

Monitoring Colorado's Birds and Shortgrass Prairie Bird Monitoring Programs: The 2007 Field Season



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Rocky Mountain Bird Observatory
14500 Lark Bunting Lane
Brighton, CO 80603
303.659.4348
www.rmbo.org
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In Cooperation With:



Rocky Mountain Bird Observatory

The mission of the Rocky Mountain Bird Observatory (RMBO) is the conservation of birds of the Rocky Mountains, Great Plains, and Intermountain West, and the habitats on which they depend. RMBO practices a multi-faceted approach to bird conservation that integrates scientific research and monitoring studies with education and outreach programs to bring bird conservation issues to the public and other conservation partners. RMBO works closely with state and federal natural resource agencies, private landowners, schools, and other nonprofit organizations. RMBO accomplishes its mission by working in four areas:

- Research: RMBO studies avian responses to habitat conditions, ecological processes, and management actions to provide scientific information that guides bird conservation efforts.
- Monitoring: RMBO monitors the distribution and abundance of birds through long-term, broad-scale monitoring programs designed to track population trends for birds of the region.
- Education: RMBO provides active, experiential, education programs for K-12 students in order to create an awareness and appreciation for birds, with a goal of their understanding of the need for bird conservation.
- Outreach: RMBO shares the latest information in land management and bird conservation practices with private landowners, land managers, and resource professionals at natural resource agencies. RMBO develops voluntary, working partnerships with these individuals and groups for habitat conservation throughout the Great Plains and Rocky Mountains.

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Contact Information:

David Hanni david.hanni@rmbo.org
Jason Beason jason.beason@rmbo.org
RMBO
P.O. Box 1232
Brighton, CO 80601-1232
303-659-4348

CHAPTER ONE: EXECUTIVE SUMMARY

Birds are excellent indicators of environmental quality and change. In addition, they are one of the most highly visible and valued components of our native wildlife. Monitoring birds provides data needed not only to effectively manage bird populations, but also to understand the effects of human activities on the ecosystem and to gauge their sustainability. Because bird communities reflect an integration of a broad array of ecosystem conditions, monitoring entire bird communities at the habitat level offers a cost-effective means for monitoring biological integrity at a variety of scales.

In 2007, Rocky Mountain Bird Observatory (RMBO), in conjunction with its funding partners, the Colorado Division of Wildlife (CDOW), the U.S.D.A. Forest Service (USFS), and the Bureau of Land Management (BLM) implemented Year 10 of Monitoring Colorado's Birds (MCB), using a protocol similar to other RMBO monitoring programs as delineated by Panjabi et al. (2001). This program is designed to provide statistically rigorous long-term trend data for populations of most diurnal, regularly breeding bird species in Colorado, including several species listed by government and non-government conservation organizations as species of concern. In the short term, MCB provides information needed to effectively manage and conserve bird populations in Colorado, including the spatial distribution, abundance, and relationship to important habitat characteristics for each species. It also contributes to RMBO's broader landscape-scale breeding bird monitoring program, which currently includes 11 states in the Rocky Mountains and Great Plains regions.

In 2007, RMBO staff conducted 160 point transect surveys (2,299 point counts) in six habitats in Colorado (high-elevation riparian, pinyon-juniper, ponderosa pine, sage shrubland, semidesert shrubland, and spruce-fir). A total of 171 breeding bird species (including low-density species detected between points) were recorded on point transects, many of which were observed on only a few occasions (Appendix A). The habitat-stratified point transect data provided precise density estimates (CV of $\leq 50\%$ in at least one habitat) for 80 bird species, including 19 Species of Greatest Conservation Need (SGCN) as designated by the Colorado Wildlife Action Plan and three species listed as sensitive species by the U.S.F.S. in Region 2 (R2SS) (Appendix B). We should be able to produce trend information for these 80 species within 30 years under the current program in at least one of the six habitats surveyed this year. Approximately 263 bird species regularly breed in Colorado; therefore we are effectively monitoring 30% of all species breeding in the state. We obtained sufficient data on several other species to monitor their populations across

habitat types, although in some cases, these species may be better monitored with additional transects in certain habitats.

Another part of MCB is the Special Species program, in which we collect data on 37 limited-range and/or patchily-distributed species for which habitat-stratified, randomly placed transects do not produce sufficient detections. For 24 of these species we know where the majority of breeding locations are located and, therefore, are capable of conducting a census of their populations every year (Appendix C). We have gathered data to track the remaining 13 species; several of these species could be monitored more effectively with additional effort. If the efforts of a fully funded special species program are included MCB could potentially monitor, or census at least 104 (40%) of Colorado's regular breeding bird species.

In Colorado, there are a total of 111 avian species that are designated as species of interest by the CDOW, the USFS, the BLM, or Partners In Flight (PIF) (Appendix D). If species monitored by the state (ducks, gallinaceous species, and species listed as threatened or endangered), and species of greatest conservation need that do not actually breed in Colorado are removed from this list, the total is reduced to 94. The MCB program will be able to produce trend information for 46 of the 94 using point transects and is gathering sufficient information on an additional 24 through the special species program that, with adequate funding, could be included on the monitored list. Therefore, using existing techniques, the MCB program could monitor 74% of all species of management interest in Colorado that are not already monitored by the state.

CHAPTER TWO: EXECUTIVE SUMMARY

Monitoring birds is fundamental to understand their population status and trend which in turn informs managers about which species are increasing or declining. In 2007 Rocky Mountain Bird Observatory (RMBO) in cooperation with the Colorado Division of Wildlife developed a spatially balanced study design for monitoring birds in native prairie habitat of eastern Colorado, Colorado's Shortgrass Prairie Bird Monitoring Program. This program replaced Section Surveys and Monitoring Colorado Birds grassland habitat monitoring programs.

Eastern Colorado is within the Shortgrass Prairie Bird Conservation Region (BCR 18), an ecoregion dominated by short grasses, including blue grama and buffalograss with prairie dog colonies scattered throughout the landscape. This region is important economically to agriculture and ranching, which has fragmented and altered the grassland landscape over time. Bird population trends will help guide management efforts within the shortgrass prairie.

In 2007 we conducted 58 point transects in BCR 18 of eastern Colorado. We detected 6,436 individual birds of 73 species. We were able to estimate density for 12 species, 3 of which are on Colorado's list of Species of Greatest Conservation Need.

From 2001 through 2005 we monitored birds of eastern Colorado under the Section Surveys program. Section Surveys used a road based study design and recognized three habitat strata: native prairie, land in the Conservation Reserve Program (CRP) in Weld County, and dry-land agriculture. Under the Section Surveys program we were able to estimate densities of 22 avian species with a coefficient of Variation (CV) less than 50 percent.

From 1999 through 2005 we monitored birds of eastern Colorado under the Monitoring Colorado Birds program (MCB). MCB uses habitat based strata and point transects to monitor birds. In native prairie habitat MCB was able to estimate densities of 11 species.

We compared the efficiency and species we are able to monitor under the three monitoring programs. The coefficient of variation of the density estimate was lower for all species under Section Surveys program compared to the other two programs, and slightly lower in Colorado's Shortgrass Prairie Bird Monitoring Program compared to Monitoring Colorado Birds in native prairie habitat. These differences reflect differences in sample size. Despite increased efficiency of the Section Survey program, results may be biased by the proximity to roads.

