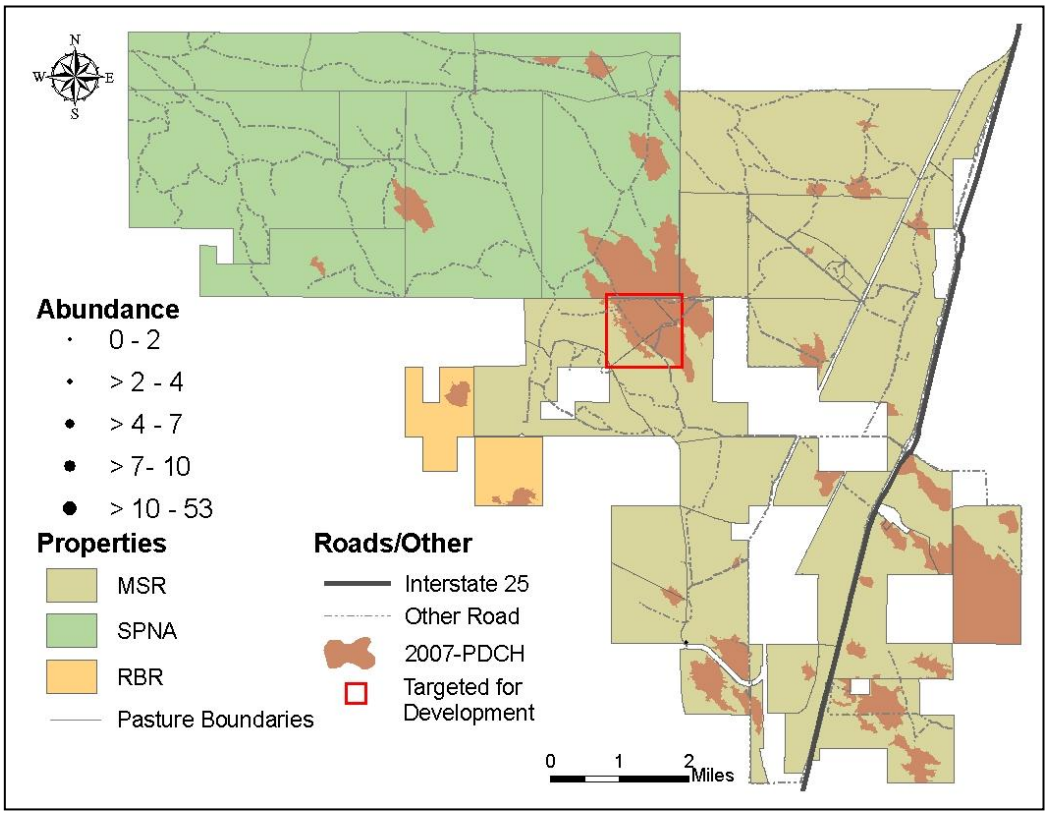
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Northern Rough-winged Swallow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Bank Swallow

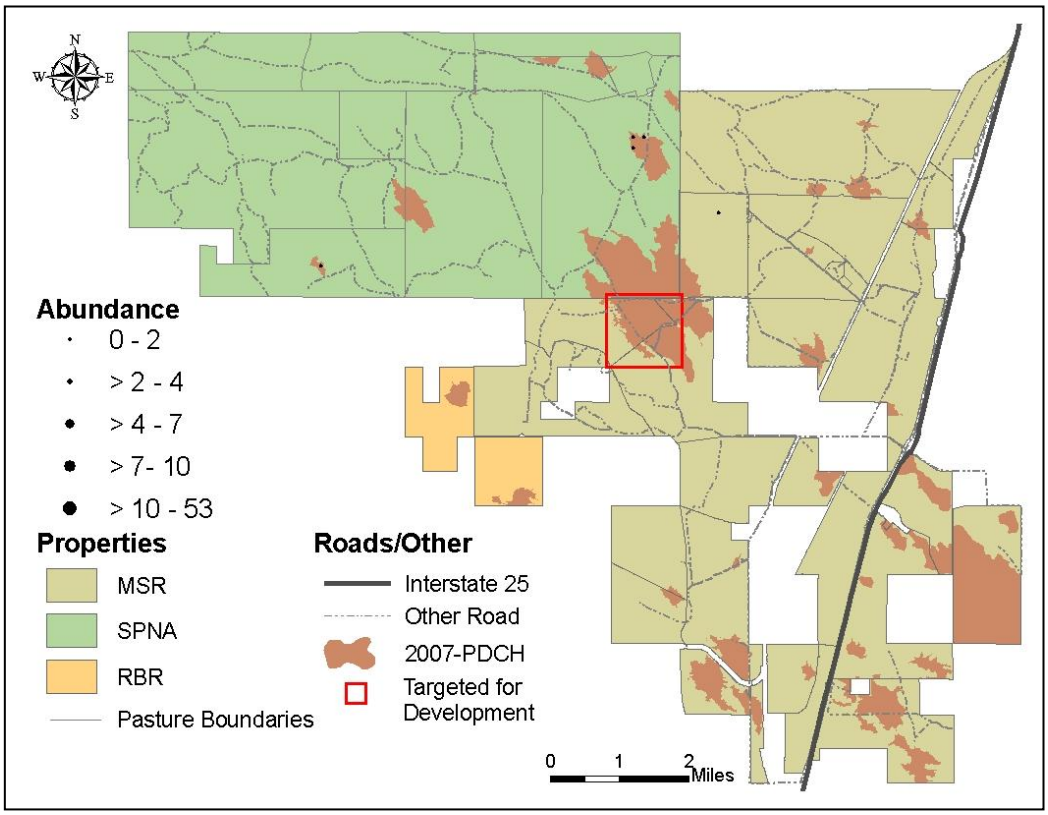
Bank Swallow nests in colonies in burrows in vertical banks, usually near water. Although they nest within the region, Bank Swallows most likely don't nest within the study area. We observed one individual, likely a transient migrant, on Barton upper east pasture in MSR in late May 2009.



Bank Swallow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Violet-green Swallow

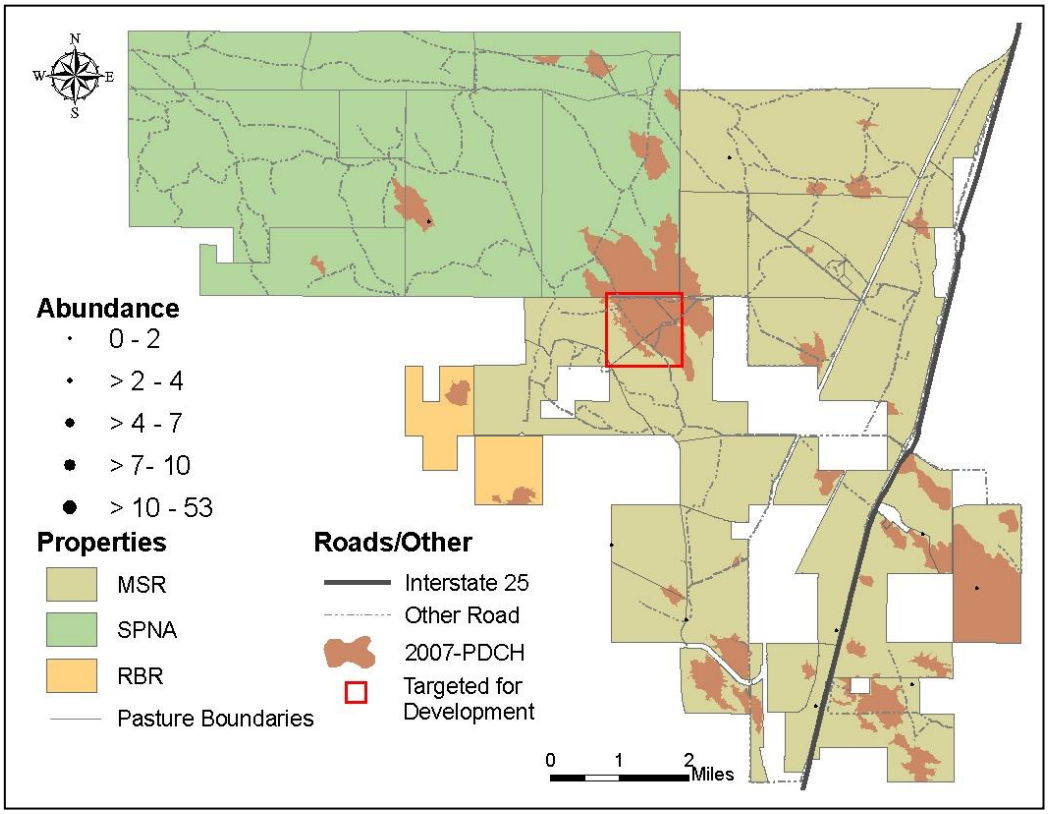
Violet-green Swallow nests mainly in montane habitats, and is a transient migrant throughout most of the study area. It may nest in the higher portions of SPNA.



Violet-green Swallow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Tree Swallow

Tree Swallow is an uncommon but possible breeder within the study area and likely a more common transient migrant. Tree Swallows nest in tree cavities or nest boxes near open country where they feed on aerial insects.



Tree Swallow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

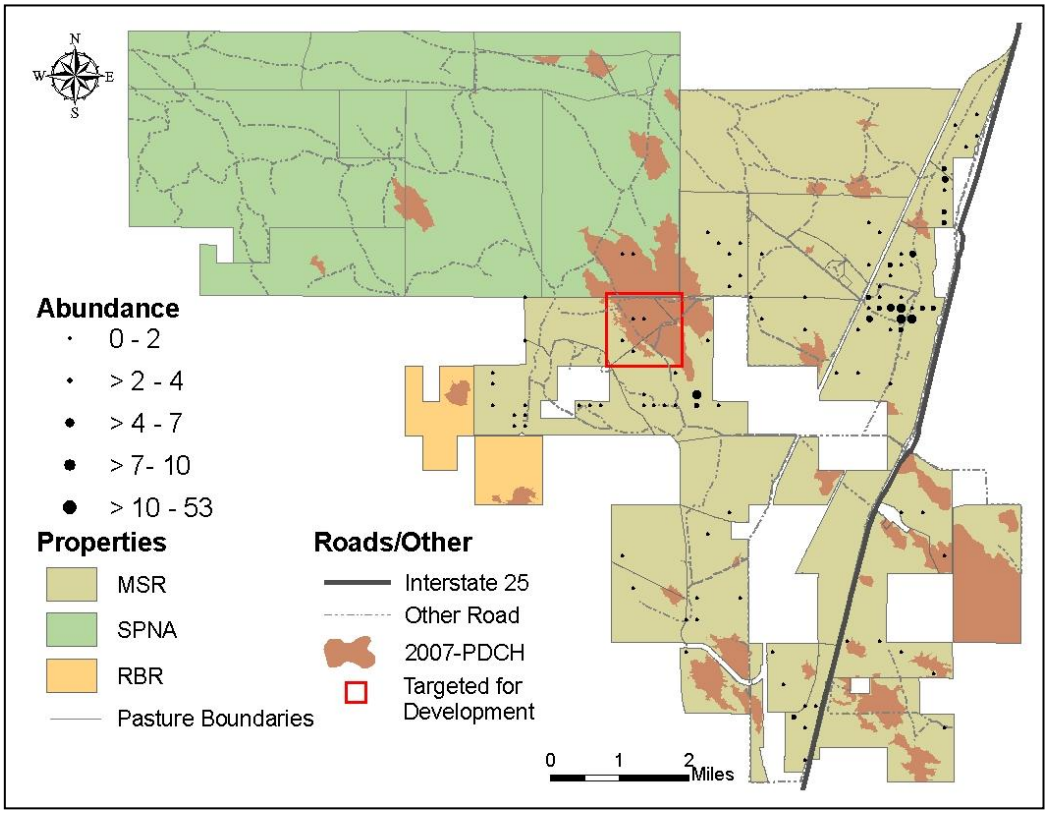
Cliff Swallow

Cliff Swallow is the most common and widespread swallow we observed within the study area, and a confirmed breeder. Cliff Swallows are colonial nesters on cliffs and canyon walls, as well as on bridges, barns, and other man-made structures, where they build their distinctive gourd-shaped mud nests.

Cliff Swallow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	14.23	14.01	10.80	18.76	4
Barton lower	5.12	14.10	3.88	6.76	1
Barton upper c-300	4.47	14.05	3.39	5.89	1
Barton upper east	10.37	13.93	7.88	13.65	4
Barton upper north	0.00				0
Barton upper southwest	4.77	14.07	3.62	6.30	1
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	772.86	94.80	28.60	20882.00	4
Benson south c-100	24.22	14.33	18.27	32.12	3
Bulger north	9.82	49.96	0.14	683.99	3
Bulger south	0.00				0
Bull	0.00				0
Butte east	58.50	43.09	24.11	141.94	13
Butte north	7.85	13.92	5.96	10.33	4
Butte west	23.04	13.93	17.51	30.32	9
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	3.23	13.97	2.45	4.25	1
Lewis middle south	5.00	14.09	3.79	6.60	1
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	16.15	14.09	12.23	21.32	5
Lonetree middle	26.14	18.86	17.68	38.66	3
Lonetree north	133.86	193.26	0.00	685200000	3
Lonetree south	134.62	16.25	97.88	185.15	48
Meadow	21.53	14.36	16.23	28.57	4
Meadow Springs	20.19	14.60	15.15	26.91	112
Round Butte	0.00				0
Soapstone	6.31	13.90	4.80	8.31	2
Global	**17.98**	**14.59**	**13.49**	**23.95**	**114**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Cliff Swallow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

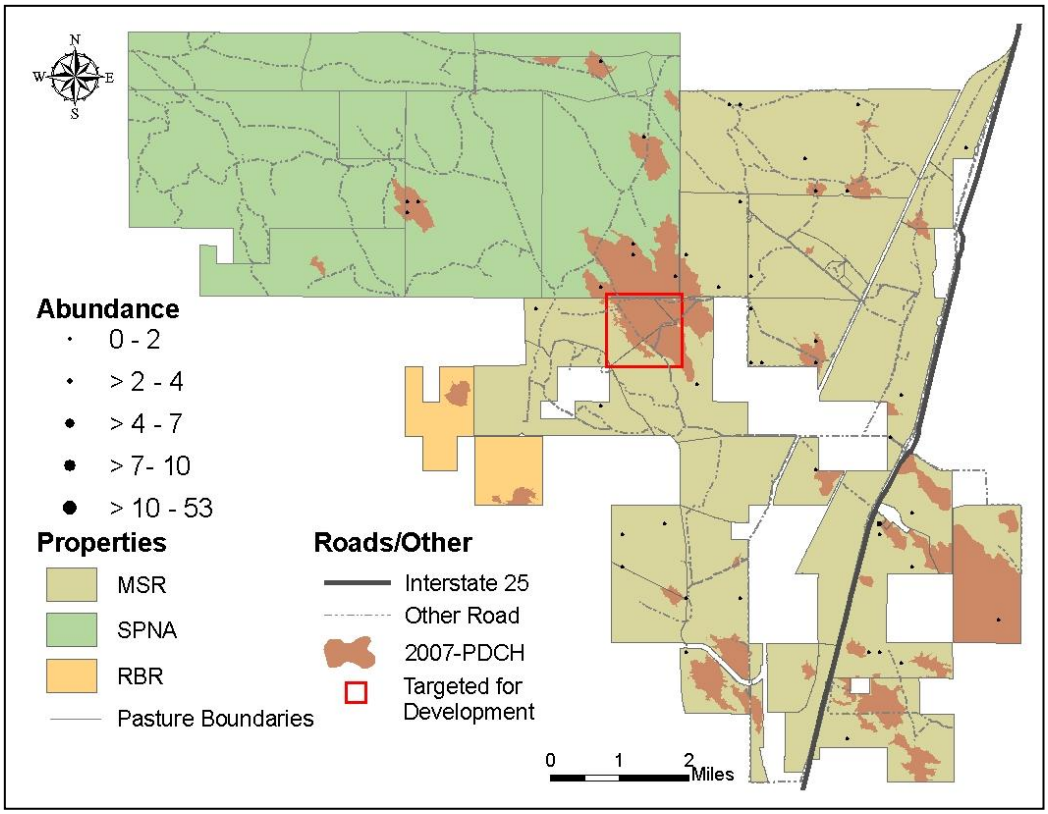
Barn Swallow

Barn Swallow is perhaps the second most common swallow within the study area where it is also a confirmed breeder. Originally nesting in caves, Barn Swallows now nest almost exclusively in man-made structures such as barns, houses, under bridges and in culverts.