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Table of Contents

Chapter One: Executive Summary	i
Chapter Two: Executive Summary	iii
Acknowledgements	iv
Table of Contents	v
Chapter 1: Monitoring Colorado’s Birds Program	1
MCB Introduction	1
Program History	1
Monitoring Objectives	2
Methods	3
Study Area	3
The Habitats	3
High-elevation Riparian	4
Pinyon-Juniper	4
Ponderosa Pine	4
Sage Shrubland	4
Semidesert Shrubland	4
Spruce-Fir	4
Field Personnel.....	5
Site Selection	5
Point Transect Protocol.....	5
Data Analysis	6
Results	8
High-elevation Riparian (HR).....	9
Pinyon-Juniper (PJ).....	17
Ponderosa Pine (PP).....	26
Sage Shrubland (SA).....	35
Semidesert Shrubland (SE).....	40
Spruce-Fir (SF)	46
Discussion and Recommendations	54
Prospects for Population Monitoring	54
Literature Cited	56
Appendix A. Birds Detected on Point Transects – Species and Totals.	60
Appendix B. Species Accounts for Species of Management Interest Detected on Point Transects.	71
Greater Sage-Grouse.....	72
Gunnison Sage-Grouse	74
Dusky Grouse.....	76
Greater Prairie-Chicken	78
Scaled Quail	80
Northern Harrier.....	82
Northern Goshawk	84
Swainson’s Hawk.....	86
Ferruginous Hawk.....	88

Golden Eagle.....	90
Peregrine Falcon	92
Prairie Falcon	94
Band-tailed Pigeon.....	96
Common Nighthawk.....	98
White-throated Swift.....	100
Black-chinned Hummingbird.....	102
Broad-tailed Hummingbird.....	104
Rufous Hummingbird	106
Lewis’s Woodpecker	108
Red-headed Woodpecker	110
Williamson’s Sapsucker.....	112
Red-naped Sapsucker.....	114
American Three-toed Woodpecker.....	116
Olive-sided Flycatcher	118
Willow Flycatcher.....	120
Gray Flycatcher.....	122
Dusky Flycatcher	124
Cordilleran Flycatcher	126
Say’s Phoebe.....	128
Loggerhead Shrike	130
Gray Vireo	132
Plumbeous Vireo.....	134
Warbling Vireo	136
Pinyon Jay.....	138
Clark’s Nutcracker	140
Black-billed Magpie.....	142
Chihuahuan Raven	144
Purple Martin	146
Violet-green Swallow	148
Juniper Titmouse.....	150
Pygmy Nuthatch.....	152
Rock Wren	154
Canyon Wren	156
Bewick’s Wren.....	158
American Dipper.....	160
Western Bluebird	162
Mountain Bluebird.....	164
Veery.....	166
Curve-billed Thrasher	168
Virginia’s Warbler	170
Yellow Warbler.....	172
Black-throated Gray Warbler.....	174
Grace’s Warbler	176
Green-tailed Towhee.....	178
Cassin’s Sparrow	180

Brewer's Sparrow	182
Vesper Sparrow.....	184
Lark Sparrow	186
Black-throated Sparrow	188
Sage Sparrow	190
Lark Bunting	192
Grasshopper Sparrow.....	194
Lazuli Bunting	196
Western Meadowlark.....	198
Red Crossbill.....	202
Pine Siskin	204
Evening Grosbeak.....	206
Appendix C. Species Accounts for Species of Management Interest which are tracked by the Special Species Program.....	208
Barrow's Goldeneye	209
Pied-billed Grebe	211
Eared Grebe	212
Western Grebe	213
Clark's Grebe.....	214
American White Pelican	215
Double-crested Cormorant.....	216
American Bittern.....	217
Great Blue Heron	218
Great Egret.....	220
Snowy Egret.....	221
Black-crowned Night-Heron.....	222
White-faced Ibis.....	223
Osprey	224
Black Rail.....	226
Forster's Tern.....	227
Black Tern.....	228
Western Yellow-billed Cuckoo.....	229
Burrowing Owl	230
Black Swift.....	231
Lewis's Woodpecker	232
Purple Martin	233
Bobolink.....	234
Appendix D. List of All Bird Species with Special Management Designation Detected on Point Counts in Colorado 1998-2007.	235
Chapter 2: Shortgrass Prairie Bird Monitoring Program.....	239
Shortgrass Introduction	239
Methods.....	242
Results	244
Discussion.....	248
Literature Cited	250

Appendix A. Species detected and number of detections on shortgrass prairie transects, 2007.	252
Appendix B. Colorado’s Species of Greatest Conservation Need and Partners In Flight Species of Continental Concern and Regional Concern (BCR 18) detected during point counts in 2007.	255
Appendix C. Bird distribution maps for the shortgrass prairie. Each detection point is scaled according to the total number of points per transect (15) a bird was detected.	256
Northern Pintail.....	257
Scaled Quail.....	258
Western Grebe	259
American White Pelican	260
Turkey Vulture.....	261
Swainson’s Hawk.....	262
Red-tailed Hawk	263
Ferruginous Hawk.....	264
American Kestrel	265
Prairie Falcon	266
Killdeer	267
Mountain Plover.....	268
American Avocet	269
Upland Sandpiper.....	270
Long-billed Curlew.....	271
Eurasian Collared-Dove.....	272
Mourning Dove.....	273
Burrowing Owl	274
Common Nighthawk.....	275
Red-headed Woodpecker	276
Say’s Phoebe.....	277
Western Kingbird.....	278
Eastern Kingbird	279
Loggerhead Shrike.....	280
Black-billed Magpie.....	281
American Crow	282
Chihuahuan Raven	283
Horned Lark	284
Bank Swallow	285
Cliff Swallow	286
Barn Swallow.....	287
American Robin	288
Northern Mockingbird	289
Cassin’s Sparrow	290
Brewer’s Sparrow	291
Vesper Sparrow.....	292
Lark Sparrow	293
Sage Sparrow	294

Lark Bunting	295
Grasshopper Sparrow	296
Song Sparrow	297
McCown's Longspur	298
Lazuli Bunting	299
Indigo Bunting	300
Dickcissel.....	301
Red-winged Blackbird	302
Western Meadowlark.....	303
Brewer's Blackbird.....	304
Common Grackle.....	305
Brown-headed Cowbird.....	306
Bullock's Oriole.....	307

CHAPTER 1: MONITORING COLORADO'S BIRDS PROGRAM

MCB INTRODUCTION

Program History

In 1995 the Rocky Mountain Bird Observatory (RMBO), in conjunction with the Colorado Division of Wildlife (CDOW), the United States Forest Service (USFS), the Bureau of Land Management (BLM) and the National Park Service (NPS), began efforts to create and conduct a Colorado-wide program to monitor breeding-bird populations, entitled Monitoring Colorado's Birds. This was the first attempt in the nation to develop and implement a statewide all-bird monitoring plan. In 1997, after review by statisticians and CDOW biologists, the program was structured so that count-based data were obtained for all breeding bird species in the state on a randomized and habitat-stratified basis. Using the Colorado GAP dataset, blocks of habitat (stands) large enough to support a 3.5 km MCB transect were randomly selected within specified habitats in Colorado. In 1998, we tested the protocol on three habitats: aspen, ponderosa pine and spruce-fir. In 1999, after a successful pilot year, the protocol was implemented in an additional 10 habitats: alpine tundra, grassland, high-elevation riparian, low-elevation riparian, mixed conifer, montane shrubland, pinon-juniper, sage shrubland, semi-desert shrubland, and wetland. Because MCB attempts to monitor as many of Colorado's breeding birds as possible, we also created a "Special Species" program in 1998. This program, which relies heavily on volunteers and agency cooperators, gathers information for many species that are not sufficiently sampled using randomly placed point transects (Appendix C).

Since 1999, RMBO has continually expanded its monitoring efforts to include neighboring states using a similar transect selection protocol and survey methodology. These include the Monitoring Birds of the Black Hills program begun in 2001, the Monitoring Wyoming Birds program, begun in 2002, monitoring 11 National Parks in the Northern Colorado Plateau Inventory and Monitoring Network, begun in 2005, and bird monitoring in Kaibab National Forest, Arizona, begun in 2007. These monitoring programs are consistent with PIF National Landbird Monitoring Strategy goals (Bart et al. 2001), and in addition to monitoring bird populations, generate information useful in managing birds (e.g., habitat associations, spatial distribution). We plan to continue to build partnerships and to expand the level of effort so that bird population monitoring occurs across Bird Conservation Regions (BCR). BCRs were delineated by the North American Bird Conservation Initiative (NABCI 2000), as ecologically based planning, implementation, and evaluation units for all birds.

Monitoring Objectives

Monitoring Colorado's Birds is designed to provide population status and trend data on all regularly-occurring breeding species within Colorado. Initially, we expect to collect data to provide "early-warning" information for all species that can be monitored through a habitat-based approach. After establishing this monitoring framework, we anticipate collecting more demographic information and testing a priori hypotheses to determine the possible reasons for known declines and to better inform management decisions.

The specific objectives of Monitoring Colorado's Birds are:

- 1.) to integrate existing bird monitoring efforts in the region to provide better information on distribution and abundance of all breeding birds, especially for priority species;
- 2.) to provide basic habitat association data for most bird species to address habitat management issues;
- 3.) to provide long-term status and trend data for all regularly occurring breeding species in Colorado, with a target of detecting a minimum rate of population change of -3.0% per year over a maximum time period of 30 years;
- 4.) to maintain a high-quality database that is accessible to all of our collaborators as well as the public on the web in the form of raw and summarized data and,
- 5.) to generate decision support tools such as population estimate models that help guide conservation efforts and provide a better measure of our conservation success.

METHODS

Study Area

In 2007, RMBO biologists conducted an average of 26.7 transects in each of six habitats selected for state-wide monitoring: high-elevation riparian, pinyon-juniper, ponderosa pine, sage shrubland, semidesert shrubland, and spruce-fir (Figure 1). Herein, we report the results for the six habitats selected by the MCB steering committee for state-wide monitoring in 2007.

We also used two other methods (colony counts and censuses) to obtain population data on Colorado's breeding-bird species that are not adequately sampled on transects. In this report we provide information on 24 of these 'special species' (Appendix C).

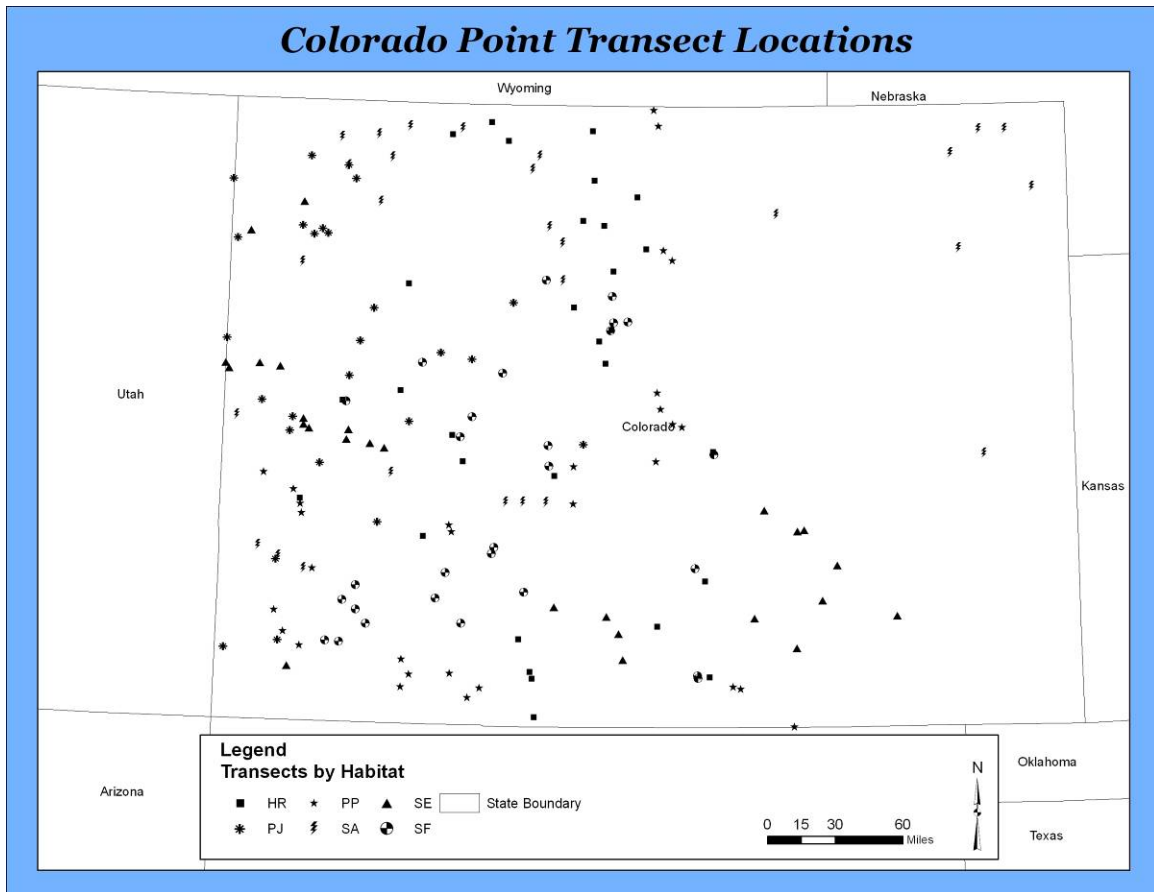


Figure 1. RMBO point-transect locations in Colorado, 2007.

The Habitats

Using the Colorado GAP dataset, suitable stands in which to place transects were randomly selected in each habitat. Selected stands had to be 1) large

enough to fit 15 points spaced at least 250 meters apart and 2) within one mile of a road.

High-elevation Riparian

High-elevation mountain streams lined with willows and other shrubs compose this habitat. Several tree species which are often present in this habitat include sub-alpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), blue spruce (*Picea pungens*), and lodgepole pine (*Pinus contorta*). Some commonly recorded shrubs in this habitat are willow (*Salix* sp.), gooseberry (*Ribes* sp.), big sagebrush (*Artemisia tridentata*), and snowberry (*Symphoricarpos* sp.).

Pinyon-Juniper

Arid forested areas dominated by pinyon pine (*Pinus edulis*) and juniper (*Juniperus* sp.) compose this habitat. We recorded dead pinyon trees, if present at a point, because they have become such a large part of the landscape in recent years. Some common shrubs in pinyon-juniper habitat are big sagebrush, Gambel's oak (*Quercus gambelii*), mountain mahogany (*Cercocarpus* sp.), rabbitbrush (*Chrysothamnus* sp.), serviceberry (*Amelanchier* sp.), chokecherry (*Prunus virginiana*), and skunkbrush (*Rhus trilobata*).

Ponderosa Pine

Ponderosa pine habitat is forest dominated by ponderosa pine (*Pinus ponderosa*). Sampled stands are often pure stands, but there are often other overstory species, such as aspen (*Populus tremuloides*), white fir (*Abies concolor*), Douglas-fir (*Pseudotsuga menziesii*), and/or blue spruce present. Also, this habitat can be mixed with lodgepole pine at higher elevations. Habitats designated PP consist primarily of ponderosa pine; areas with greater than 20% of other conifer species are labeled mixed conifer. The habitat often has a well-developed woody understory in areas with a history of aggressive fire control. Some frequently encountered shrubs are Gambel's oak, snowberry, serviceberry, gooseberry, and mountain mahogany.

Sage Shrubland

Open landscapes dominated by big sagebrush make up this habitat. In addition to big sagebrush, some other common shrubs in this habitat are serviceberry and rabbitbrush.

Semidesert Shrubland

This is a shrub-dominated habitat in Colorado. We commonly record saltbush (*Atriplex* sp.), greasewood (*Sarcobatus* sp.), rabbitbrush, and cholla (*Cylindropuntia* sp.) in this habitat.

Spruce-Fir

This habitat is composed of high-elevation coniferous trees, such as Englemann spruce, lodgepole pine, blue spruce, and subalpine fir. Some of the frequently

recorded plants in the understory are gooseberry, common juniper, willow, snowberry, Utah honeysuckle (*Lonicera* sp.), and alder (*Alnus* sp.).

Field Personnel

Seven experienced biological technicians with great aural and visual bird-identification skills comprised the RMBO staff who executed the field component of MCB in 2007. Each technician completed a four-day training program to ensure full understanding of the field protocols, to gain exposure to Colorado's birds and plants, and to practice distance estimation.

Site Selection

Survey sites were selected in 1998 for ponderosa pine and spruce-fir. In 1999, high-elevation riparian, pinyon-juniper, sage shrubland, and semidesert shrubland transects were established. Many of the original transects were in the incorrect habitat and new transect locations were randomly selected in subsequent years.