Barn Swallow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	6.45	19.17	4.39	9.48	3
Barton lower	6.19	19.23	4.21	9.11	1
Barton upper c-300	8.10	38.46	1.32	49.89	2
Barton upper east	3.13	19.11	2.13	4.60	2
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	6.12	19.11	4.17	8.98	4
Bulger south	3.02	19.11	2.06	4.44	1
Bull	4.70	19.43	3.18	6.94	1
Butte east	0.82	19.13	0.56	1.20	1
Butte north	1.19	19.25	0.81	1.75	1
Butte west	0.00				0
Carr	1.41	19.11	0.96	2.07	1
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	2.64	19.08	1.80	3.88	5
Lewis south	7.81	19.21	5.31	11.49	4
Lonetree middle	0.00				0
Lonetree north	3.85	19.31	2.61	5.67	1
Lonetree south	1.02	19.09	0.69	1.49	1
Meadow	3.25	19.25	2.21	4.79	1
Meadow Springs	2.53	19.56	1.71	3.75	29
Round Butte	0.00				0
Soapstone	8.85	22.44	5.65	13.87	8
Global	**2.83**	**19.45**	**1.92**	**4.18**	**37**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Barn Swallow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

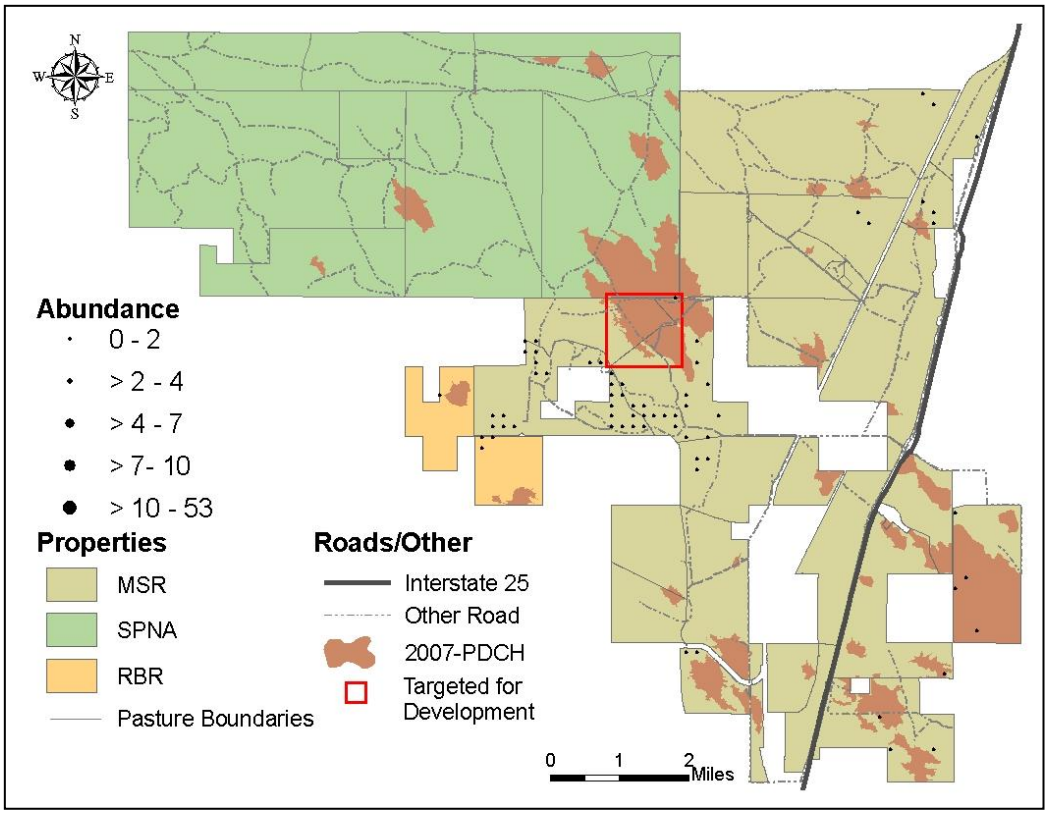
Rock Wren

Rock Wren is common in hilly, arid country with rocky outcrops. Within the study area, Rock Wrens were most abundant in Butte pasture of MSR. Although we did not confirm breeding, Rock Wrens are probable breeders within the study area.

Rock Wren density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	1.17	18.89	0.80	1.70	2
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.73	18.80	0.50	1.05	2
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.29	18.78	0.20	0.42	1
Bulger south	0.85	18.78	0.59	1.24	3
Bull	0.00				0
Butte east	2.47	18.79	1.70	3.58	16
Butte north	0.00				0
Butte west	8.75	18.80	6.04	12.69	30
Carr	1.33	18.80	0.92	1.93	5
Lewis middle east	0.00				0
Lewis middle north	0.74	18.80	0.51	1.07	2
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.30	18.75	0.21	0.43	3
Lewis south	0.00				0
Lonetree middle	2.28	19.53	1.55	3.35	2
Lonetree north	0.73	18.98	0.50	1.05	1
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.93	18.74	0.64	1.35	67
Round Butte	1.23	18.80	0.85	1.79	5
Soapstone	0.18	18.75	0.12	0.26	1
Global	**0.90**	**18.74**	**0.62**	**1.30**	**73**

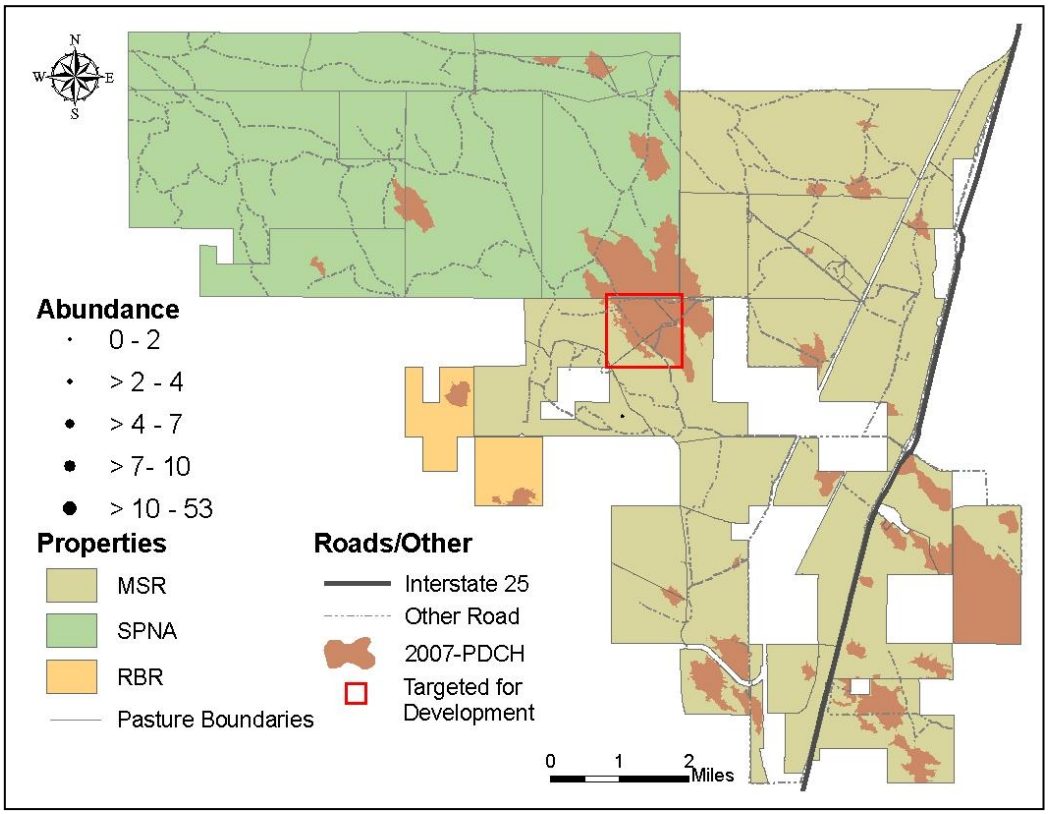
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D**.**



Rock Wren abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Blue-gray Gnatcatcher

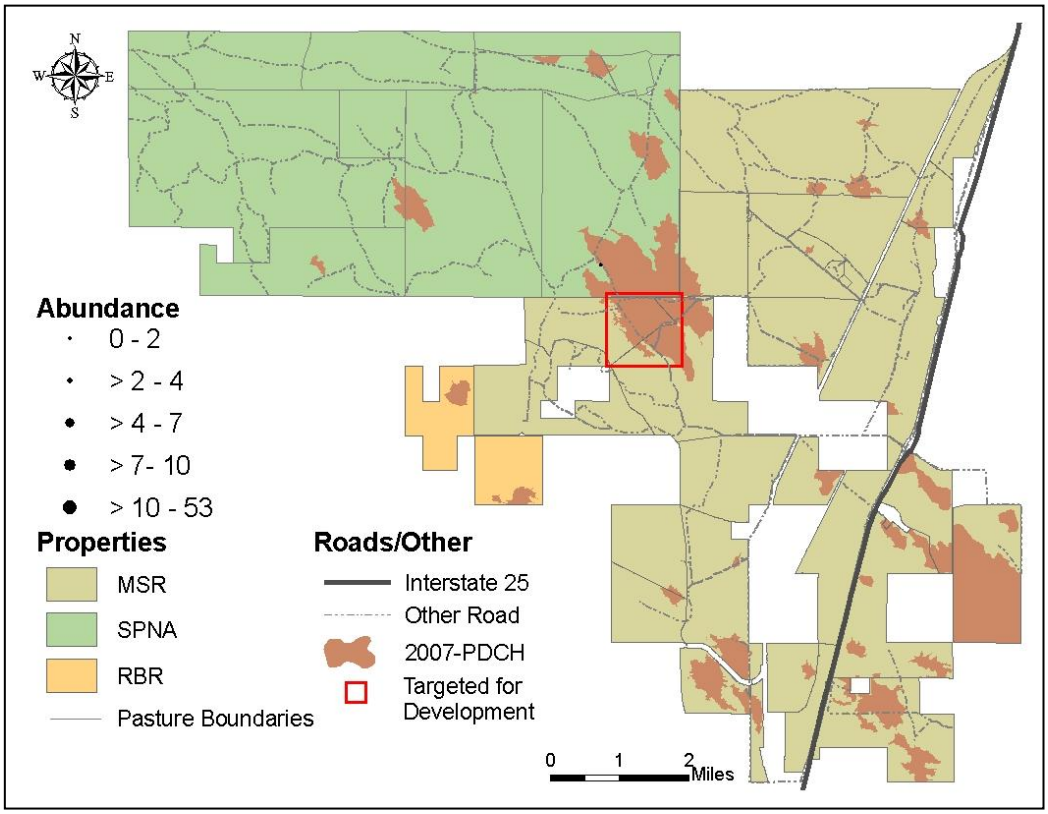
Blue-gray Gnatcatcher is an uncommon but probable breeder within the study area, and a more common breeder in the higher portions of SPNA. We observed one individual in the shrublands of Butte west pasture on MSR in 2008.



Blue-gray Gnatcatcher abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Western Bluebird

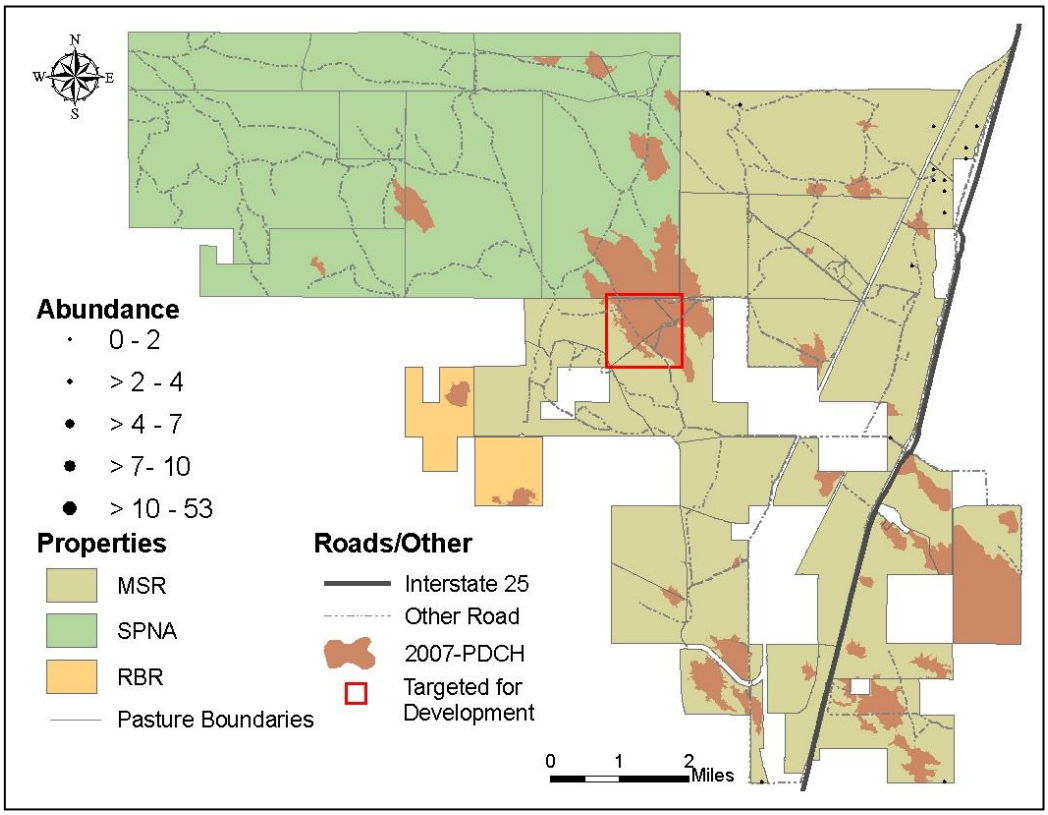
Western Bluebird is a transient migrant within the study area that nests in montane meadow and open woodland habitats of western North America.



Western Bluebird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

American Robin

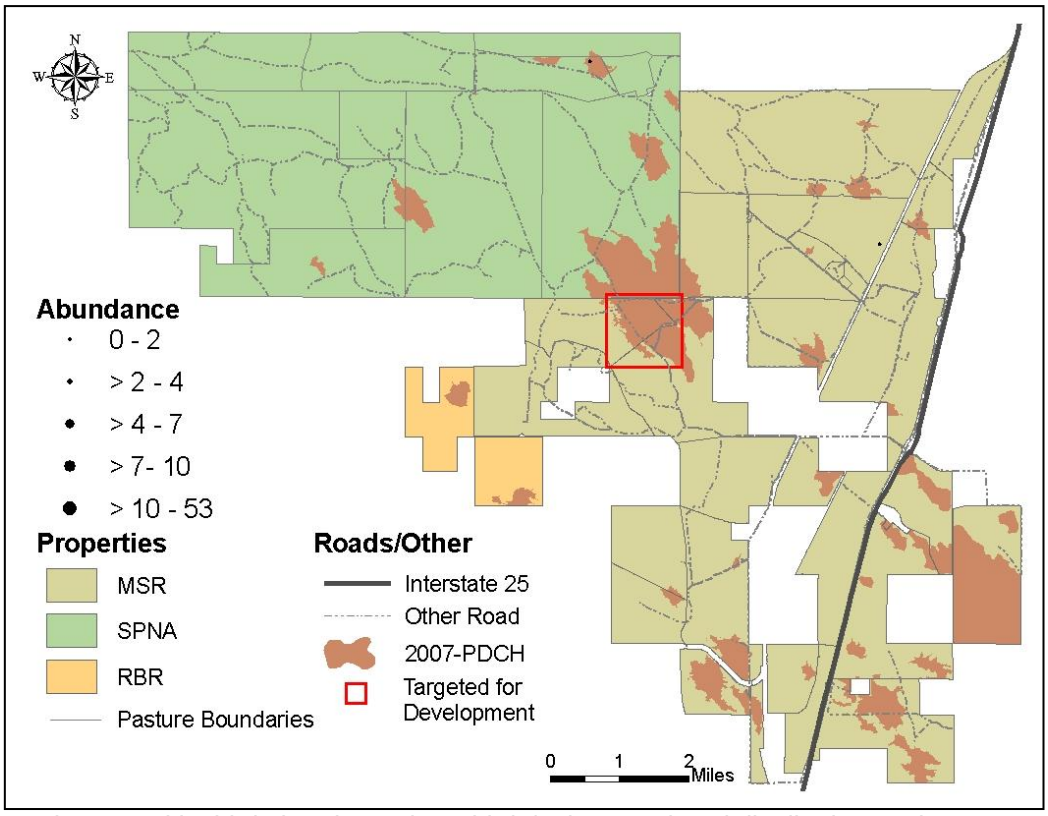
American Robin is an uncommon but probable breeder within the study area, where it was found primarily in Lonetree and Lewis pastures, as well as near human habitations in the south. Robins generally require trees for nesting.



American Robin abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Northern Mockingbird

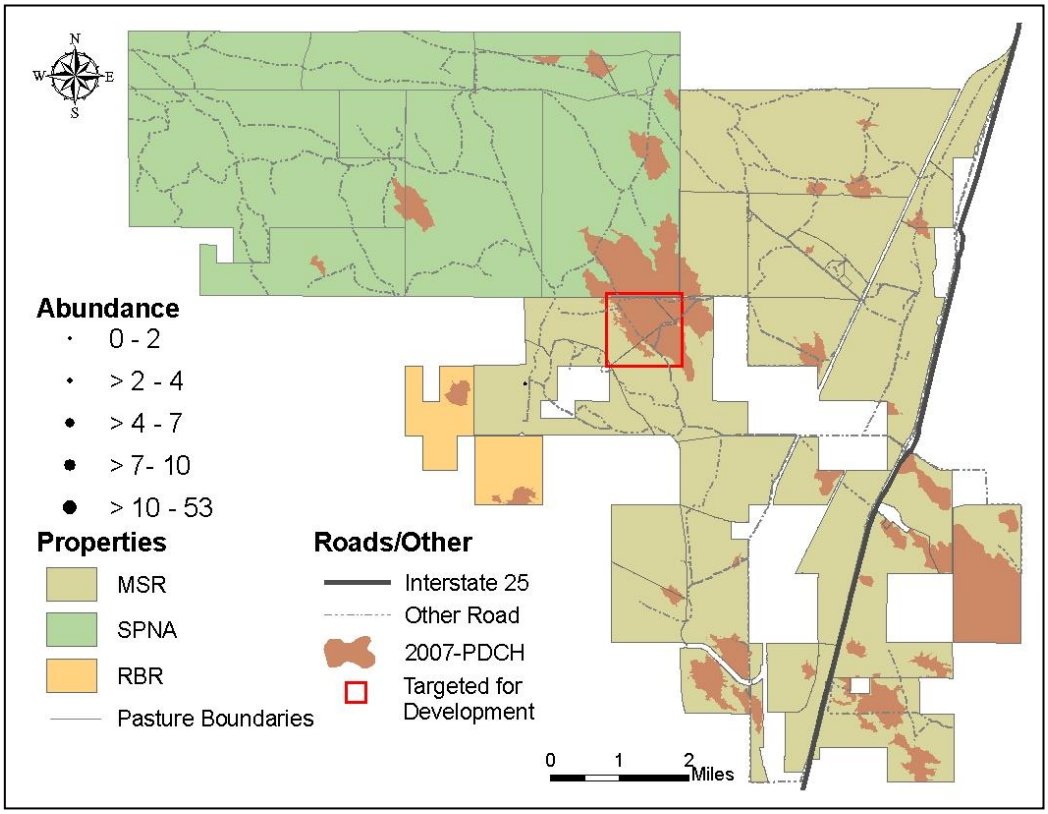
Northern Mockingbird is an uncommon but probable breeder within the study area, although it is more common in the higher portions of SPNA. We detected one mockingbird each on SPNA and MSR.



Northern Mockingbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Sage Thrasher

Sage Thrasher is an uncommon transient migrant throughout the study area. We detected a single individual on Butte west pasture of MSR in 2008.