Point Transect Protocol

RMBO staff conducted point transects (Buckland et al. 1993) in order to sample bird populations in each habitat selected for monitoring. Each transect was surveyed by one observer following protocol established by Leukering (2000) and modified by Panjabi (2005). Observers conducted all transect surveys in the morning, between ½-hour before sunrise and 11 AM; most surveys were completed before 10 AM. The observer began the point transect at the first count station and then continued along the pre-selected bearing for all remaining points. If a bearing takes the observer out of the target habitat the observer then the observer turned the transect 90 degrees to stay in the desired habitat (a coin was flipped to determine which way to turn). Observers recorded atmospheric data (i.e., temperature in degrees Fahrenheit, cloud cover, precipitation, and wind (using the Beaufort scale) and the time at the start and end of each transect. They measured distances between count stations using hand-held Global Positioning System (GPS) units. All GPS data were logged in Universal Transverse Mercator (UTM) North American Datum 1927.

Observers conducted five-minute point counts at up to 15 stations located at 250-m intervals along each transect. One exception is in high-elevation riparian habitat points are spaced at 200-m intervals and the number of points depends on stand size because it is difficult to find large contiguous stands of this habitat. Prior to beginning the bird count at each count station, observers recorded UTM coordinates, whether the station was within 100m of a road, and vegetation data, including structural stage and canopy closure of the forest, mean canopy height, types and relative proportions of overstory trees, sub-canopy volume and tree species composition, and % coverage and types of shrubs within a 50 m radius

of the point. Then observers conducted a five-minute point count, recording all bird detections on standardized forms (in 2007, we experimented with eight-minute point counts in spruce-fir habitat). Fly-overs (birds flying over but not using the immediate surrounding landscape) were recorded, but excluded from analyses of density. For each bird detected, observers recorded the species, sex, how it was detected (call, song, drumming, or visual), and distance from the observation point. Distances were measured using laser rangefinders. When it was not possible to measure distance to a bird, observers estimated distance by measuring to an object near where the bird was detected.

Observers treated the 250-m intervals between count stations as parts of a line transect and recorded number, distance, and bearing from the line to birds of a short list of low-density species (all grouse, raptors, woodpeckers, and a few other rare or uncommon species). Individuals of low-density species initially detected on points that were again detected while moving between points were not included in the line-transect data. Conversely, birds detected between points and then again during the subsequent point count were removed from the line-transect data and included only on the point count.

When two or more birds of the same species were detected in close proximity to each other, they were recorded as one independent detection (a 'cluster'). This is to meet the assumption that all observations are independent of each other.

Data Analysis

We used program DISTANCE (Thomas et al. 1998-99) to generate density estimates (D) using only data collected at point count stations. The notation, concepts, and analysis methods of Distance sampling were developed by Buckland et al. (1993). In Distance analysis, a unique detection function is fit to each distribution of distances associated with a species in a given habitat. Distance analysis relies on three assumptions, all of which are reasonably well met by MCB: 1) all birds at distance=0 are detected, 2) distances of birds close to the point are measured accurately, and 3) birds do not move in response to the observer's presence.

As a general rule, density estimates were generated only for species for which there was a minimum average of 10 independently detected observations per year as recorded from count stations in a given habitat (not including fly-overs or between-point observations, and prior to truncation or removal of outliers). Because we considered only independent detections in our analyses of density, the number of observations (n) reported for each species may be lower than the number of individuals (N) observed. This is especially true for species that tend to associate in groups (e.g., swifts, swallows, crossbills, etc.) Both numbers may be useful, especially for low-density species, and thus both are reported in the "Species Accounts" section. Note however, that in the habitat accounts in the "Results" section, the number of observations reported (n) reflects only the

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

number of independent detections used to estimate density (i.e., after any truncation or removal of outliers), and may be less than the total number of independent detections or the total number of individuals observed.

RESULTS

Field staff conducted a total of 2,299 point counts along 160 point transects in 6 habitats between 12 May and 21 July 2007. At least 23 point transects were surveyed in each habitat (Table 1). Habitats surveyed were high-elevation riparian, pinyon-juniper, ponderosa pine, sage shrubland, semidesert shrubland, and spruce-fir.

Table 1. Bird sampling periods and effort in each habitat in Colorado, 2007.

Habitat	Dates sampled	# point transects	# point counts
High-elevation Riparian	7 June – 9 July	28	372
Pinyon-Juniper	13 May – 14 June	26	376
Ponderosa Pine	28 May – 8 July	29	435
Sage Shrubland	15 May – 12 July	23	345
Semidesert Shrubland	12 May – 4 June	26	388
Spruce-Fir	29 June – 21 July	28	383
All Habitats	12 May – 21 July	160	2,299

Field personnel observed a total of 24,448 birds of 167 species on point transects (Appendix A). Of these, 166 species are believed to be regular breeders in Colorado, representing 63% of the 263 species believed to breed in the state. Data collected on transects enabled us to estimate densities for 100 species in at least one habitat (Tables 3-8). For several species we are able to calculate density estimates in more than one habitat (Tables 3-8).

Total number of species detected in each habitat in 2007 ranged from 63 in spruce-fir to 103 in sage shrubland (Table 2). While these totals communicate the spectrum of possible species across a range of sites within a habitat type, note that some species observed were largely peripheral to the habitat in which they were recorded. Thus, species richness measures reflect both the within- and between-habitat diversity of the sites surveyed in each habitat category.

Of the habitats surveyed in 2007, more birds were detected, and average species richness was greatest, in ponderosa pine (Table 2). We have provided estimates of avian species richness at both the count-level (i.e., sub-sample) and the transect (i.e., site) level. Count-level data are not influenced by stand size (i.e., the number of sub-samples per site) and therefore are best for direct inter-habitat comparisons, while site-level data, which are influenced by stand size, provide a more complete picture of the bird community within a given stand of habitat. Thus, both estimates are useful from a management perspective.

Table 2. Bird detections and species richness in habitats surveyed in Colorado, summer 2007.

Habitat	# birds detected	Avg. # birds/point	# species detected	Avg.# species/point	Avg. # species/transect
High-elevation Riparian	3,990	10.7	85	6.9	24.0
Pinyon-Juniper	4,176	11.1	90	8.1	30.9
Ponderosa Pine	4,934	12.2	81	8.2	31.0
Sage Shrubland	3,768	10.9	103	5.6	19.2
Semidesert Shubland	2,960	7.6	83	3.7	14.4
Spruce-Fir ¹	4,620	12.1	63	7.2	23.1
All Habitats	24,448	10.7	167	6.6	24.0

¹Points on Spruce-Fir transects were eight minutes long in 2007 instead of the traditional five minutes

High-elevation Riparian (HR)

Field staff conducted 372 counts along 28 transects in high-elevation riparian habitat between 7 June and 9 July 2007 (Table 1). We recorded a total of 3,990 birds in this habitat, with an average of 10.7 birds at each count station (Table 2). Observers detected a total of 85 species, and on average, 6.9 species per point count and 24.0 species per site in high-elevation riparian.

Point transect data from high-elevation riparian yielded robust density estimates (CV<50%) for 35 species and moderately robust estimate for seven additional species (CV=50-75%; Table 3) for which we are able to provide densities. MCB should be able to produce trend information within 30 years for these 42 species, which represent 49% of all species recorded from high-elevation riparian in 2007. Six species listed as SGCN (Brewer's Sparrow, Broad-tailed Hummingbird, Cordilleran Flycatcher, Dusky Flycatcher, Red Crossbill, and Red-naped Sapsucker) and one R2SS (Brewer's Sparrow) should be effectively monitored under the MCB program in this habitat (Appendix B).

Broad-tailed Hummingbird, Wilson's Warbler, Lincoln's Sparrow, White-crowned Sparrow, and Pine Siskin were the most abundant species in this habitat in 2007. Nineteen species (Spotted Sandpiper, Wilson's Snipe, Broad-tailed Hummingbird, Red-naped Sapsucker, Willow Flycatcher, Dusky Flycatcher, Tree Swallow, Swainson's Thrush, Orange-crowned Warbler, Yellow Warbler, MacGillivray's Warbler, Wilson's Warbler, Savannah Sparrow, Fox Sparrow, Song Sparrow, Lincoln's Sparrow, White-crowned Sparrow, Black-headed Grosbeak, and Lazuli Bunting) had higher estimated densities in high-elevation riparian than in other habitats surveyed in 2007.