Sage Thrasher abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

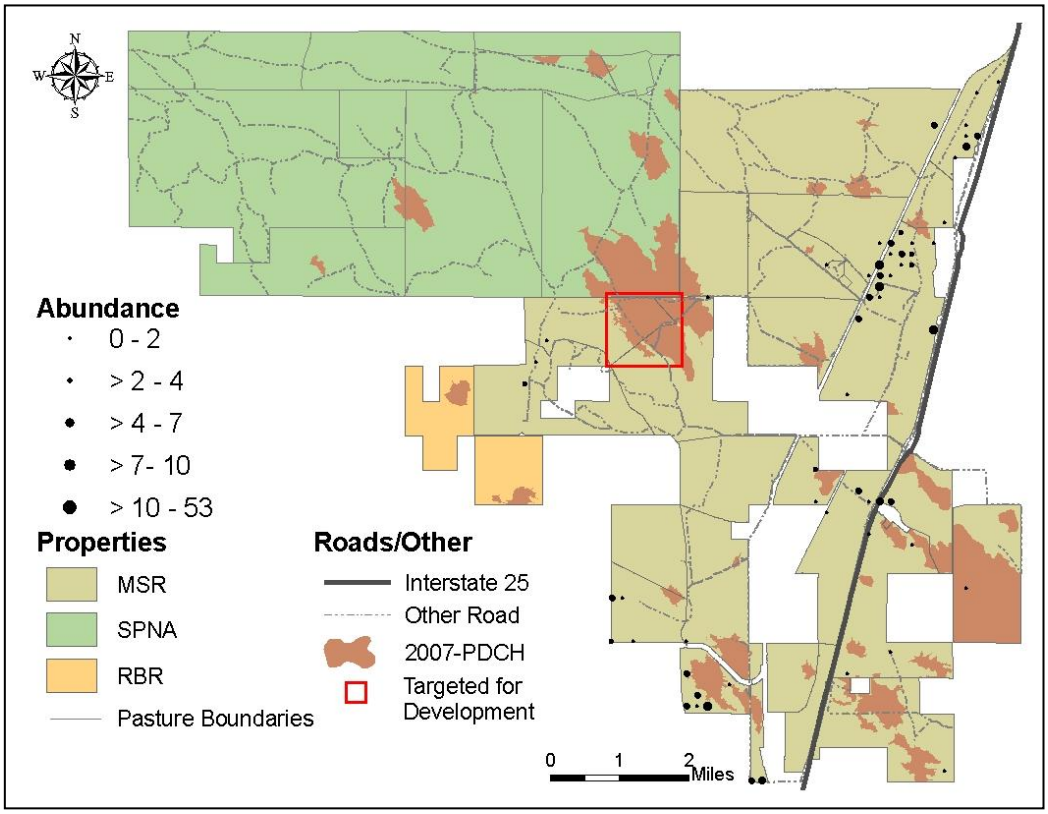
European Starling

European Starling is a probable breeder within the study area, although it is most common around homes, barns, and other human structures. This species nests, often gregariously, in large crevices or holes in buildings, barns, light poles and other structures, including trees. Where starlings nest in natural woodland settings, they generally out-compete native birds for nest sites, thereby reducing their populations.

European Starling density estimates stratified by 27 MSR pastures, by 3 CFC properties (MSR, RBR, and SPNA), and globally, 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	12.67	34.93	6.14	26.13	11
Barton upper c-300	0.00				0
Barton upper east	0.47	16.01	0.35	0.65	1
Barton upper north	0.00				0
Barton upper southwest	1.75	66.73	0.00	657.61	3
Benson north north	0.00				0
Benson north south	1.93	35.79	0.78	4.76	5
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.93	16.00	0.68	1.27	4
Bulger south	15.10	139.49	0.19	1181.70	4
Bull	3.56	25.83	1.52	8.32	2
Butte east	0.12	16.02	0.09	0.17	1
Butte north	0.18	16.17	0.13	0.25	1
Butte west	0.94	52.50	0.01	60.61	2
Carr	0.21	16.00	0.16	0.29	1
Lewis middle east	0.00				0
Lewis middle north	1.18	16.03	0.86	1.63	2
Lewis middle south	0.00				0
Lewis middle west	3.85	18.83	2.65	5.58	1
Lewis north	0.40	15.96	0.29	0.55	1
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	12.12	27.66	6.95	21.14	12
Lonetree south	19.29	27.76	11.16	33.35	26
Meadow	2.47	62.30	0.01	477.55	2
Meadow Springs	2.48	18.58	1.72	3.57	79
Round Butte	0.00				0
Soapstone	0.00				0
Global	**2.19**	**18.58**	**1.52**	**3.15**	**79**

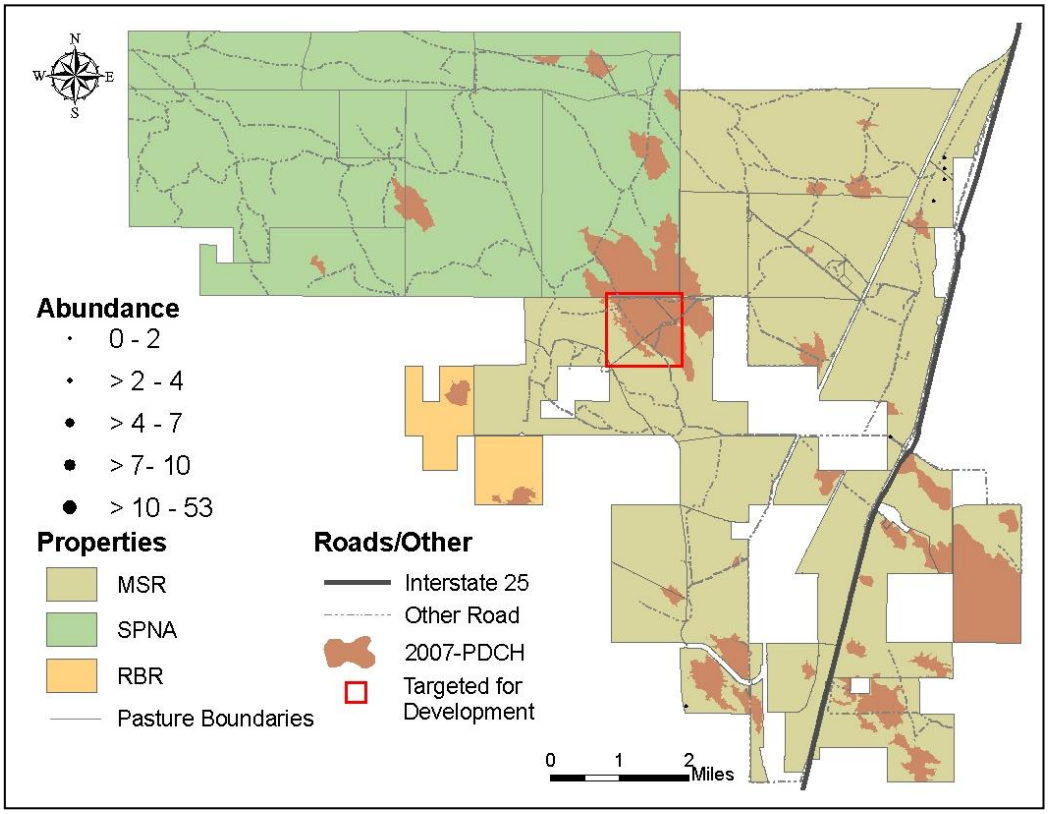
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



European Starling abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Yellow Warbler
Priority species (PIF)

Yellow Warbler is a probable but local breeder within the study area. Yellow Warblers breed in moist, deciduous thickets and woodlands. We observed six individuals in north and middle Lonetree pastures of MSR. Yellow Warbler is PIF species of regional concern due to documented population declines and moderate threats to its breeding habitat in the shortgrass prairie region, particularly in the south. Because their presence and abundance is closely tied to the health of riparian ecosystems, they are good indicators of the ecological integrity of riverine ecosystems.

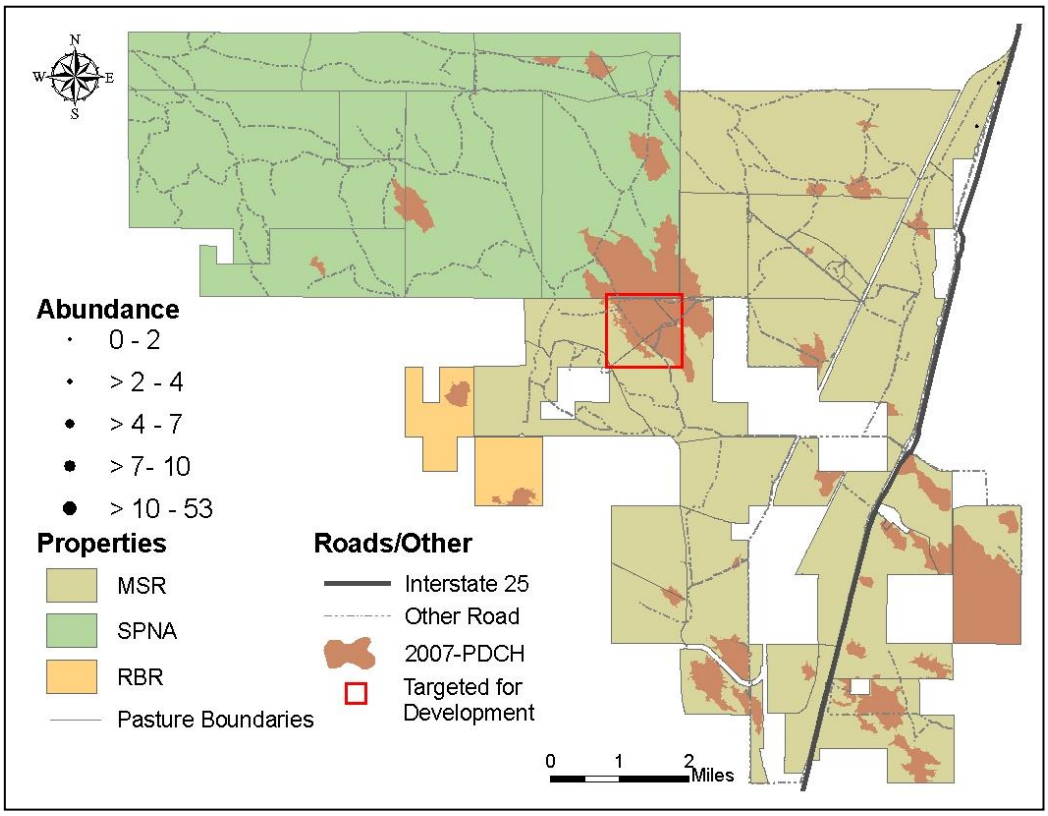


Yellow Warbler abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Blue Grosbeak

Blue Grosbeak is an uncommon but probable breeder within the study area in shrublands, forest edges, and stream corridors. Two individuals were detected on point

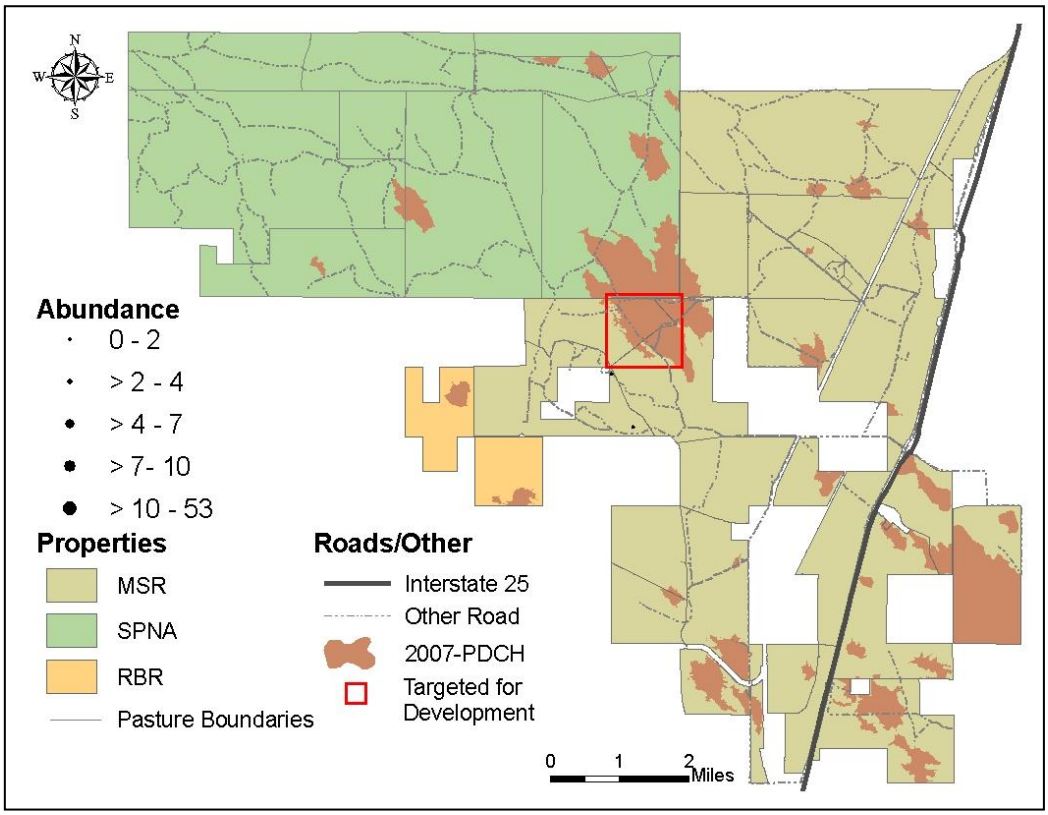
counts in Lonetree north pasture of MSR. Another individual was observed along County Rd. 17 and Carr pasture.



Blue Grosbeak abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Spotted Towhee

Spotted Towhee is a local and uncommon probable breeder within the study area, where it occurs in the hilly shrublands in west Butte pasture. It is more common in the higher portions of SPNA.



Spotted Towhee abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Cassin's Sparrow

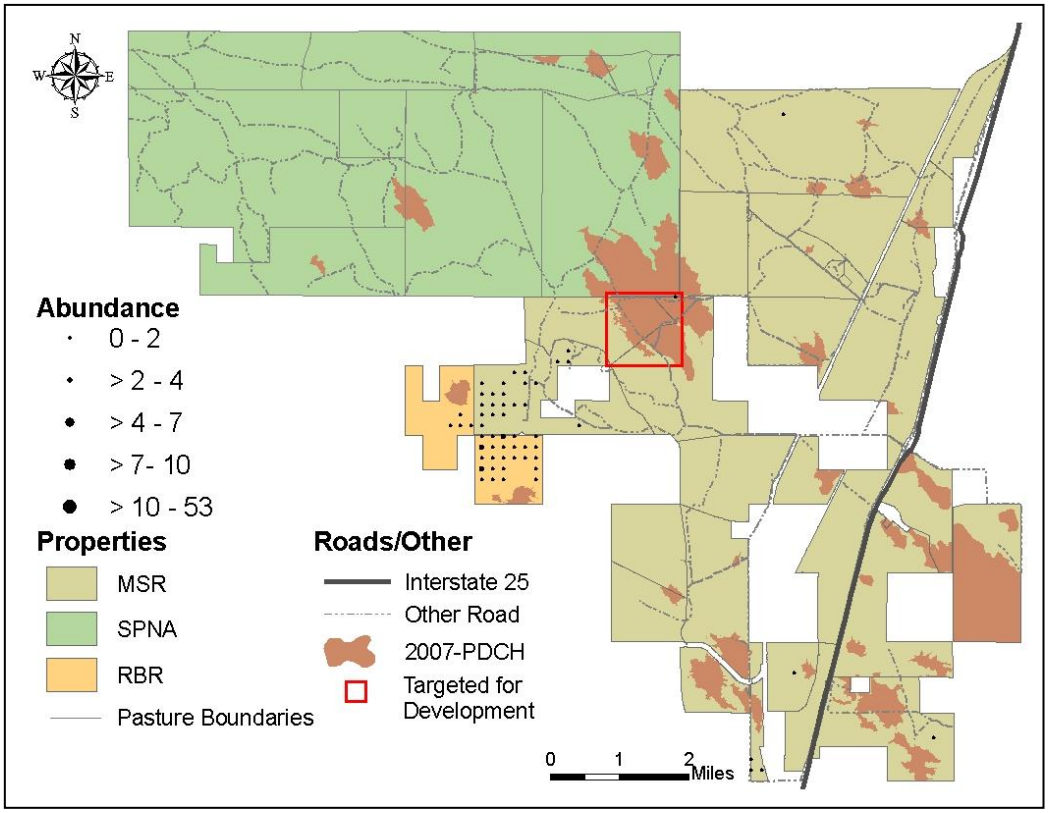
Priority species (PIF, CDOW)

Cassin's Sparrow is a locally common, irruptive summer resident within the study area, probably breeding in some years, and then disappearing in others, likely in response to local and regional environmental conditions. It prefers arid shrubby grasslands, and nests on the ground under shrubs. We observed a greater number of Cassin's sparrows in 2008 (n=68) than in 2009 (n=13), but it is unclear whether this is due to differences in areas sampled each year or environmental variation. Cassin's Sparrows were most common on RBR and adjacent west Butte pasture of MSR.

Cassin's Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	1.98	16.23	1.43	2.73	5
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.62	16.15	0.45	0.86	1
Bulger north	0.00				0
Bulger south	0.19	15.73	0.14	0.26	1
Bull	0.00				0
Butte east	0.00				0
Butte north	0.00				0
Butte west	4.35	15.74	3.18	5.95	22
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.07	15.69	0.05	0.09	1
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	0.00				0
Meadow Springs	0.28	15.68	0.21	0.39	30
Round Butte	5.01	15.74	3.67	6.86	30
Soapstone	0.00				0
Global	**0.50**	**15.68**	**0.37**	**0.68**	**60**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Cassin's Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Brewer's Sparrow

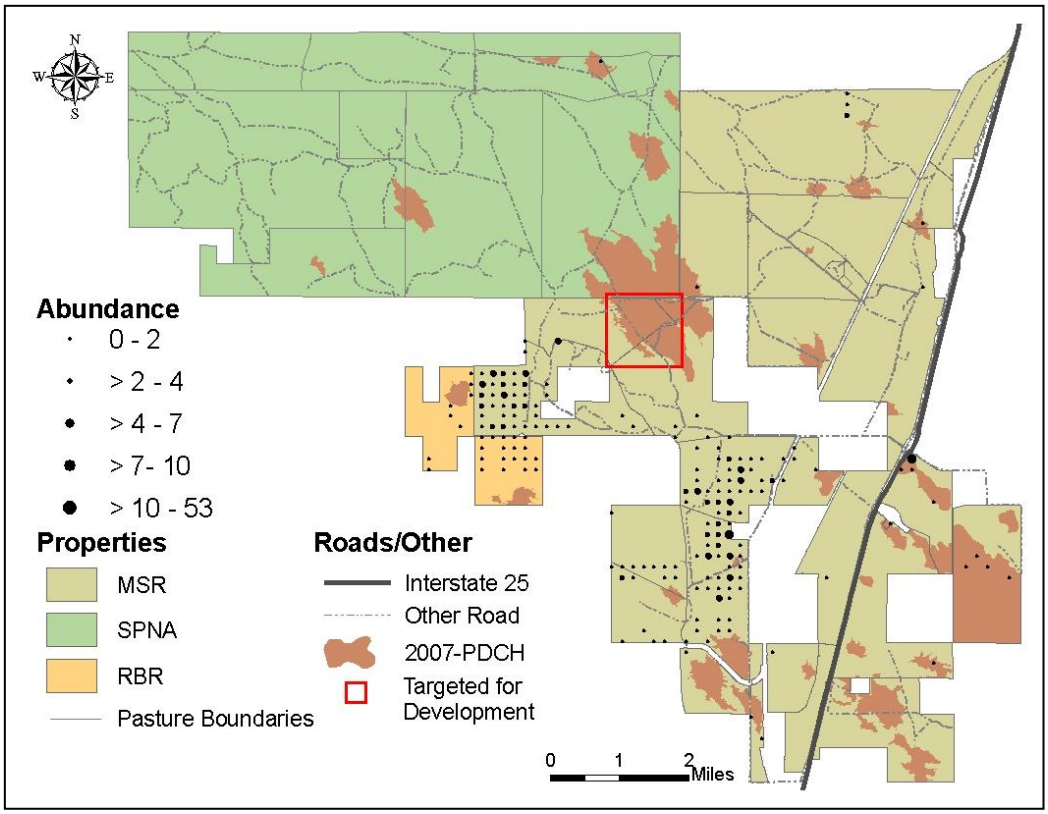
Priority species (PIF, CDOW, USFWS)

Brewer's Sparrow is a common and confirmed breeder within the study area, especially in shrublands dominated by saltbush (*Atriplex* sp.). Its distribution nearly mirrors that of shrublands across the study area. We observed territorial and breeding behaviors during surveys, such as singing and carrying food and nesting materials.

Brewer's Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	3.05	21.33	2.02	4.63	1
Barton lower	6.59	21.45	4.34	10.01	3
Barton upper c-300	23.00	21.54	15.12	34.98	12
Barton upper east	79.16	22.31	51.30	122.14	61
Barton upper north	92.65	21.88	60.53	141.80	55
Barton upper southwest	22.52	21.67	14.77	34.34	11
Benson north north	0.00				0
Benson north south	1.58	21.39	1.04	2.40	1
Benson south	0.00				0
Benson south c-100	3.46	21.67	2.27	5.28	1
Bulger north	3.26	39.59	0.62	16.97	2
Bulger south	0.00				0
Bull	9.45	21.79	6.18	14.45	3
Butte east	2.32	21.37	1.53	3.52	4
Butte north	0.00				0
Butte west	94.76	21.81	61.99	144.84	60
Carr	4.00	21.35	2.64	6.07	4
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	1.50	21.33	0.99	2.27	4
Lewis south	0.00				0
Lonetree middle	12.87	21.37	8.49	19.51	1
Lonetree north	0.00				0
Lonetree south	1.44	21.34	0.95	2.18	1
Meadow	64.75	94.90	5.84	717.79	5
Meadow Springs	15.34	21.47	10.10	23.30	229
Round Butte	23.22	21.36	15.32	35.19	25
Soapstone	2.03	21.33	1.34	3.08	1
Global	**14.82**	**21.45**	**9.76**	**22.50**	**255**

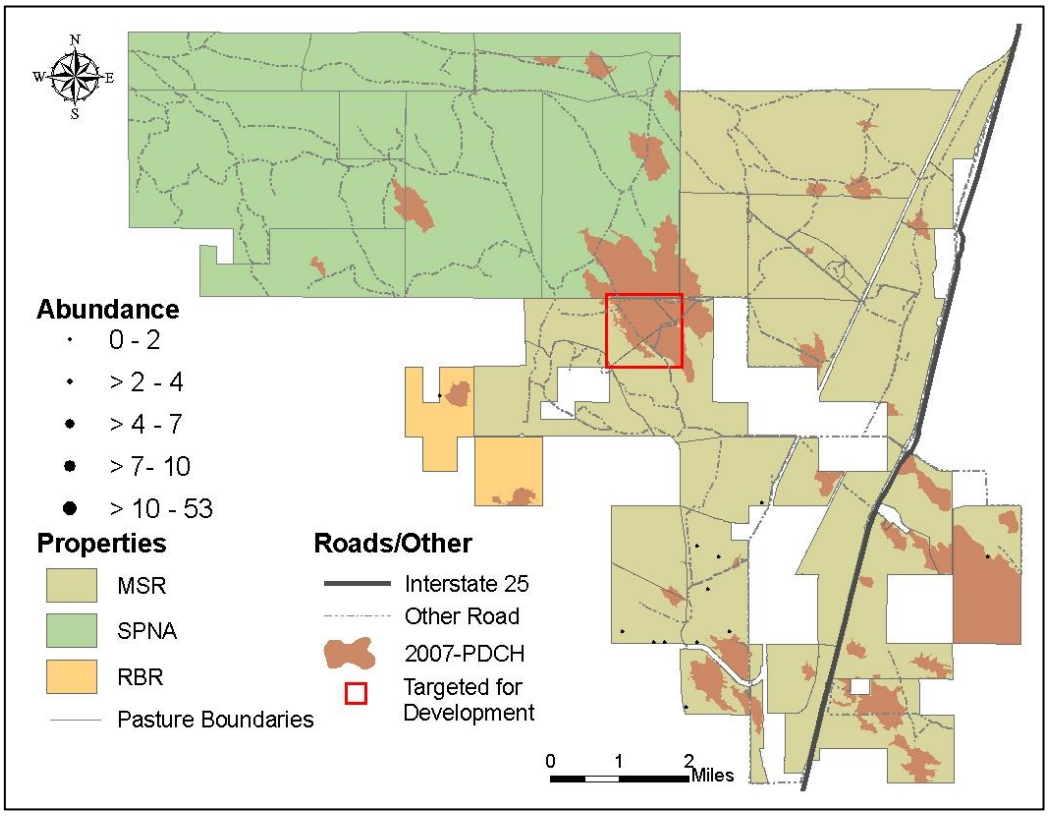
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Brewer's Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Clay-colored Sparrow

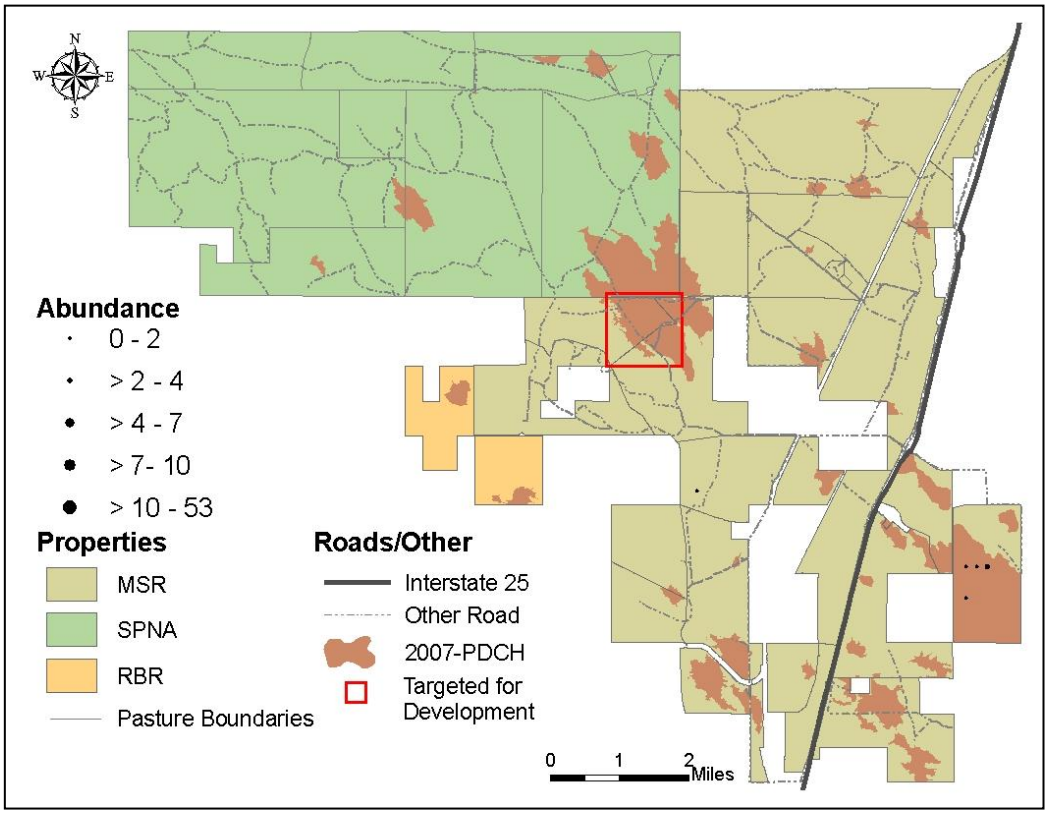
Clay-colored Sparrow is primarily a transient migrant within the study area, nesting in the northern Great Plains and wintering in Mexico. Most observations were of birds in mid to late May, although we had one record of a singing bird in mid June.



Clay-colored Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Chipping Sparrow

Chipping Sparrows occur within the study area mainly as a transient migrant. Ten Individuals were observed in the study area, all in May.



Chipping Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Grasshopper Sparrow

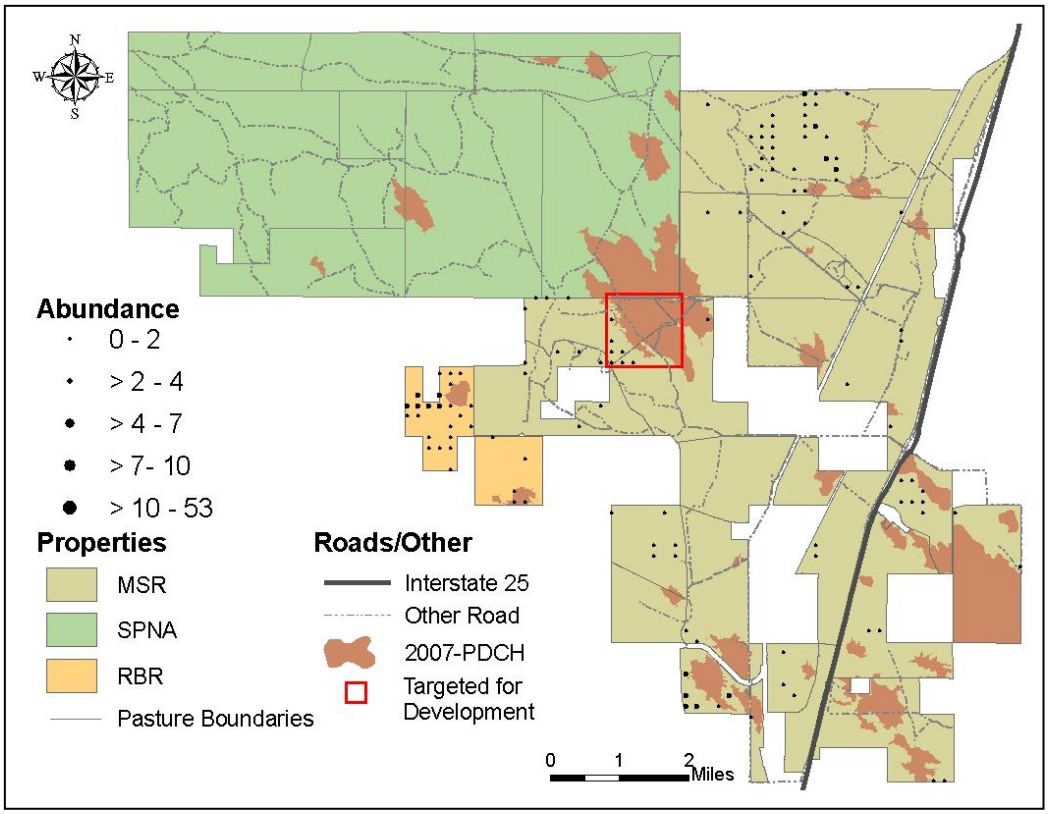
Priority species (PIF, CDOW)

Grasshopper Sparrow is a fairly common although somewhat local probable breeder within the study area that prefers areas with tall grasses (at least above calf height). In 2009, it seemed the population appeared to increase within the study area toward the end of the survey period. Overall it seems population density was higher in 2009 than in 2008, likely due to the abundant rainfall which created widespread favorable conditions for this species.

Grasshopper Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	2.25	9.01	1.88	2.69	2
Barton lower	30.75	10.83	24.85	38.06	19
Barton upper c-300	11.30	9.25	9.42	13.55	8
Barton upper east	1.64	8.87	1.38	1.95	2
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	7.66	9.47	6.35	9.23	3
Bulger north	1.60	8.87	1.34	1.90	2
Bulger south	1.58	8.86	1.33	1.88	2
Bull	0.00				0
Butte east	1.28	8.79	1.08	1.53	3
Butte north	6.20	8.91	5.20	7.39	10
Butte west	2.43	8.86	2.04	2.89	3
Carr	1.47	8.85	1.24	1.76	2
Lewis middle east	22.12	15.97	15.55	31.47	2
Lewis middle north	4.08	8.91	3.43	4.87	4
Lewis middle south	1.58	9.10	1.32	1.89	1
Lewis middle west	0.00				0
Lewis north	14.10	8.82	11.85	16.78	51
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	1.59	8.82	1.34	1.89	3
Meadow	13.61	9.21	11.36	16.32	8
Meadow Springs	4.83	8.79	4.06	5.74	125
Round Butte	28.05	8.95	23.52	33.46	41
Soapstone	0.00				0
Global	**5.65**	**8.79**	**4.76**	**6.72**	**166**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Grasshopper Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

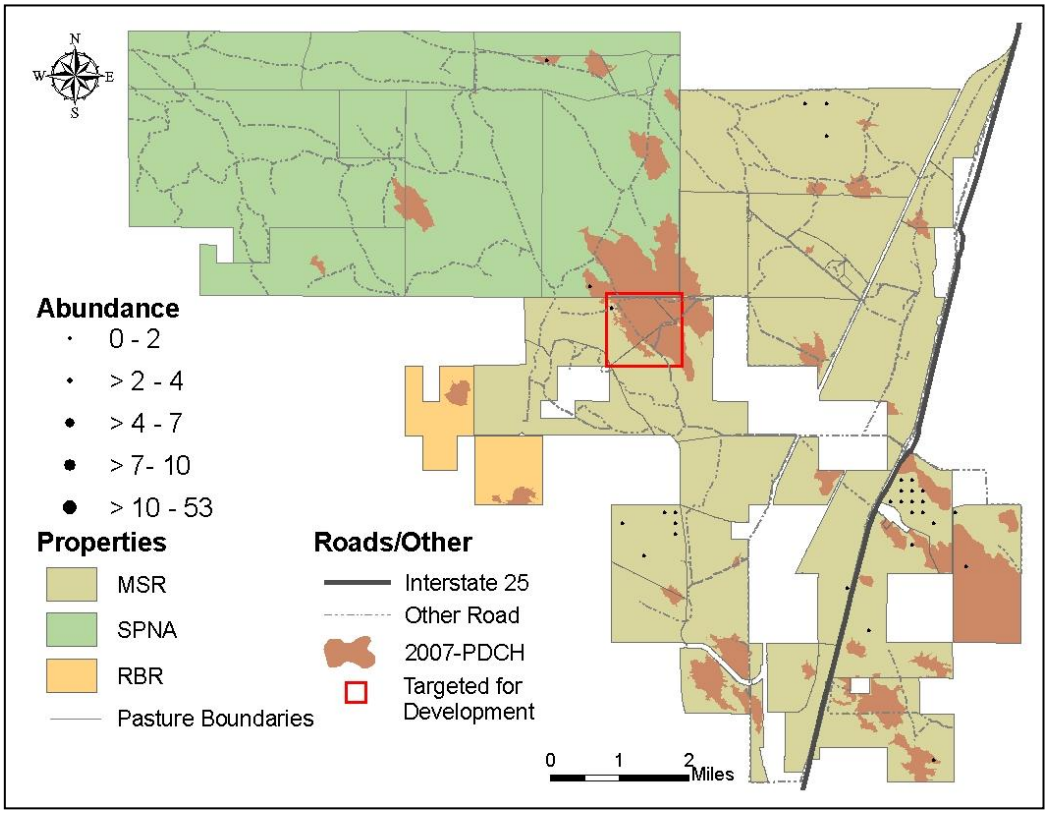
Savannah Sparrow

Savannah Sparrow is a locally common and confirmed breeder within the study area in wet meadows and tall grasses next to wetlands. This habitat type is quite uncommon within the study area. The largest population of Savannah Sparrows is likely in the large wet meadow in Meadow Pasture on MSR, near the Carr exit on I-25.