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Table 3. Estimated densities of breeding birds in high-elevation riparian habitat in Colorado, 1999-2007.

Species	Year	D	%CV	LCL	UCL	n
Spotted Sandpiper	1999	3.8	62	1.4	10	7
	2000	6.9	55	2.9	17	15
	2001	7.1	41	3.6	14	15
	2002	8.4	56	3.4	20	15
	2004	6.1	38	3.3	11	15
	2005	12	44	5.9	24	29
	2006	3.0	44	1.5	6.2	7
	2007	7.3	42	3.7	15	18
Wilson's Snipe	1999	0.1	100	0.0	0.2	1
	2000	0.1	75	0.0	0.5	3
	2001	0.0	--	--	--	0
	2002	0.3	48	0.2	0.8	7
	2004	0.5	46	0.3	1.1	12
	2005	1.1	58	0.4	2.8	25
	2006	0.8	66	0.3	2.3	18
	2007	0.4	75	0.1	1.1	8
Mourning Dove	1999	0.9	59	0.4	2.4	12
	2000	1.9	45	0.9	3.9	29
	2001	0.1	100	0.0	0.3	1
	2002	0.8	59	0.3	2.0	11
	2004	0.6	56	0.2	1.4	10
	2005	0.1	67	0.0	0.3	2
	2006	0.4	54	0.2	1.0	5
	2007	0.6	50	0.3	1.3	10
Broad-tailed Hummingbird	1999	153	33	89	264	62
	2000	239	29	148	386	114
	2001	144	35	82	253	71
	2002	138	34	79	240	64
	2004	180	34	104	311	94
	2005	210	29	131	338	111
	2006	243	29	151	389	119
	2007	258	27	165	403	135
Red-naped Sapsucker	1999	31	58	13	77	17
	2000	34	45	17	71	22
	2001	12	62	4.6	31	8
	2002	33	45	16	68	21
	2004	61	40	32	114	44
	2005	69	39	37	128	49
	2006	34	40	18	63	23
	2007	44	45	22	90	32
Northern Flicker	1999	6.1	31	3.6	10	55
	2000	7.1	19	5.2	9.7	76
	2001	2.5	26	1.6	3.9	28
	2002	3.7	27	2.3	5.9	39
	2004	2.8	21	2.0	4.0	34
	2005	3.7	18	2.7	5.0	43
	2006	3.6	25	2.3	5.4	42

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Western Wood-Pewee	2007	2.9	31	1.7	4.8	35
	1999	2.0	43	1.0	4.1	20
	2000	2.2	33	1.3	3.9	26
	2001	1.4	36	0.8	2.6	17
	2002	1.1	36	0.6	2.1	13
	2004	2.5	37	1.4	4.6	33
	2005	2.3	35	1.3	4.2	30
	2006	2.8	40	1.5	5.4	35
Willow Flycatcher	2007	1.7	36	0.9	3.0	22
	1999	0.6	68	0.2	1.8	2
	2000	0.0	--	--	--	0
	2001	0.3	100	0.1	1.1	1
	2002	4.8	73	1.5	15	18
	2004	0.7	72	0.2	2.1	3
	2005	3.8	62	1.4	10	16
	2006	2.2	71	0.7	6.6	9
Dusky Flycatcher	2007	5.8	69	2.0	17	25
	1999	7.8	40	4.0	15	21
	2000	14	34	7.7	24	43
	2001	20	31	12	33	65
	2002	13	35	7.4	24	42
	2004	25	25	17	38	90
	2005	12	31	7.3	20	43
	2006	21	19	15	29	71
Cordilleran Flycatcher	2007	29	24	20	44	105
	1999	11	36	5.9	20	39
	2000	7.0	35	3.9	12	30
	2001	10	23	7.0	15	46
	2002	8.0	36	4.4	15	34
	2004	7.6	27	4.9	12	37
	2005	3.6	38	1.9	6.7	17
	2006	3.7	35	2.1	6.6	17
Warbling Vireo	2007	5.6	32	3.3	9.4	27
	1999	15	39	7.7	28	58
	2000	43	23	29	62	127
	2001	35	23	24	52	138
	2002	15	28	9.1	23	88
	2004	12	33	7.2	21	65
	2005	16	27	10	25	94
	2006	22	20	16	31	132
Steller's Jay	2007	17	36	9.5	30	116
	1999	5.9	35	3.3	11	33
	2000	6.3	26	4.1	9.6	41
	2001	4.1	29	2.6	6.6	28
	2002	4.3	33	2.5	7.4	27
	2004	1.2	51	0.5	2.7	9
	2005	2.1	45	1.0	4.2	14
	2006	2.3	32	1.3	3.9	15
2007	1.8	42	0.9	3.5	12	

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Clark's Nutcracker	1999	0.2	65	0.1	0.5	3
	2000	1.2	60	0.5	3.0	23
	2001	0.9	68	0.3	2.6	18
	2002	0.5	55	0.2	1.3	10
	2004	0.6	66	0.2	1.5	8
	2005	0.3	101	0.1	1.2	6
	2006	1.1	55	0.5	2.6	23
	2007	0.2	71	0.1	0.7	4
Black-billed Magpie	1999	1.6	52	0.7	3.7	21
	2000	1.0	44	0.5	2.1	16
	2001	0.5	88	0.1	1.8	7
	2002	0.5	71	0.2	1.6	8
	2004	0.2	79	0.1	0.7	4
	2005	0.5	138	0.1	2.7	8
	2006	0.1	141	0.0	0.7	2
	2007	0.6	91	0.2	2.3	10
Common Raven	1999	0.1	101	0.0	0.4	1
	2000	1.0	43	0.5	2.0	12
	2001	0.5	54	0.2	1.1	6
	2002	0.6	63	0.2	1.6	6
	2004	1.3	35	0.8	2.3	18
	2005	0.6	53	0.2	1.3	8
	2006	1.3	50	0.6	2.8	14
	2007	1.3	40	0.7	2.6	18
Tree Swallow	1999	5.6	61	2.1	15	11
	2000	6.5	48	3.0	14	15
	2001	2.1	74	0.7	6.4	5
	2002	9.6	54	4.1	23	19
	2004	5.7	48	2.6	12	13
	2005	14	44	7.1	29	35
	2006	19	40	10	37	35
	2007	9.4	37	5.2	17	23
Violet-green Swallow	1999	11	51	4.9	26	18
	2000	31	35	18	56	59
	2001	18	38	9.4	33	36
	2002	24	31	15	41	48
	2004	40	30	25	66	60
	2005	41	36	23	74	76
	2006	30	36	17	54	43
	2007	34	43	17	68	49
Mountain Chickadee	1999	13	43	6.2	26	34
	2000	29	25	19	44	91
	2001	15	28	9.2	23	48
	2002	25	28	15	40	74
	2004	22	22	15	31	70
	2005	13	26	8.4	20	41
	2006	25	30	15	41	84
	2007	20	26	13	31	71
House Wren	1999	23	33	13	40	49