Savannah Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	9.43	24.21	5.80	15.33	6
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	1.30	24.20	0.80	2.11	1
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	1.78	24.17	1.10	2.89	2
Bulger south	0.88	24.17	0.54	1.43	1
Bull	0.00				0
Butte east	0.00				0
Butte north	0.69	24.15	0.43	1.12	1
Butte west	0.00				0
Carr	1.64	24.16	1.01	2.67	2
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.92	24.14	0.57	1.50	3
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.00				0
Meadow	30.30	24.31	18.61	49.33	16
Meadow Springs	1.38	24.14	0.85	2.23	32
Round Butte	0.00				0
Soapstone	0.56	24.15	0.34	0.90	1
Global	**1.25**	**24.14**	**0.77**	**2.03**	**33**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Savannah Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Vesper Sparrow

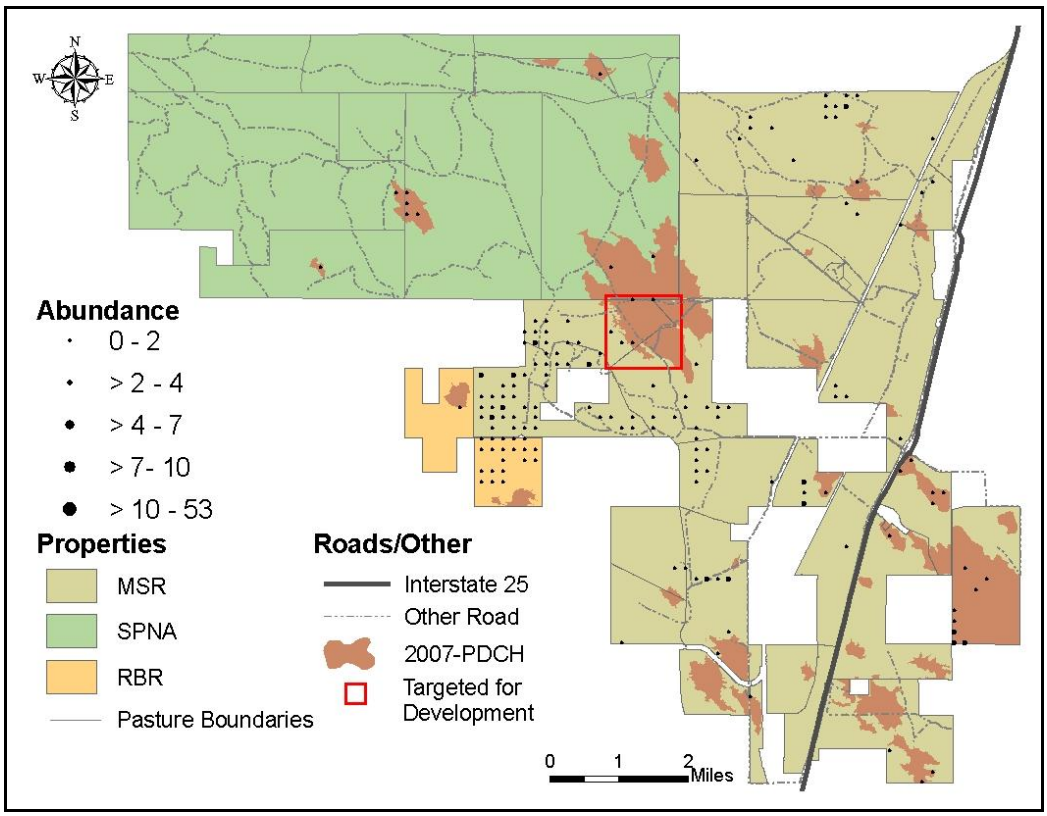
Priority species (PIF, CDOW)

Vesper Sparrow is a confirmed breeder within the study area, where it occupies shrub-dominated grasslands, particularly those dominated with Saltbush (*Atriplex* sp.). Most of Vesper Sparrows observed in prairie dog colonies were likely transient migrants observed in early May. Like most of the grassland birds within the study area, Vesper Sparrows nest on the ground.

Vesper Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	1.22	16.84	0.88	1.70	1
Barton upper c-300	1.07	16.80	0.77	1.48	1
Barton upper east	8.67	16.87	6.23	12.06	14
Barton upper north	10.27	20.92	6.77	15.56	9
Barton upper southwest	1.14	16.82	0.82	1.58	1
Benson north north	0.00				0
Benson north south	0.88	16.76	0.63	1.22	1
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.60	16.71	0.44	0.84	1
Bulger south	2.98	16.80	2.15	4.15	5
Bull	50.28	58.53	10.41	242.89	5
Butte east	3.88	16.71	2.80	5.38	12
Butte north	7.48	18.06	5.25	10.66	12
Butte west	27.51	16.74	19.82	38.19	45
Carr	9.93	22.87	6.28	15.71	10
Lewis middle east	0.00				0
Lewis middle north	1.54	16.73	1.11	2.14	2
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	4.39	16.68	3.16	6.08	21
Lewis south	0.00				0
Lonetree middle	4.78	17.55	3.39	6.73	2
Lonetree north	0.00				0
Lonetree south	2.01	16.68	1.45	2.78	5
Meadow	7.71	16.95	5.54	10.75	6
Meadow Springs	5.25	16.73	3.78	7.28	153
Round Butte	12.41	16.71	8.94	17.21	24
Soapstone	6.57	17.83	4.64	9.31	14
Global	**5.73**	**16.71**	**4.13**	**7.94**	**191**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Vesper Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Lark Bunting

Priority species (PIF, CDOW, USFWS)

Male Lark Bunting singing on Meadow Springs Ranch, Larimer County, Colorado. Photo by Mike Forsberg.

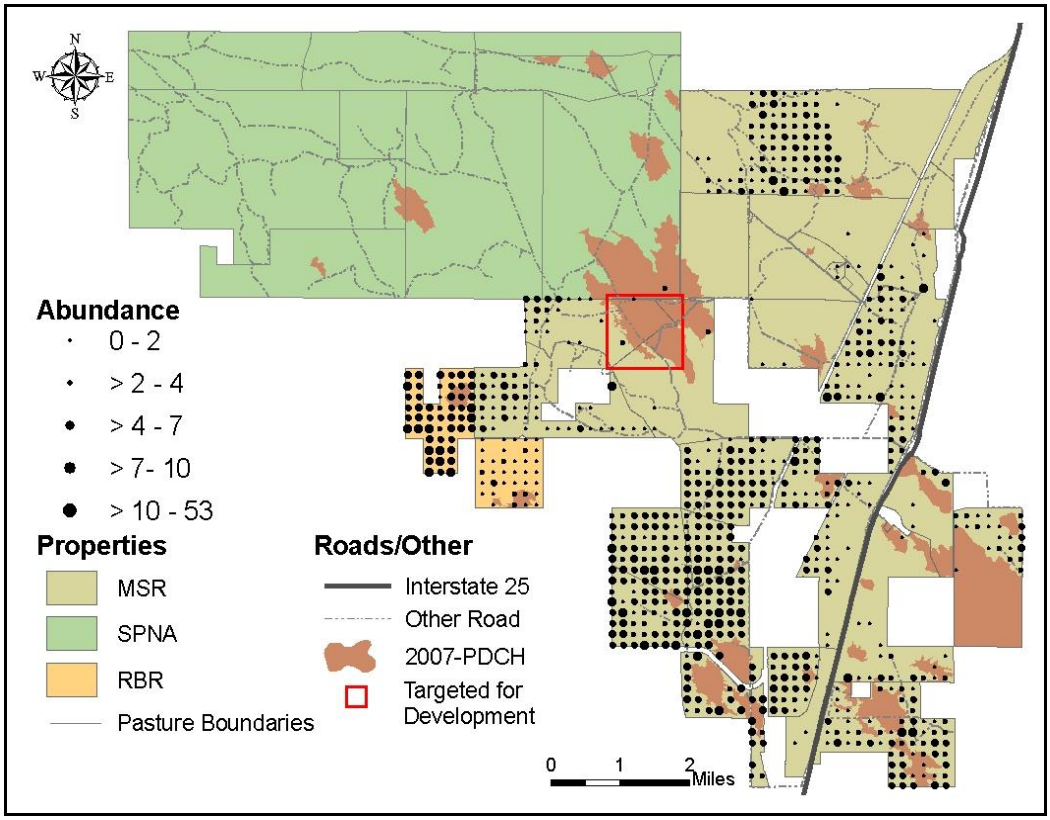
Lark Bunting, Colorado's state bird, is a common and widespread, although somewhat irruptive, breeder in the study area. It can be found in a range of grasslands but is most abundant where there are ample shrubs. Lark Buntings are known for shifting their populations in response to moisture levels and food resources (Neimuth et al. 2008; Shane 2000). In 2008, Lark Buntings were relatively uncommon within the study area, whereas in 2009, Lark Buntings settled in unusually large numbers. The contrast in their abundance and distribution between areas surveyed in 2008 and 2009 is clearly evident on the map, and should not be construed to indicate differences in habitat suitability between areas, but rather between years. Lark Buntings densities likely are significantly lower within prairie dog colonies, as these areas typically support relatively lower grass and shrub cover. However, it should be noted that in 2009 we surveyed prairie dog colonies prior to the arrival of most Lark Buntings, so the map probably under-represents their abundance in this habitat.

Lark Bunting density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	183.04	8.58	154.44	216.93	133
Barton upper c-300	219.52	5.67	196.42	245.35	180
Barton upper east	307.46	5.18	277.77	340.33	386
Barton upper north	170.86	5.10	154.61	188.81	220
Barton upper southwest	243.11	5.86	216.69	272.74	189
Benson north north	90.65	17.21	54.52	150.73	8
Benson north south	49.50	7.26	42.91	57.10	50
Benson south	18.24	10.03	13.07	25.47	3
Benson south c-100	223.32	6.41	196.80	253.43	111
Bulger north	19.66	13.48	14.96	25.82	27
Bulger south	123.97	5.72	110.82	138.68	172
Bull	128.41	9.27	106.76	154.46	68
Butte east	17.45	324.75	0.00	7331100000.00	3
Butte north	25.40	11.12	20.40	31.63	45
Butte west	74.15	6.86	64.81	84.84	95
Carr	28.36	6.83	24.80	32.43	47
Lewis middle east	7.55	17.21	4.95	11.54	1
Lewis middle north	2.09	4.55	1.91	2.29	3

Pasture	D	%CV	LCL	UCL	n_t
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	55.54	5.11	50.25	61.38	220
Lewis south	0.70	4.66	0.64	0.76	1
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	80.39	5.87	71.64	90.20	159
Meadow	15.70	23.69	9.39	26.23	11
Meadow Springs	72.47	4.37	66.51	78.95	2132
Round Butte	206.25	5.29	185.95	228.78	376
Soapstone	3.07	4.35	2.82	3.34	1
Global	**74.40**	**4.36**	**68.30**	**81.04**	**2509**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Lark Bunting abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Lark Sparrow

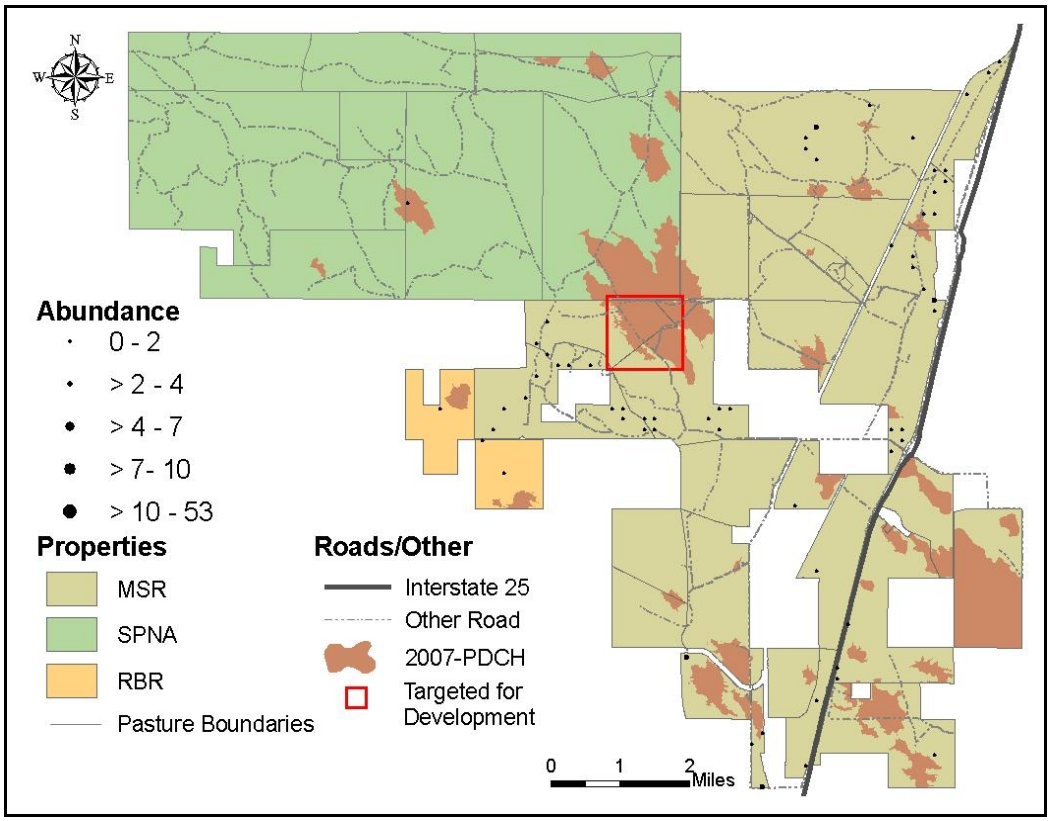
Priority species (PIF)

Lark Sparrow is a fairly common but somewhat local confirmed breeder within the study area. Lark Sparrows inhabit shrub-dominated grasslands, particularly in hilly areas.

Lark Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	4.30	15.08	3.18	5.82	2
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	44.11	52.17	10.53	184.77	2
Benson north south	0.00				0
Benson south	18.57	15.70	13.58	25.40	2
Benson south c-100	0.00				0
Bulger north	3.19	14.94	2.36	4.30	3
Bulger south	6.83	21.45	3.73	12.48	3
Bull	3.27	15.35	2.40	4.44	1
Butte east	2.85	14.96	2.11	3.84	5
Butte north	2.47	36.60	0.26	23.10	2
Butte west	12.46	17.16	8.85	17.55	10
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	1.84	14.92	1.36	2.48	5
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	2.67	15.20	1.97	3.62	1
Lonetree south	7.55	28.04	4.08	14.00	7
Meadow	0.00				0
Meadow Springs	2.85	15.59	2.09	3.89	43
Round Butte	1.82	14.94	1.35	2.45	1
Soapstone	0.66	14.91	0.49	0.89	1
Global	**2.69**	**15.58**	**1.97**	**3.68**	**45**

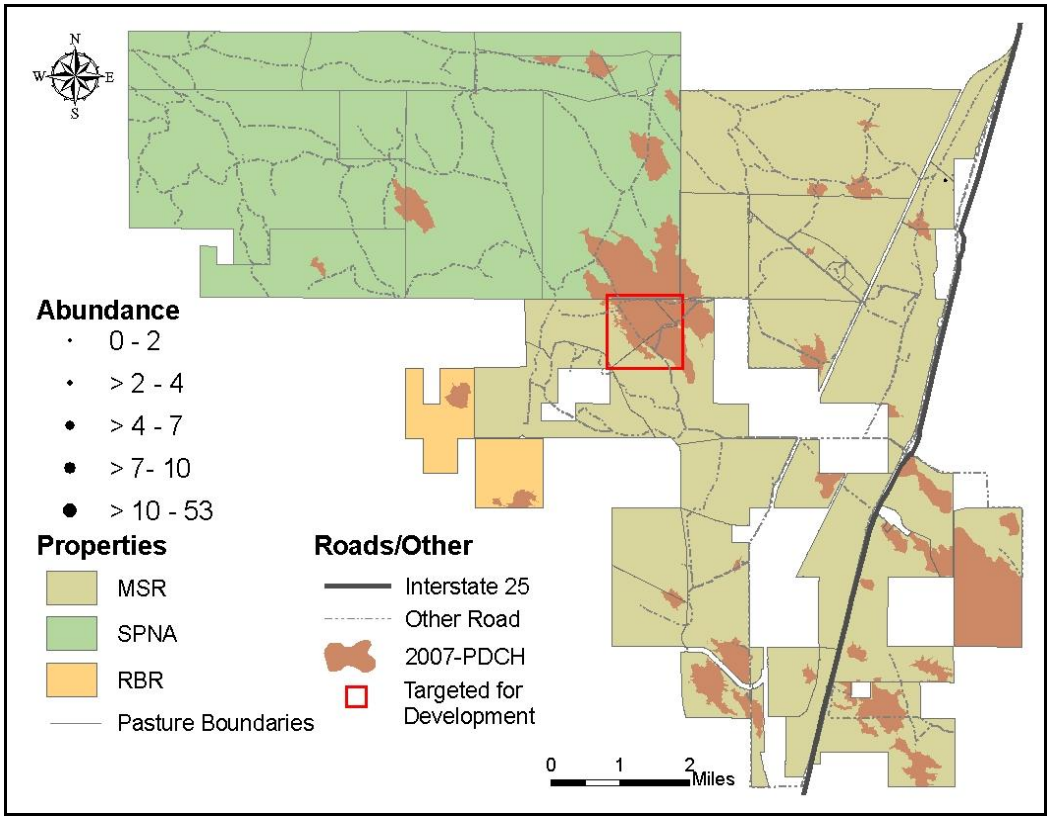
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Lark Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Song Sparrow

Although locally common elsewhere in the region, Song Sparrow is not common within the study area, although it is a possible breeder. In western North America, Song Sparrows occur almost exclusively in riparian shrublands, especially willow thickets, where they are often common. Very little suitable habitat for this species exists within the study area, but we did observe one individual in Lonetree middle pasture of MSR. Song sparrow populations are good indicators of healthy riparian habitats.



Song Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

McCown's Longspur

Priority species (PIF, CDOW, USFWS)

McCown's Longspur nest on Soapstone Natural Area Larimer County, Colorado. Photo by Loni Beyer.

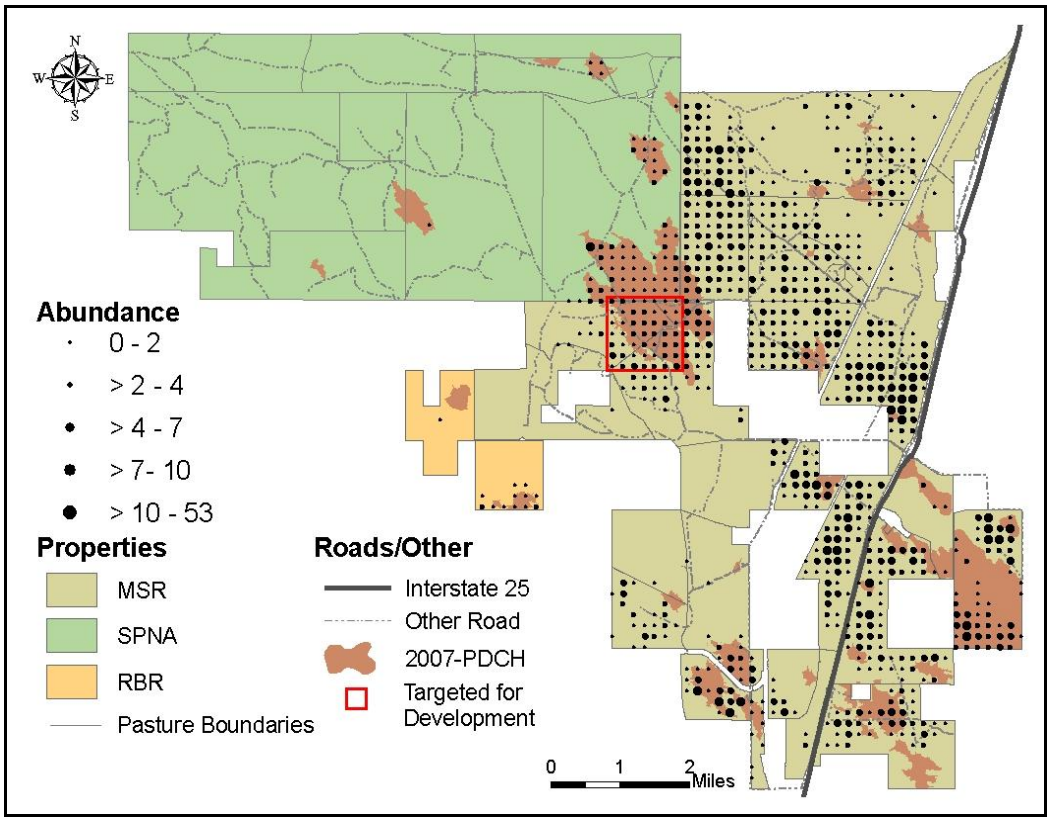
McCown's Longspur is one of several bird species found within the study area that is endemic to the western Great Plains, occurring nowhere else. Many of its populations appear to be declining, but McCown's Longspur is one of the most common breeding birds within the study area. Still, it is not ubiquitous. Within it found only has a limited range within the western Great Plains, but it is a common and confirmed breeder within the study area, which lies on the southern extreme of this species range. McCown's Longspurs prefer areas with short grass and sparse vegetation, including prairie dog towns and blue grama-buffalograss grasslands. We found McCown's Longspur to be equally as abundant within prairie dog towns as outside of them. We observed McCown's Longspur arriving early to the breeding ground and nesting well into July.

McCown's Longspur density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	315.97	4.77	287.76	346.94	189
Barton lower	228.97	13.21	176.45	297.12	57
Barton upper c-300	1.70	4.68	1.55	1.87	1
Barton upper east	49.76	8.30	42.22	58.65	34
Barton upper north	19.85	15.80	14.21	27.73	13
Barton upper southwest	98.41	7.55	84.79	114.20	43
Benson north north	0.00				0
Benson north south	273.48	6.93	238.57	313.50	180
Benson south	16.86	13.38	12.79	22.23	4
Benson south c-100	57.30	15.15	42.20	77.81	17
Bulger north	184.27	5.65	164.93	205.88	165
Bulger south	108.63	6.20	96.19	122.68	97
Bull	301.59	13.20	231.10	393.59	81
Butte east	188.81	4.72	172.12	207.13	293
Butte north	155.59	4.86	141.46	171.13	169
Butte west	1.95	4.34	1.79	2.13	2
Carr	219.69	6.49	193.41	249.54	171
Lewis middle east	40.05	10.83	31.00	51.75	3
Lewis middle north	73.20	6.40	64.54	83.02	58
Lewis middle south	173.27	5.12	156.72	191.57	87
Lewis middle west	277.40	17.07	192.33	400.12	20
Lewis north	112.54	4.73	102.58	123.46	278

Pasture	D	%CV	LCL	UCL	n_t
Lewis south	195.18	5.22	176.20	216.21	155
Lonetree middle	3.81	7.16	3.30	4.41	1
Lonetree north	0.00				0
Lonetree south	223.22	5.72	199.55	249.69	282
Meadow	10.10	23.22	5.50	18.54	6
Meadow Springs	139.69	4.22	128.59	151.74	2406
Round Butte	14.86	4.40	13.64	16.20	18
Soapstone	250.69	5.28	226.02	278.04	264
Global	**140.62**	**4.22**	**129.46**	**152.74**	**2688**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



McCown's Longspur abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Chestnut-collared Longspur

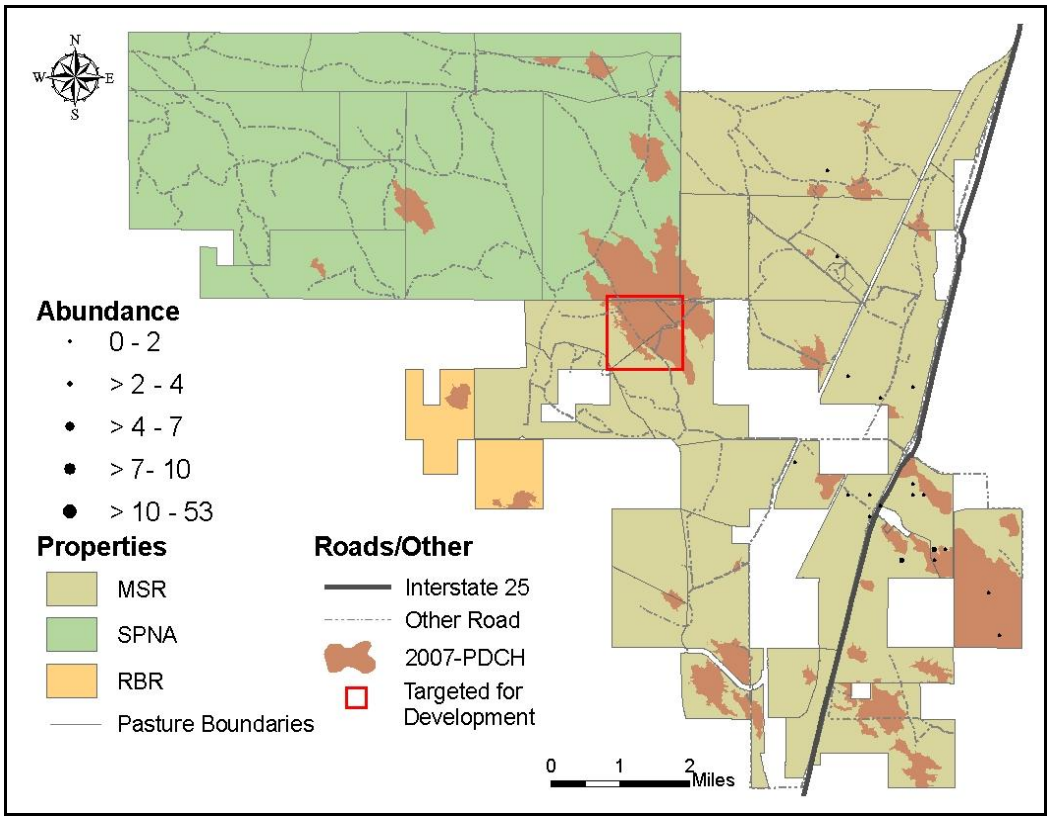
Priority species (PIF, CDOW, USFWS)

Chestnut-collared Longspur is a mixed-grass prairie specialist, preferring areas of taller grass within the shortgrass prairie. Meadow Springs Ranch probably represents the southern edge of the species' breeding range, which extends north into Canada. It is a species of high conservation concern due to long-term population declines. We observed Chestnut-collared Longspurs breeding adjacent to moist and wet areas in areas dominated by western wheat grass and other grasses.

Chestnut-collared Longspur density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	0.00				0
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	8.12	51.11	1.88	34.98	3
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	3.29	48.05	0.94	11.54	2
Bulger south	0.00				0
Bull	3.37	34.72	1.67	6.80	1
Butte east	0.00				0
Butte north	0.00				0
Butte west	0.00				0
Carr	3.04	48.00	0.87	10.65	2
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	9.11	35.94	4.44	18.69	1
Lewis north	0.38	34.52	0.19	0.76	1
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	2.97	41.88	1.25	7.04	4
Meadow	31.50	37.42	14.98	66.23	9
Meadow Springs	1.70	35.32	0.84	3.46	23
Round Butte	0.00				0
Soapstone	0.00				0
Global	**1.50**	**35.32**	**0.74**	**3.05**	**23**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Chestnut-collared Longspur abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

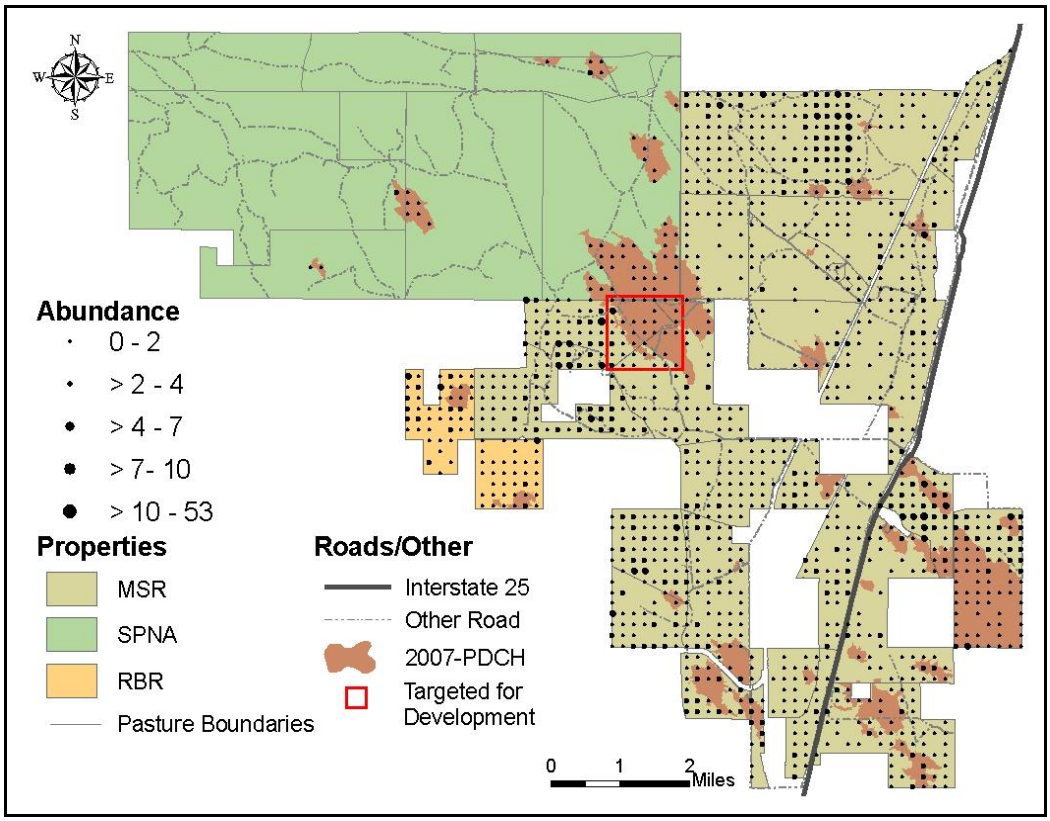
Western Meadowlark

Western Meadowlark is one of the most common and conspicuous birds within they study area, where it is a confirmed breeder. Meadowlarks require tall dense grass and litter cover for nesting and are most common around wet areas and hills. Western Meadowlarks can be found within the study area from April through November.

Western Meadowlark density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	6.11	4.63	5.58	6.69	26
Barton lower	20.19	5.23	18.22	22.37	58
Barton upper c-300	28.64	5.25	25.84	31.75	88
Barton upper east	18.28	4.56	16.71	19.99	105
Barton upper north	16.68	4.67	15.22	18.28	76
Barton upper southwest	17.19	6.55	15.11	19.55	49
Benson north north	17.34	18.86	9.90	30.37	5
Benson north south	11.86	5.24	10.70	13.14	48
Benson south	21.95	5.67	19.63	24.53	29
Benson south c-100	12.80	4.72	11.67	14.05	24
Bulger north	9.93	5.85	8.85	11.14	54
Bulger south	13.59	4.93	12.34	14.97	77
Bull	14.49	6.73	12.69	16.55	27
Butte east	8.03	5.00	7.28	8.86	83
Butte north	16.73	5.56	15.00	18.66	118
Butte west	28.84	4.75	26.28	31.66	157
Carr	19.70	4.74	17.95	21.62	119
Lewis middle east	11.56	12.17	8.65	15.44	5
Lewis middle north	8.19	5.04	7.42	9.04	36
Lewis middle south	4.62	5.17	4.18	5.12	14
Lewis middle west	6.93	10.94	5.48	8.78	5
Lewis north	16.28	4.58	14.88	17.81	259
Lewis south	5.24	8.48	4.40	6.22	16
Lonetree middle	7.38	10.98	5.82	9.36	9
Lonetree north	15.23	6.48	13.41	17.31	33
Lonetree south	11.64	4.64	10.62	12.74	102
Meadow	37.63	5.72	33.64	42.10	94
Meadow Springs	14.84	4.45	13.60	16.19	1716
Round Butte	20.01	4.64	18.27	21.92	133
Soapstone	9.15	5.10	8.28	10.12	81
Global	**14.70**	**4.44**	**13.48**	**16.04**	**1930**

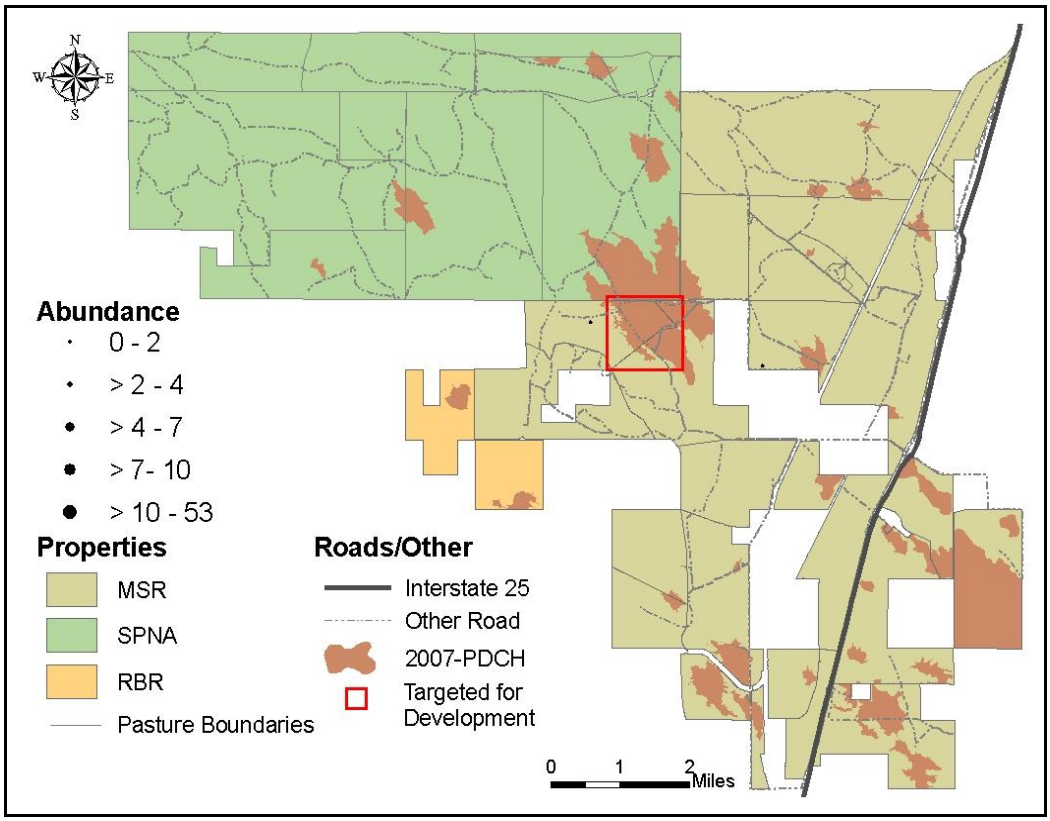
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Western Meadowlark abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Eastern Meadowlark

Eastern Meadowlark is very rare possible breeder within the study area. Similar to the Western Meadowlark, it inhabits native grasslands and pastures where it prefers heavy grass and litter cover for nesting. We observed 2 Eastern Meadowlarks in Butte north and Lewis south pastures of MSR.



Eastern Meadowlark abundance (avg. birds/point-count) and distribution on three properties in Northern Larimer and Weld counties, 2008 & 2009.

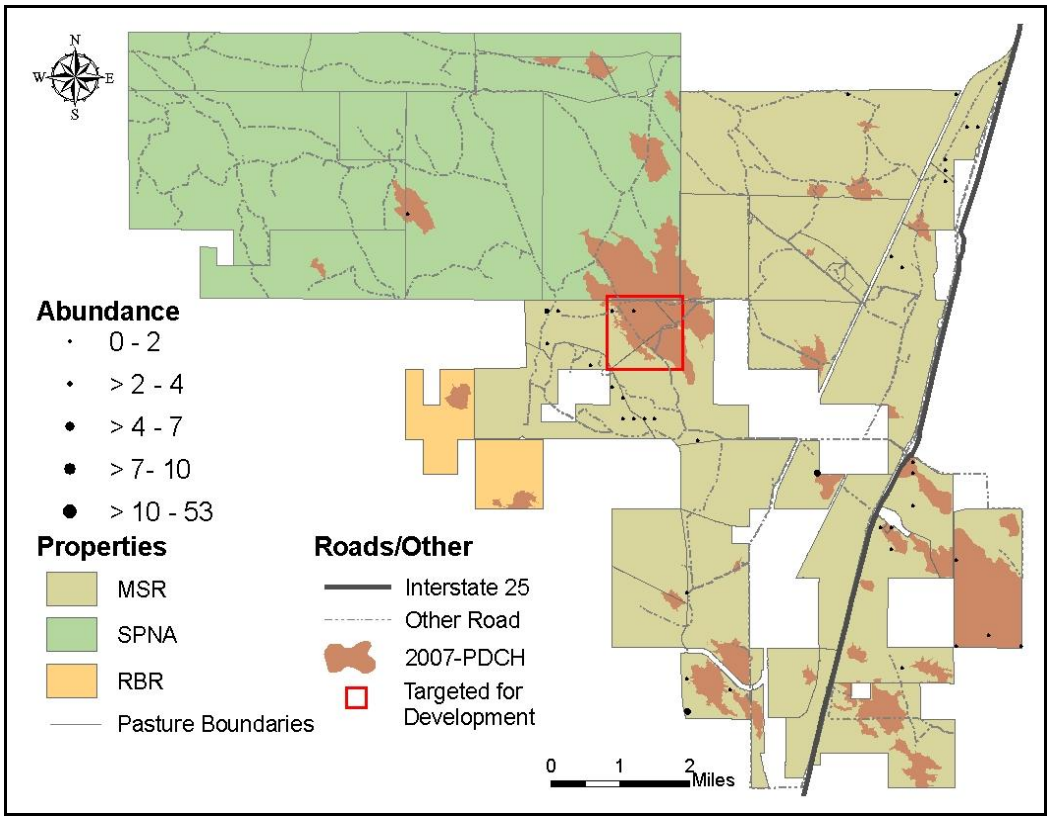
Brown-headed Cowbird

Brown-headed Cowbird is an uncommon but confirmed breeder within the study area. Cowbirds are brood parasites, meaning they build no nest of their own and instead lay their eggs in nests of other bird species, and depend on host parents to raise their young, often at the expense of the host's own young. Cowbirds are most common around feedlots, woodlands and shrublands. We observed Brown-headed Cowbird parasitism in a Lark Bunting nest in Barton upper c-300 pasture of MSR.