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2000	22	33	13	37	54
	2001	17	38	9.3	32	45
	2002	11	56	4.6	28	27
	2004	7.4	37	4.1	13	20
	2005	8.6	39	4.5	16	24
	2006	13	36	7.0	23	33
	2007	12	34	6.9	21	34
Ruby-crowned Kinglet	1999	2.3	53	1.0	5.4	20
	2000	16	30	9.6	26	82
	2001	7.7	24	5.1	12	80
	2002	27	20	20	38	160
	2004	22	21	16	31	153
	2005	25	24	17	36	133
	2006	15	18	12	21	203
	2007	14	18	10	18	160
Mountain Bluebird	1999	0.4	100	0.1	1.8	2
	2000	1.6	49	0.7	3.6	9
	2001	1.4	63	0.5	3.7	8
	2002	3.6	51	1.6	8.3	16
	2004	0.6	55	0.3	1.5	4
	2005	0.8	48	0.4	1.8	5
	2006	3.9	38	2.1	7.2	21
	2007	2.1	43	1.0	4.2	11
Swainson's Thrush	1999	0.6	80	0.2	2.0	4
	2000	1.6	44	0.8	3.3	13
	2001	0.4	74	0.1	1.1	3
	2002	0.9	64	0.3	2.4	7
	2004	3.6	40	1.9	6.8	33
	2005	1.8	59	0.7	4.5	16
	2006	0.7	39	0.4	1.3	6
	2007	2.1	81	0.6	6.9	19
Hermit Thrush	1999	0.7	57	0.3	1.8	10
	2000	2.9	35	1.6	5.1	46
	2001	2.2	33	1.3	3.9	37
	2002	4.0	20	2.9	5.6	64
	2004	3.6	23	2.5	5.4	66
	2005	2.0	27	1.3	3.2	36
	2006	2.9	33	1.7	4.9	49
	2007	3.8	26	2.5	5.9	69
American Robin	1999	44	25	29	67	87
	2000	51	16	39	66	165
	2001	26	16	20	33	161
	2002	51	19	37	71	162
	2004	57	25	38	85	171
	2005	46	15	35	59	220
	2006	43	19	32	60	277
	2007	42	16	32	54	256
Orange-crowned Warbler	1999	2.3	78	0.7	7.6	4
	2000	7.8	54	3.3	19	16

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2001	5.2	38	2.8	9.7	11
	2002	5.4	39	2.8	10	11
	2004	1.3	60	0.5	3.3	3
	2005	3.5	43	1.7	7.1	8
	2006	7.8	56	3.2	19	17
	2007	3.9	46	1.8	8.2	9
Yellow Warbler	1999	47	61	18	125	65
	2000	15	51	6.4	34	24
	2001	24	61	9.2	64	41
	2002	27	46	13	58	44
	2004	11	32	6.7	19	21
	2005	25	57	10	61	45
	2006	19	38	10	36	33
	2007	44	40	23	85	81
Yellow-rumped Warbler	1999	15	35	8.2	26	31
	2000	21	22	15	31	53
	2001	32	24	22	49	84
	2002	44	29	27	71	107
	2004	28	24	19	42	79
	2005	34	23	23	50	92
	2006	26	22	18	38	72
	2007	32	22	22	46	91
MacGillivray's Warbler	1999	45	30	28	75	53
	2000	31	34	18	55	43
	2001	43	28	27	68	61
	2002	23	43	11	46	31
	2004	15	40	7.7	28	22
	2005	28	45	13	57	42
	2006	9.5	43	4.7	19	13
	2007	41	36	23	74	64
Wilson's Warbler	1999	49	46	23	104	25
	2000	99	35	56	173	59
	2001	157	32	94	262	97
	2002	209	34	120	367	123
	2004	267	31	161	442	180
	2005	181	26	119	276	119
	2006	150	27	96	233	95
	2007	204	29	127	329	136
Western Tanager	1999	6.3	44	3.0	13	31
	2000	5.5	42	2.8	11	32
	2001	3.5	63	1.3	9.4	21
	2002	4.7	52	2.0	11	27
	2004	2.7	35	1.5	4.9	18
	2005	4.2	46	2.0	8.8	27
	2006	1.1	43	0.6	2.3	7
	2007	3.7	44	1.8	7.5	24
Green-tailed Towhee	1999	14	32	8.4	24	56
	2000	14	50	6.1	31	63
	2001	6.5	46	3.1	14	31

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	3.9	59	1.5	10	18
	2004	2.1	53	0.9	4.9	11
	2005	4.1	60	1.6	11	21
	2006	3.6	27	2.3	5.7	18
	2007	2.7	45	1.3	5.6	14
Chipping Sparrow	1999	2.0	61	0.7	5.1	6
	2000	6.6	42	3.4	13	24
	2001	5.3	49	2.4	12	20
	2002	7.0	37	3.8	13	25
	2004	9.0	37	5.0	16	36
	2005	3.7	34	2.1	6.5	15
	2006	5.9	54	2.5	14	23
	2007	13	38	7.1	25	54
Brewer's Sparrow	1999	0.0	--	--	--	0
	2000	1.7	87	0.5	6.0	14
	2001	0.0	--	--	--	0
	2002	0.2	105	0.1	1.1	2
	2004	0.3	75	0.1	1.0	2
	2005	0.6	94	0.2	2.5	6
	2006	1.8	66	0.6	5.0	15
	2007	4.1	43	2.0	8.2	39
Savannah Sparrow	1999	0.0	--	--	--	0
	2000	3.9	100	0.9	16	12
	2001	9.3	70	3.2	27	30
	2002	2.6	92	0.7	10	8
	2004	14	85	4.0	49	49
	2005	12	49	5.4	26	41
	2006	18	68	6.4	53	58
	2007	14	56	5.6	33	48
Fox Sparrow	1999	5.7	56	2.3	14	15
	2000	8.3	48	3.9	18	26
	2001	1.2	50	0.6	2.8	4
	2002	2.6	48	1.2	5.6	8
	2004	6.2	53	2.7	14	22
	2005	16	44	7.8	32	55
	2006	9.0	46	4.2	19	30
	2007	6.2	60	2.4	16	22
Song Sparrow	1999	38	40	20	74	71
	2000	36	42	18	71	78
	2001	15	38	8.0	28	34
	2002	24	51	10	55	52
	2004	15	33	9.0	26	38
	2005	16	31	9.8	28	40
	2006	31	27	20	48	71
	2007	33	28	21	52	81
Lincoln's Sparrow	1999	74	45	36	151	93
	2000	208	34	120	359	208
	2001	127	22	88	184	321
	2002	435	47	207	914	307

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2004	408	19	301	553	582
	2005	290	25	194	433	559
	2006	102	15	79	132	454
	2007	121	16	93	158	516
White-crowned Sparrow	1999	16	47	7.3	35	32
	2000	44	32	26	75	105
	2001	37	33	21	64	91
	2002	56	29	34	91	131
	2004	99	19	71	137	261
	2005	127	25	84	194	331
	2006	122	25	81	184	303
	2007	104	25	68	159	278
Dark-eyed Junco	1999	20	46	9.6	43	38
	2000	42	22	29	61	93
	2001	40	24	27	61	91
	2002	31	18	23	42	68
	2004	59	21	42	83	138
	2005	37	21	26	52	83
	2006	57	18	42	77	133
	2007	64	19	47	88	156
Black-headed Grosbeak	1999	2.9	41	1.5	5.6	10
	2000	0.2	101	0.1	1.0	1
	2001	3.1	40	1.6	5.9	13
	2002	0.7	77	0.2	2.4	3
	2004	1.9	52	0.8	4.5	9
	2005	2.9	69	1.0	8.3	13
	2006	2.7	50	1.2	6.1	12
	2007	4.7	41	2.4	9.2	22
Lazuli Bunting	1999	2.7	74	0.9	8.5	6
	2000	3.8	66	1.4	11	10
	2001	1.9	66	0.7	5.2	5
	2002	1.6	106	0.3	6.9	4
	2004	0.3	90	0.1	1.2	1
	2005	9.4	76	3.0	29	27
	2006	7.5	57	3.1	18	21
	2007	14	70	4.8	41	39
Red-winged Blackbird	1999	2.8	74	0.9	8.7	11
	2000	3.0	65	1.1	8.2	14
	2001	0.4	100	0.1	1.7	2
	2002	6.7	67	2.3	19	23
	2004	3.0	56	1.2	7.3	14
	2005	5.9	56	2.5	14	30
	2006	3.6	86	1.0	13	16
	2007	0.6	111	0.1	2.6	3
Brown-headed Cowbird	1999	0.8	69	0.3	2.5	2
	2000	3.6	41	1.8	7.0	10
	2001	4.5	38	2.4	8.3	13
	2002	7.9	37	4.3	15	20
	2004	4.4	41	2.3	8.5	14

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2005	5.6	36	3.1	10	18
	2006	7.6	46	3.7	16	16
	2007	9.1	39	4.8	17	28
Red Crossbill	1999	0.0	--	--	--	0
	2000	1.1	76	0.3	3.4	8
	2001	0.0	--	--	--	0
	2002	5.0	46	2.3	11	23
	2004	5.5	34	3.2	9.6	32
	2005	0.6	74	0.2	1.9	5
	2006	1.1	50	0.5	2.5	8
	2007	4.1	42	2.1	8.2	22
Pine Siskin	1999	29	50	13	64	56
	2000	56	24	37	83	114
	2001	19	49	8.8	41	56
	2002	25	23	17	37	83
	2004	52	19	38	70	130
	2005	68	23	46	99	125
	2006	93	23	63	137	194
	2007	104	18	78	139	268

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D; %CV = coefficient of variation of D; n = number of observations used to estimate D

Pinyon-Juniper (PJ)

Field staff conducted 376 point counts along 26 transects in pinyon-juniper stands between 13 May and 14 June 2007 (Table 1). They recorded a total of 4,176 birds in this habitat, with an average of 11.1 birds detected at each count station (Table 2). Observers detected 90 species in total and on average, detected 8.1 species per point count and 30.9 species per site.

Point transect data from pinyon-juniper habitat yielded robust density estimates (CV<50%) for 37 species and moderately robust estimates for another four species (CV=50-75%; Table 4). MCB should be able to produce trend information within 30 years for these 41 species, which represent 46% of all species recorded from pinyon-juniper in 2007. Nine species listed as SGCN (Black-chinned Hummingbird, Black-throated Gray Warbler, Brewer's Sparrow, Broad-tailed Hummingbird, Gray Flycatcher, Juniper Titmouse, Pinyon Jay, Vesper Sparrow, and Virginia's Warbler) and one species listed as a R2SS (Brewer's Sparrow) should be effectively monitored under the MCB program in this habitat (Appendix B).

Black-chinned Hummingbird, Blue-gray Gnatcatcher, Broad-tailed Hummingbird, Gray Flycatcher, and Black-throated Gray Warbler were the most abundant species in this habitat this year. Nineteen species (White-throated Swift, Black-chinned Hummingbird, Gray Flycatcher, Ash-throated Flycatcher, Gray Vireo,

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Plumbeous Vireo, Western Scrub-Jay, Pinyon Jay, Common Raven, Juniper Titmouse, Bushtit, Rock Wren, Bewick's Wren, Blue-gray Gnatcatcher, Virginia's Warbler, Black-throated Gray Warbler, Spotted Towhee, Chipping Sparrow, and House Finch) had higher estimated densities in pinyon-juniper than in other habitats surveyed in 2007.

Table 4. Estimated densities of breeding birds in pinyon-juniper habitat in Colorado, 1999-2007.

Species	Year	D	%CV	LCL	UCL	n
Mourning Dove	1999	9.4	22	6.6	14	113
	2000	9.2	20	6.6	13	133
	2001	2.9	30	1.8	4.7	63
	2002	7.4	22	5.1	11	96
	2003	13	26	8.3	19	137
	2004	13	20	9.6	18	164
	2005	9.9	22	6.9	14	174
	2006	21	21	15	30	249
	2007	13	23	8.8	19	148
White-throated Swift	1999	0.9	104	0.2	3.7	3
	2000	2.3	55	1.0	5.5	8
	2001	7.8	61	3.0	20	23
	2002	2.0	60	0.8	5.2	5
	2003	1.8	62	0.7	4.8	6
	2004	4.8	78	1.5	15	6
	2005	10	64	3.7	27	13
	2006	2.4	56	1.0	5.8	7
	2007	14	52	6.4	33	24
Black-chinned Hummingbird	1999	38	42	19	76	11
	2000	50	34	29	87	14
	2001	0.0	--	--	--	0
	2002	32	57	13	78	9
	2003	37	64	14	102	10
	2004	66	42	34	130	17
	2005	52	39	27	98	14
	2006	46	35	26	82	11
	2007	134	29	82	218	32
Broad-tailed Hummingbird	1999	42	25	28	64	30
	2000	36	28	23	57	25
	2001	44	31	26	74	30
	2002	27	35	15	48	19
	2003	42	42	21	85	28
	2004	57	34	32	99	36
	2005	61	43	31	122	41
	2006	32	32	19	55	19
	2007	71	32	42	121	42
Northern Flicker	1999	4.0	45	2.0	8.2	32
	2000	2.2	44	1.1	4.4	17
	2001	2.8	50	1.3	6.0	21
	2002	1.3	56	0.5	3.0	10
	2003	0.7	63	0.3	1.8	5

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2004	1.3	49	0.6	2.7	9
	2005	1.2	49	0.6	2.6	9
	2006	3.5	46	1.7	7.2	23
	2007	3.0	46	1.5	6.3	20
Gray Flycatcher	1999	25	26	17	38	135
	2000	63	22	44	91	124
	2001	48	28	31	75	138
	2002	30	25	20	45	147
	2003	48	21	34	69	179
	2004	64	24	43	95	165
	2005	43	25	29	65	145
	2006	49	23	33	71	179
	2007	41	21	29	58	207
Dusky Flycatcher	1999	9.4	34	5.4	17	32
	2000	11	35	6.4	20	38
	2001	16	44	7.8	32	52
	2002	7.4	37	4.1	14	25
	2003	7.3	44	3.6	15	23
	2004	12	44	5.8	24	36
	2005	5.6	43	2.8	11	18
	2006	5.3	57	2.2	13	15
	2007	12	54	4.9	28	33
Ash-throated Flycatcher	1999	4.3	28	2.7	6.8	43
	2000	3.0	23	2.0	4.4	29
	2001	7.4	21	5.2	11	71
	2002	6.7	28	4.2	11	66
	2003	12	19	9.0	17	115
	2004	10	23	7.0	15	90
	2005	12	20	8.4	17	112
	2006	17	18	12	23	138
	2007	16	21	11	22	126
Gray Vireo	1999	0.5	51	0.2	1.1	5
	2000	0.2	69	0.1	0.6	2
	2001	0.6	70	0.2	1.8	6
	2002	0.5	51	0.2	1.2	5
	2003	1.6	52	0.7	3.7	15
	2004	3.4	51	1.5	7.6	30
	2005	1.8	43	0.9	3.7	17
	2006	2.4	63	0.9	6.5	20
	2007	4.6	55	1.9	11	38
Plumbeous Vireo	1999	4.8	29	3.0	7.8	34
	2000	8.4	22	5.8	12	58
	2001	10	22	7.2	15	70
	2002	8.1	20	5.8	11	57
	2003	13	21	9.4	19	88
	2004	14	20	9.9	19	85
	2005	9.6	24	6.5	14	64
	2006	9.2	27	5.9	14	53
	2007	14	20	10	20	84

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Western Scrub-Jay	1999	14	26	9.0	21	64
	2000	13	29	8.0	21	59
	2001	11	26	7.3	17	46
	2002	7.8	32	4.6	13	36
	2003	12	25	7.7	17	50
	2004	4.1	37	2.2	7.4	17
	2005	9.5	27	6.1	15	38
	2006	14	30	8.6	23	43
Pinyon Jay	2007	12	32	6.8	20	41
	1999	5.8	42	3.0	11	79
	2000	2.5	28	1.6	3.9	51
	2001	5.9	31	3.6	9.9	65
	2002	3.2	50	1.4	7.1	43
	2003	5.0	27	3.2	7.8	98
	2004	5.0	24	3.4	7.5	58
	2005	4.6	36	2.6	8.2	62
Clark's Nutcracker	2006	6.7	54	2.9	15	55
	2007	6.3	27	4.1	9.8	67
	1999	0.5	55	0.2	1.2	11
	2000	0.3	52	0.1	0.8	7
	2001	0.5	46	0.3	1.1	9
	2002	0.2	53	0.1	0.5	5
	2003	0.5	63	0.2	1.4	9
	2004	0.5	58	0.2	1.2	9
Black-billed Magpie	2005	0.9	51	0.4	2.0	18
	2006	0.7	52	0.3	1.5	12
	2007	1.3	37	0.7	2.5	23
	1999	1.8	39	1.0	3.5	45
	2000	0.8	47	0.4	1.6	18
	2001	0.8	43	0.4	1.6	19
	2002	0.9	39	0.5	1.6	24
	2003	1.0	39	0.5	1.8	22
Common Raven	2004	1.7	46	0.8	3.5	34
	2005	1.2	39	0.6	2.2	26
	2006	1.6	53	0.7	3.6	22
	2007	0.5	39	0.3	0.9	10
	1999	0.6	37	0.3	1.2	24
	2000	1.2	34	0.7	2.1	40
	2001	1.1	28	0.7	1.7	39
	2002	1.0	27	0.6	1.5	36
Violet-green Swallow	2003	2.0	27	1.3	3.0	66
	2004	1.6	24	1.1	2.4	42
	2005	2.5	32	1.5	4.2	68
	2006	2.3	24	1.5	3.4	64
	2007	2.3	23	1.6	3.3	67
	1999	9.6	33	5.6	16	29
	2000	9.1	33	5.3	16	27
	2001	13	29	8.3	21	35
2002	13	37	7.2	24	26	