Brown-headed Cowbird density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	57.23	65.77	0.20	16727.00	3
Barton upper c-300	0.00				0
Barton upper east	1.02	16.72	0.73	1.42	1
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	7.79	28.18	2.78	21.85	3
Bulger south	0.00				0
Bull	21.34	73.72	0.04	12255.00	2
Butte east	1.59	16.73	1.14	2.23	3
Butte north	16.63	28.61	8.82	31.37	6
Butte west	4.02	16.71	2.87	5.62	4
Carr	8.56	28.88	4.35	16.83	5
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	1.03	37.27	0.13	8.04	2
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	9.98	16.90	7.11	14.00	4
Lonetree south	1.98	37.28	0.25	15.41	2
Meadow	6.33	17.19	4.49	8.93	3
Meadow Springs	3.98	18.35	2.76	5.73	38
Round Butte	0.00				0
Soapstone	1.86	16.69	1.33	2.60	1
Global	3.76	18.36	2.61	5.41	39

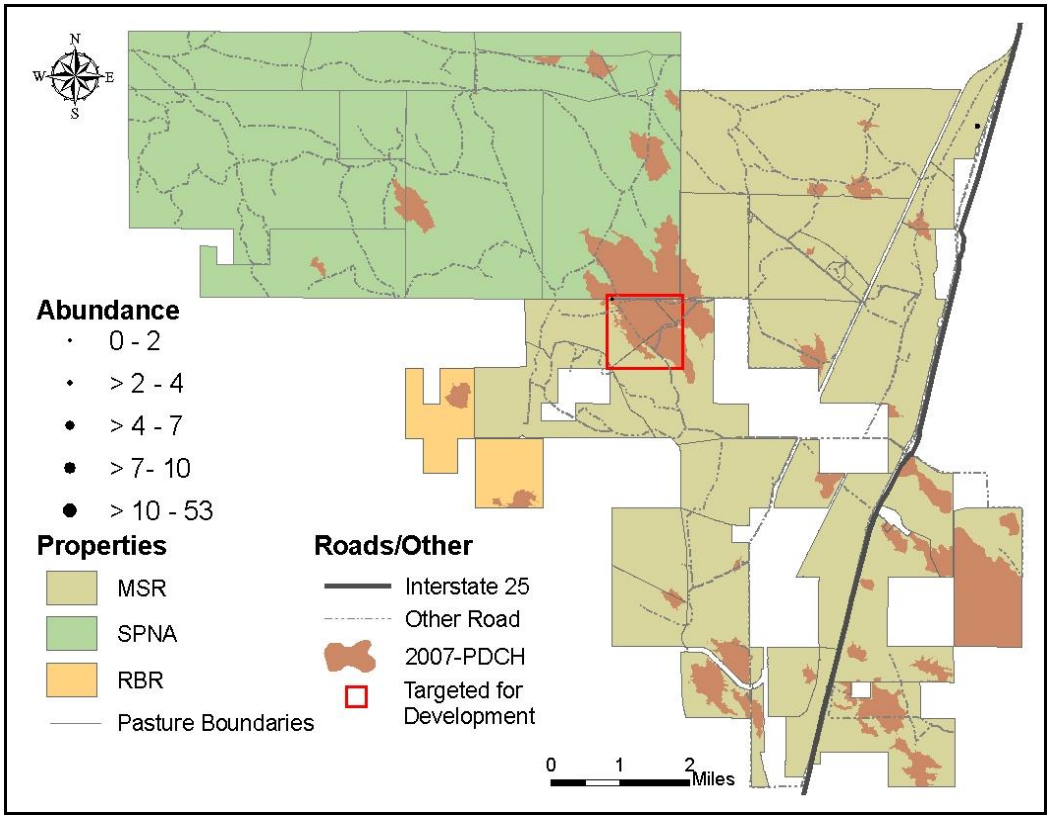
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Brown-headed Cowbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Yellow-headed Blackbird

Yellow-headed Blackbird nests exclusively in wetlands, placing its nests over water. Yellow-headed Blackbird breeds locally but is an unlikely breeder within the study area due to lack of suitable habitat.



Yellow-headed Blackbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

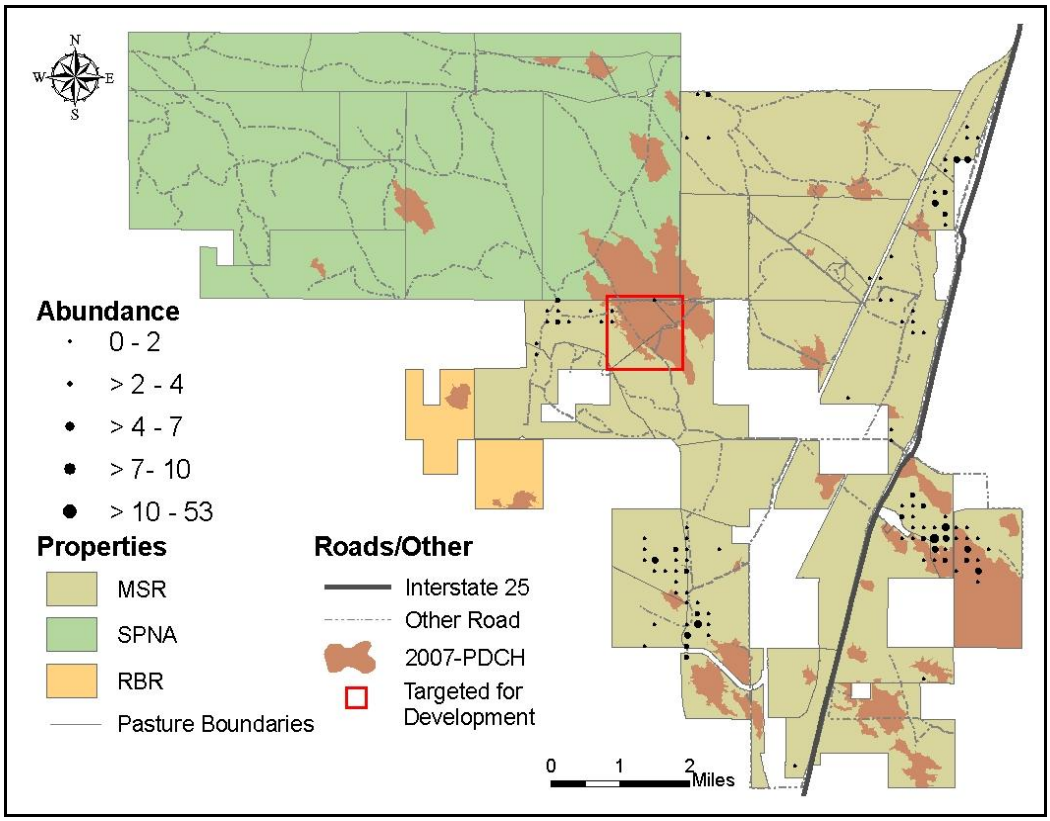
Red-winged Blackbird

Red-winged Blackbird breeds in a variety of wetland habitats within the study area. We observed Red-winged Blackbird territorial behaviors in most intermittent wet and moist areas within the study area and found a nest in Meadow pasture of MSR.

Red-winged Blackbird density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	5.07	59.02	0.45	57.26	2
Barton upper c-300	22.61	31.92	12.23	41.79	18
Barton upper east	32.59	31.84	17.66	60.15	37
Barton upper north	0.00				0
Barton upper southwest	2.36	31.05	1.30	4.30	2
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	2.74	31.42	1.49	5.01	1
Benson south c-100	0.00				0
Bulger north	4.38	31.07	2.41	7.98	7
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.00				0
Butte north	7.29	31.28	3.99	13.32	15
Butte west	1.27	31.00	0.70	2.30	1
Carr	19.67	34.39	10.16	38.06	15
Lewis middle east	0.00				0
Lewis middle north	0.80	31.01	0.44	1.45	1
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	16389.00	539.39	0.00	1.73E+14	3
Lewis south	0.00				0
Lonetree middle	47.81	36.05	23.99	95.27	14
Lonetree north	29.52	33.41	15.54	56.05	13
Lonetree south	3.69	33.66	1.93	7.05	11
Meadow	80.79	32.70	43.10	151.43	41
Meadow Springs	7.66	31.07	4.21	13.95	181
Round Butte	0.00				0
Soapstone	0.00				0
Global	**6.76**	**31.07**	**3.71**	**12.30**	**181**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Red-winged Blackbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

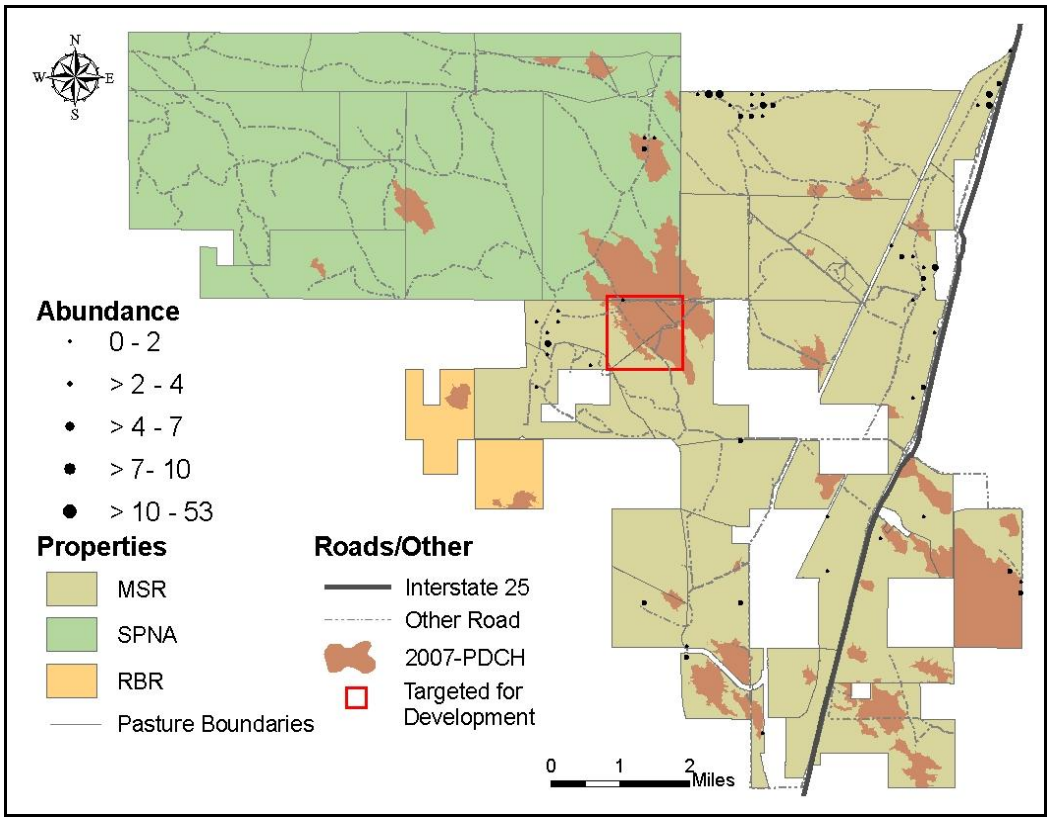
Brewer's Blackbird

Brewer's Blackbird is a confirmed breeder within the study area, inhabiting scrublands near water, riparian woodlands, and possibly other habitats. They are social and are known to forage up to six miles from their nests.

Brewer's Blackbird density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	13.63	94.79	0.20	927.96	3
Barton upper c-300	0.00				0
Barton upper east	0.97	44.73	0.41	2.29	1
Barton upper north	3.56	44.74	1.51	8.42	1
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.00				0
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.94	44.73	0.40	2.23	1
Bulger south	0.00				0
Bull	0.00				0
Butte east	0.00				0
Butte north	12.31	46.45	5.07	29.87	10
Butte west	1.91	44.73	0.81	4.52	2
Carr	3.48	67.09	0.53	22.70	2
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	13.65	65.31	3.97	46.96	9
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	41.60	74.63	8.72	198.33	5
Lonetree south	10.94	47.37	4.44	26.96	10
Meadow	4.02	44.79	1.70	9.50	1
Meadow Springs	3.50	45.51	1.46	8.36	45
Round Butte	0.00				0
Soapstone	4.78	96.09	0.06	376.32	3
Global	**3.81**	**45.71**	**1.59**	**9.13**	**48**

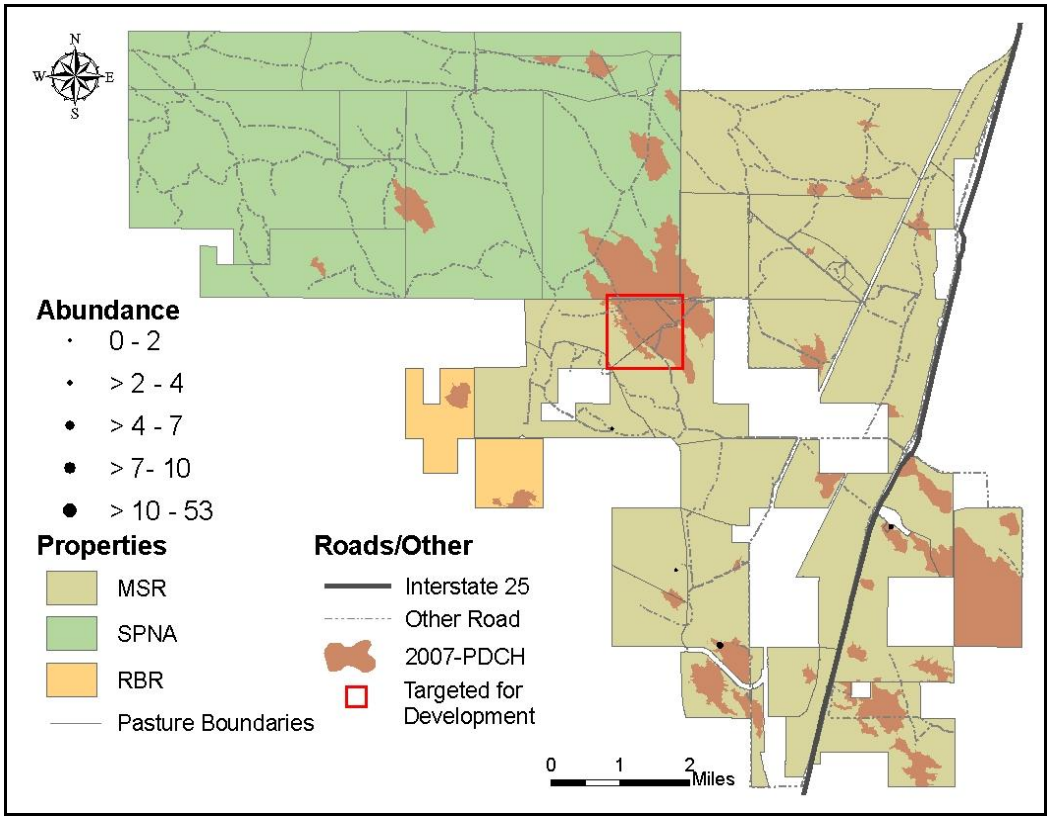
D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



Brewer's Blackbird abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Common Grackle

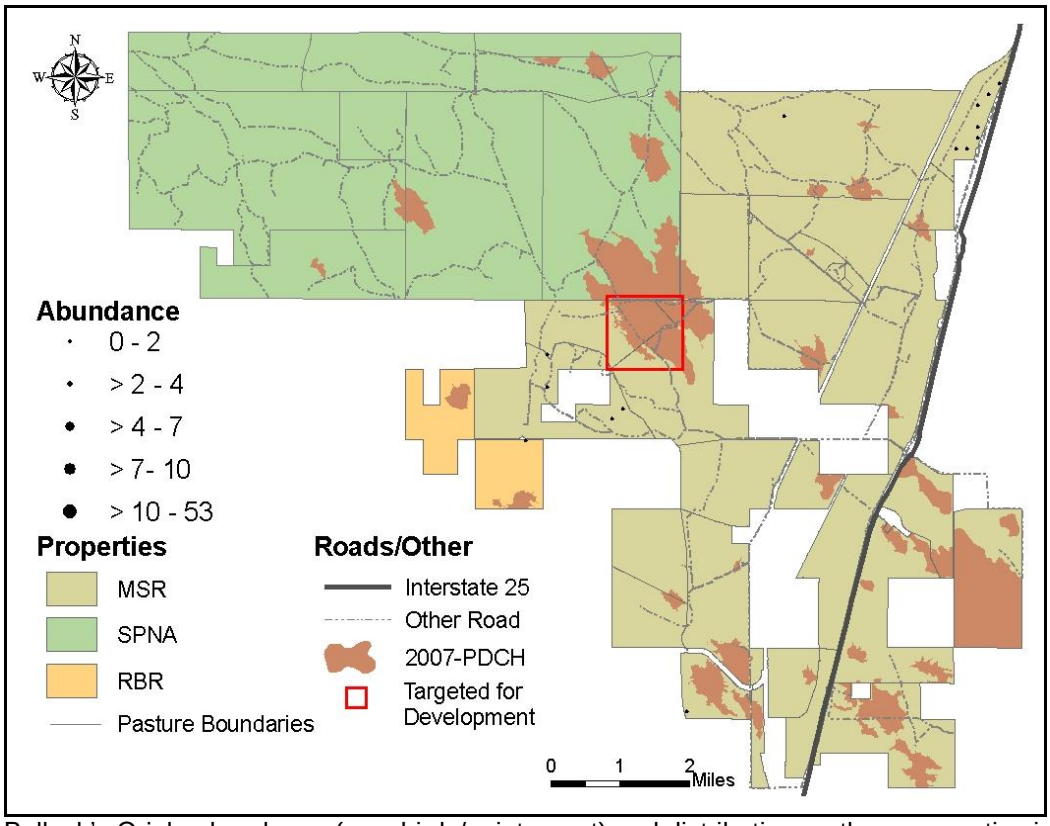
Common Grackle is an uncommon but possible breeder within the study area. It is more common around human habitations just outside the study area.



Common Grackle abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

Bullock's Oriole

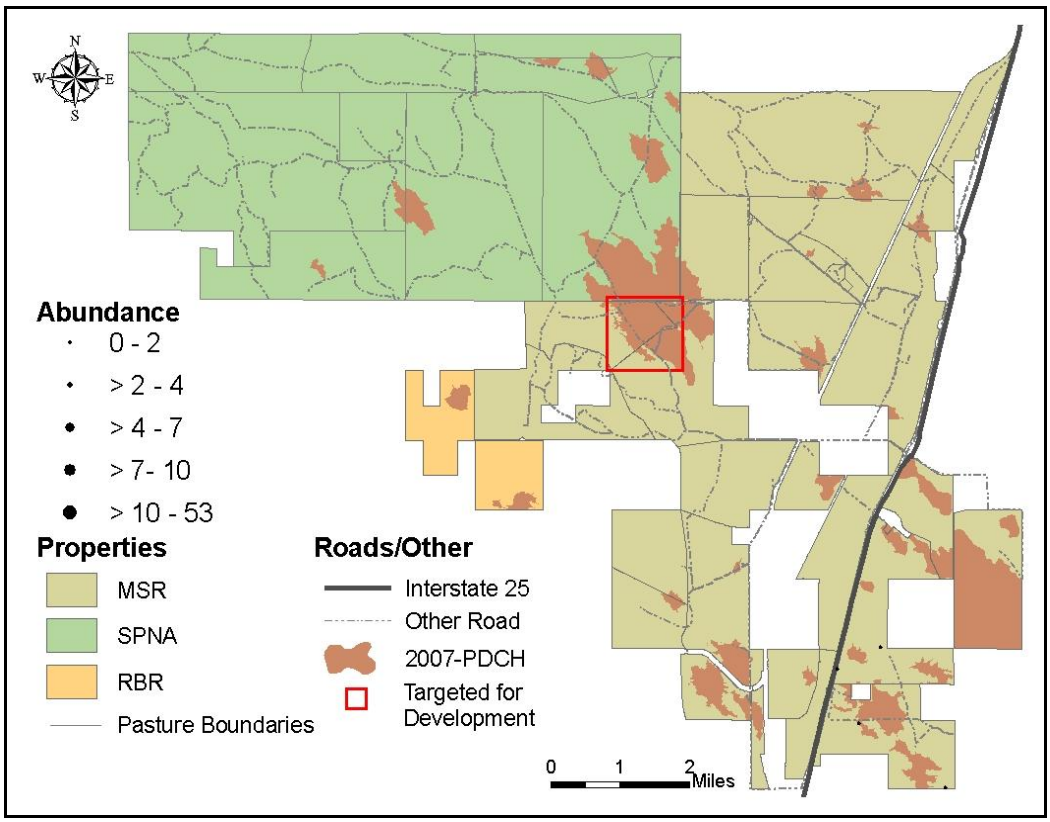
Bullock's Oriole is a confirmed breeder within the study area, primarily occupying riparian woodlands along wetlands and streams, large isolated trees, and to a lesser extent, mountain mahogany shrublands.



Bullock's Oriole abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

House Finch

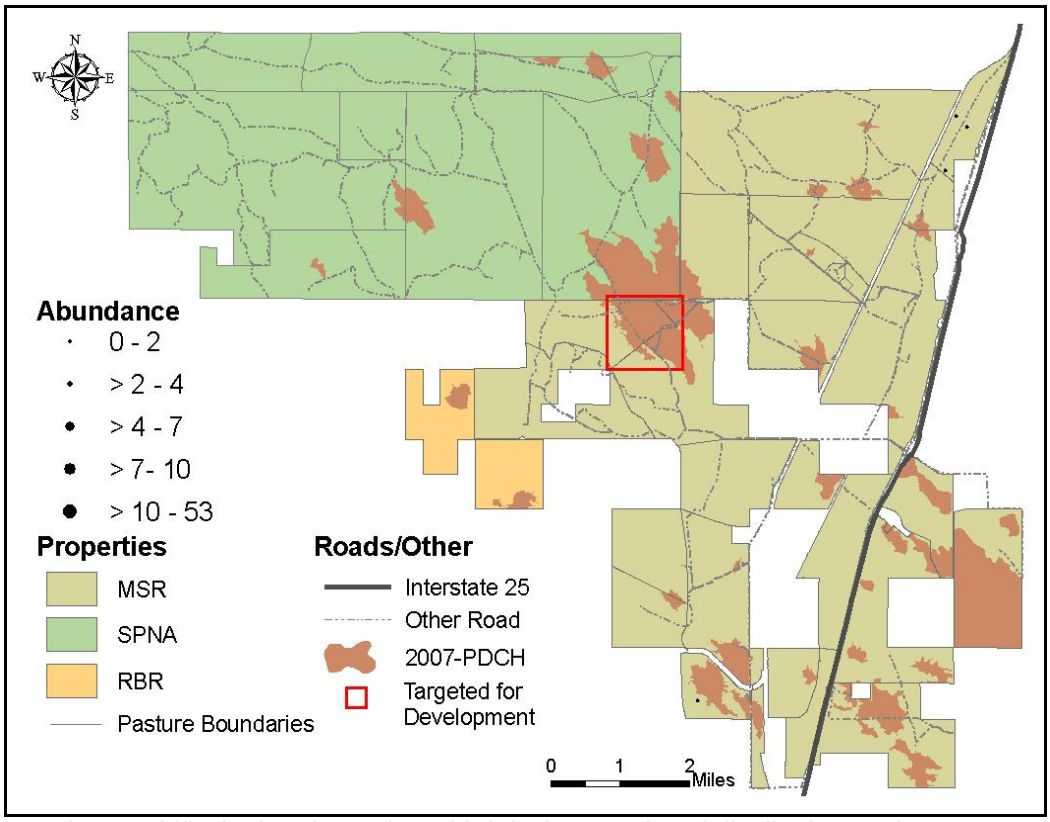
House Finch is an uncommon but possible breeder within the study area. We observed four individuals in North and South Bulger pastures of MSR that were possibly breeding in and near human structures.



House Finch abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

American Goldfinch

American Goldfinch is an uncommon and local but probable breeder within the study area, mainly in North Lonetree pasture, in riparian woodland.



American Goldfinch abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

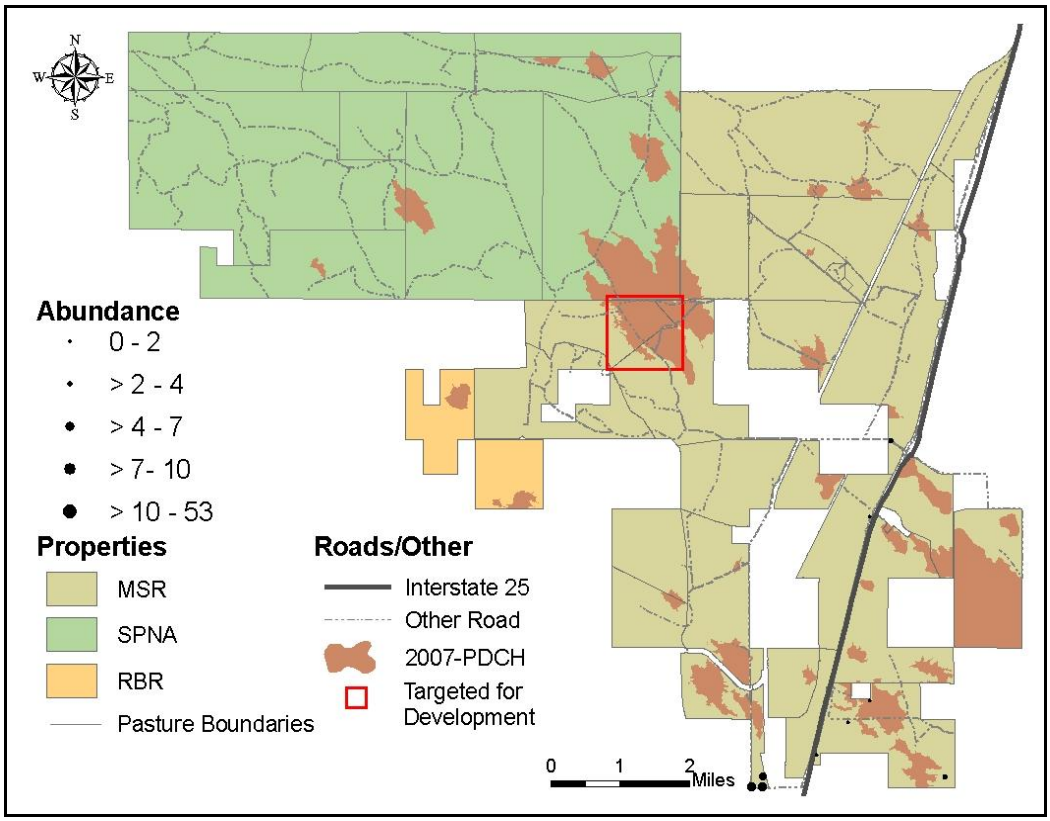
House Sparrow

House Sparrow is an exotic invasive species that rarely breeds away from human structures. House Sparrows are gregarious and often chase out native species from their nest sites. Nearly all House Sparrows detected were breeding in old haystacks at a feed lot neighboring Barton lower pasture on MSR.

House Sparrow density in each pasture on Meadow Springs Ranch, each City of Fort Collins property, and the entire study area in 2008 & 2009.

Pasture	D	%CV	LCL	UCL	n_t
Antelope	0.00				0
Barton lower	39.36	87.89	6.18	250.77	6
Barton upper c-300	0.00				0
Barton upper east	0.00				0
Barton upper north	0.00				0
Barton upper southwest	0.00				0
Benson north north	0.00				0
Benson north south	0.56	37.68	0.26	1.25	1
Benson south	0.00				0
Benson south c-100	0.00				0
Bulger north	0.00				0
Bulger south	10.99	115.87	0.79	152.89	5
Bull	0.00				0
Butte east	0.00				0
Butte north	0.00				0
Butte west	0.00				0
Carr	0.00				0
Lewis middle east	0.00				0
Lewis middle north	0.00				0
Lewis middle south	0.00				0
Lewis middle west	0.00				0
Lewis north	0.00				0
Lewis south	0.00				0
Lonetree middle	0.00				0
Lonetree north	0.00				0
Lonetree south	0.77	37.65	0.35	1.71	1
Meadow	0.00				0
Meadow Springs	1.83	62.17	0.56	6.00	13
Round Butte	0.00				0
Soapstone	0.00				0
Global	**1.61**	**62.17**	**0.49**	**5.29**	**13**

D = Density estimate (birds/km^2); %CV = percent coefficient of variation of D; LCL = lower 95% confidence limit of D; UCL = upper 95% confidence limit of D; n_t = number of observations used to estimate D.



House Sparrow abundance (avg. birds/point-count) and distribution on three properties in Larimer and Weld counties, Colorado, 2008 & 2009.

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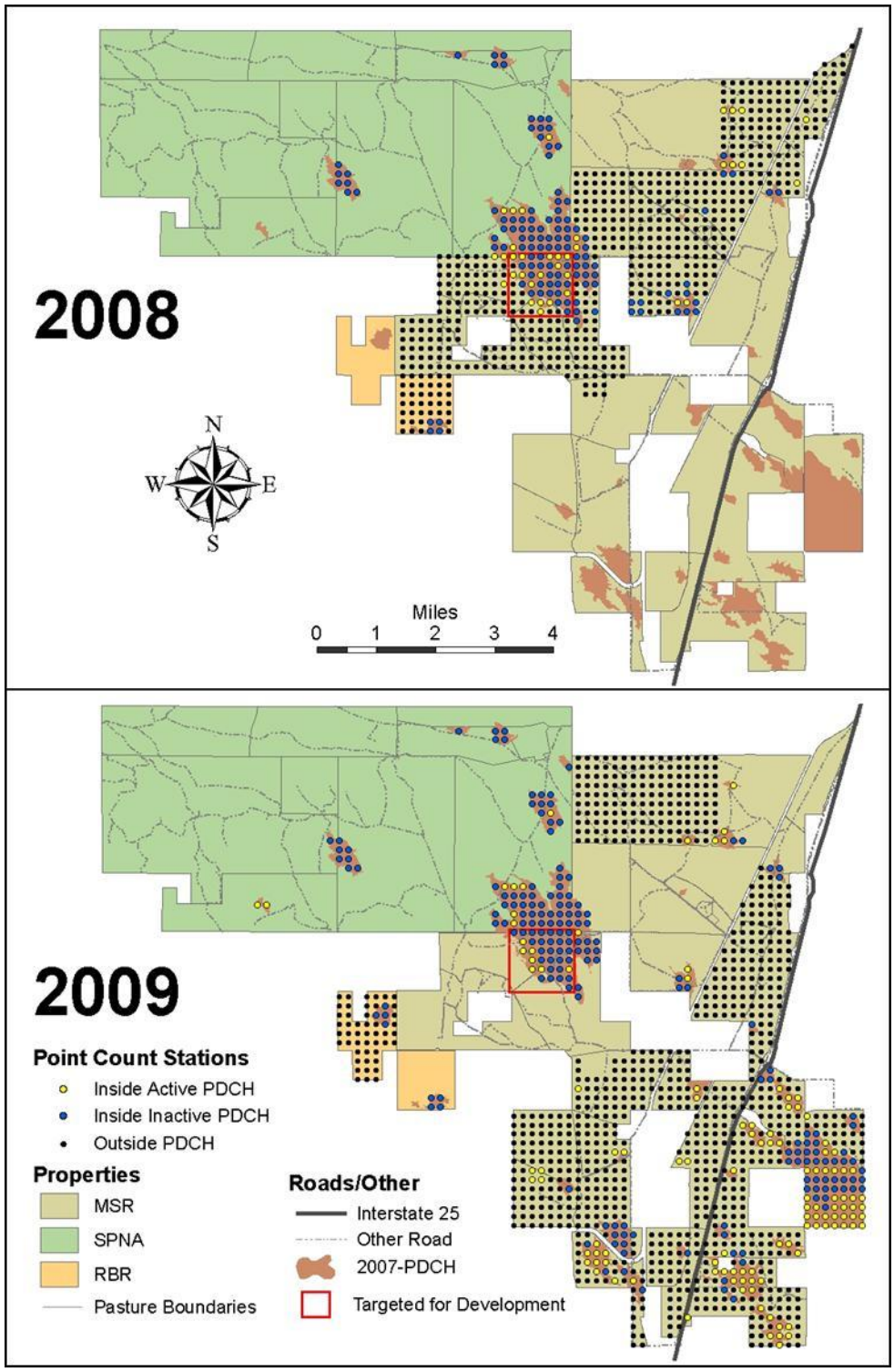
APPENDIX B. Scientific Names of Bird Species

Species	Scientific Name
American White Pelican	*Pelecanus erythrorhynchos*
Double Crested Cormorant	*Phalacrocorax auritus*
Great Blue Heron	*Ardea herodias*
White-faced Ibis	*Plegadis chihi*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Northern Shoveler	*Anas clypeata*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Golden Eagle	*Aquila chrysaetos*
Merlin	*Falco columbarius*
American Kestrel	*Falco sparverius*
Prairie Falcon	*Falco mexicanus*
Peregrine Falcon	*Falco peregrinus*
Killdeer	*Charadrius vociferus*
Mountain Plover	*Charadrius montanus*
American Avocet	*Recurvirostra americana*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Catoptrophorus semipalmatus*
Upland Sandpiper	*Bartramia longicauda*
Long-billed Curlew	*Numenius americanus*
Wilson's Snipe	*Gallinago delicata*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Mourning Dove	*Numenius americanus*
Eurasian Collared-Dove	*Streptopelia decaocto*
Rock Pigeon	*Columba livia*
Barn Owl	*Tytp alba*
Short-eared Owl	*Asio flammeus*
Great Horned Owl	*Bubo virginianus*
Burrowing Owl	*Athene cunicularia*
Common Poorwill	*Phalaenoptilus nuttallii*
Common Nighthawk	*Chordeiles minor*

Species	Scientific Name
Broad-tailed Hummingbird	*Selasphorus platycercus*
Northern Flicker	*Colaptes auratus*
Western Wood-pewee	*Contopus sordidulus*
Say's Phoebe	*Sayornis saya*
Eastern Kingbird	*Tyrannus tyrannus*
Cassin's Kingbird	*Tyrannus vociferans*
Western Kingbird	*Tyrannus verticalis*
Loggerhead Shrike	*Lanius ludovicianus*
Warbling Vireo	*Vireo gilvus*
Common Raven	*Corvus corax*
American Crow	*Corvus brachyrhynchos*
Horned Lark	*Eremophila alpestris*
N. Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Violet-green Swallow	*Tachycineta thalassina*
Tree Swallow	*Tachycineta bicolor*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
House Wren	*Troglodytes aedon*
Rock Wren	*Salpinctes obsoletus*
Blue-grey Gnatcatcher	*Polioptila caerulea*
Western Bluebird	*Sialia mexicana*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
Swainson's Thrush	*Catharus ustulatus*
Northern Mockingbird	*Mimus polyglottos*
Brown Thrasher	*Toxostoma rufum*
Sage Thrasher	*Oreoscoptes montanus*
Yellow Warbler	*Dendroica petechia*
Western Tanager	*Piranga ludoviciana*
European Starling	*Sturnus vulgaris*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Spotted Towhee	*Pipilo maculatus*
Green-tailed Towhee	*Pipilo chlorurus*
Cassin's Sparrow	*Aimophila cassinii*
Brewer's Sparrow	*Spizella breweri*
Clay-colored Sparrow	*Spizella pallida*
Chipping Sparrow	*Spizella passerina*
Grasshopper Sparrow	*Ammodramus savannarum*
Savannah Sparrow	*Passerculus sandwichensis*

Species	Scientific Name
Vesper Sparrow	*Pooecetes gramineus*
Lark Bunting	*Calamospiza melanocorys*
Lark Sparrow	*Chondestes grammacus*
White-crowned Sparrow	*Zonotrichia leucophrys*
Song Sparrow	*Melospiza melodia*
McCown's Longspur	*Calcaruis mccownii*
Chestnut-collared Longspur	*Calcaruis ornatus*
Western Meadowlark	*Sturnella neglecta*
Eastern Meadowlark	*Sturnella magna*
Brown-headed Cowbird	*Molothrus ater*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Common Grackle	*Quiscalus quiscula*
Bullock's Oriole	*Icterus bullockii*
House Finch	*Carpodacus mexicanus*
American Goldfinch	*Carduelis tristis*
House Sparrow	*Passer domesticus*

APPENDIX C: Observed Prairie Dog Activity



Prairie dog activity in 2008 (upper panel) and 2009 (lower panel) during point count surveys. Some active colonies were found outside of 2007-PDCH.