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2003	17	33	9.6	29	46
	2004	20	32	12	34	26
	2005	18	33	10	31	32
	2006	13	42	6.4	25	22
	2007	12	38	6.3	22	22
Mountain Chickadee	1999	7.7	37	4.2	14	24
	2000	22	22	16	32	69
	2001	7.6	32	4.5	13	21
	2002	9.6	42	4.9	19	30
	2003	11	34	6.2	19	32
	2004	9.6	34	5.5	17	27
	2005	13	39	6.9	25	39
	2006	17	45	8.1	35	42
	2007	29	35	16	53	74
Juniper Titmouse	1999	11	23	7.4	16	37
	2000	16	27	10	25	54
	2001	22	24	14	32	69
	2002	15	27	9.7	24	51
	2003	20	20	14	28	62
	2004	15	21	11	22	45
	2005	11	25	7.0	16	29
	2006	17	26	11	26	43
	2007	33	23	23	49	88
Bushtit	1999	30	34	17	52	30
	2000	51	41	27	97	37
	2001	33	79	9.8	114	6
	2002	63	46	30	131	21
	2003	34	44	17	68	17
	2004	38	56	16	91	10
	2005	72	53	31	164	30
	2006	63	47	30	134	23
	2007	31	38	17	58	24
White-breasted Nuthatch	1999	3.1	29	2.0	5.0	23
	2000	5.1	23	3.5	7.6	37
	2001	3.5	33	2.1	6.1	25
	2002	2.5	30	1.5	4.1	18
	2003	1.2	40	0.6	2.3	8
	2004	2.0	48	0.9	4.3	13
	2005	1.3	36	0.7	2.4	9
	2006	1.3	44	0.6	2.7	8
	2007	11	30	6.5	18	63
Rock Wren	1999	5.5	39	2.9	10	63
	2000	4.6	34	2.6	8.1	52
	2001	1.9	54	0.8	4.5	21
	2002	2.6	36	1.4	4.6	28
	2003	5.5	28	3.4	8.7	58
	2004	4.9	30	3.0	8.0	50
	2005	4.3	38	2.3	8.1	47
	2006	6.6	41	3.4	13	62

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Bewick's Wren	2007	6.0	27	3.8	9.4	54
	1999	18	28	11	29	178
	2000	53	27	33	83	160
	2001	17	32	10	29	120
	2002	16	30	9.6	26	81
	2003	28	21	20	40	159
	2004	46	27	29	71	162
	2005	21	32	13	36	124
	2006	63	33	37	108	230
Blue-gray Gnatcatcher	2007	10	30	6.3	17	108
	1999	69	19	51	94	120
	2000	60	21	42	85	116
	2001	47	28	30	75	85
	2002	101	24	68	149	117
	2003	69	20	50	96	95
	2004	82	21	58	115	115
	2005	72	17	54	95	113
	2006	104	16	80	136	141
Mountain Bluebird	2007	77	12	63	94	157
	1999	13	27	8.6	21	66
	2000	29	30	18	47	80
	2001	9.1	36	5.1	16	55
	2002	27	29	17	44	103
	2003	22	24	15	34	131
	2004	35	25	23	52	153
	2005	28	26	19	43	110
	2006	56	27	36	87	136
Hermit Thrush	2007	10	27	6.5	16	72
	1999	0.2	53	0.1	0.3	5
	2000	0.9	59	0.3	2.2	28
	2001	0.6	52	0.2	1.3	18
	2002	0.3	48	0.1	0.6	9
	2003	0.7	70	0.2	2.0	21
	2004	0.3	56	0.1	0.8	10
	2005	0.7	68	0.2	2.0	22
	2006	0.0	101	0.0	0.2	1
American Robin	2007	1.3	45	0.6	2.8	37
	1999	6.9	23	4.7	10	60
	2000	3.2	31	1.9	5.3	27
	2001	5.8	44	2.8	12	47
	2002	7.0	33	4.1	12	60
	2003	7.1	31	4.2	12	57
	2004	6.6	26	4.3	10	51
	2005	5.2	27	3.4	8.2	43
	2006	8.3	30	5.1	14	60
Orange-crowned Warbler	2007	6.9	25	4.6	11	50
	1999	2.5	68	0.9	7.1	8
	2000	3.8	58	1.5	9.5	12
	2001	3.6	53	1.6	8.2	11

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	0.6	73	0.2	1.9	2
	2003	5.0	56	2.1	12	15
	2004	5.9	53	2.6	14	17
	2005	5.6	66	2.0	15	17
	2006	4.9	74	1.6	15	13
	2007	0.4	100	0.1	1.6	1
Virginia's Warbler	1999	36	34	21	63	94
	2000	23	31	14	39	59
	2001	24	39	13	45	60
	2002	16	29	9.8	26	41
	2003	17	35	9.5	30	41
	2004	29	34	17	51	68
	2005	16	47	7.6	35	40
	2006	27	61	10	70	56
	2007	36	26	24	56	79
Yellow-rumped Warbler	1999	4.8	63	1.8	13	12
	2000	8.1	63	3.1	21	20
	2001	5.0	52	2.2	11	12
	2002	1.2	62	0.5	3.1	3
	2003	1.7	83	0.5	5.8	4
	2004	0.9	104	0.2	3.8	2
	2005	0.8	74	0.3	2.6	2
	2006	3.3	76	1.1	10	7
	2007	12	46	6.0	26	24
Black-throated Gray Warbler	1999	43	34	25	74	167
	2000	103	25	69	154	188
	2001	40	19	29	55	207
	2002	68	26	45	105	169
	2003	77	23	53	113	181
	2004	51	21	36	73	201
	2005	52	20	37	72	205
	2006	75	28	48	119	226
	2007	37	16	29	49	321
Western Tanager	1999	1.6	34	0.9	2.9	17
	2000	2.0	40	1.1	3.9	21
	2001	2.3	48	1.1	5.0	23
	2002	1.4	36	0.8	2.4	14
	2003	3.4	32	2.0	5.8	33
	2004	2.7	31	1.6	4.5	24
	2005	2.0	31	1.2	3.4	20
	2006	1.7	54	0.7	4.1	14
	2007	4.1	29	2.6	6.7	36
Green-tailed Towhee	1999	18	30	11	29	106
	2000	20	30	12	33	118
	2001	6.8	41	3.5	13	39
	2002	3.9	37	2.1	7.1	23
	2003	6.3	46	3.0	13	35
	2004	19	29	12	32	103
	2005	13	30	7.8	21	72

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Spotted Towhee	2006	8.8	31	5.2	15	44
	2007	12	28	7.8	20	62
	1999	29	24	19	43	237
	2000	63	26	41	98	211
	2001	29	28	19	47	200
	2002	66	29	41	106	140
	2003	24	28	15	38	90
	2004	53	33	31	91	143
	2005	47	32	28	79	157
	2006	27	30	17	45	147
Chipping Sparrow	2007	25	24	16	36	166
	1999	75	16	57	98	166
	2000	175	18	130	235	258
	2001	41	17	31	54	159
	2002	45	25	30	67	133
	2003	43	17	33	57	188
	2004	103	19	76	141	170
	2005	58	14	46	73	186
	2006	153	15	119	197	213
	2007	35	17	26	47	164
Brewer's Sparrow	1999	3.9	30	2.4	6.4	39
	2000	1.9	48	0.9	4.2	19
	2001	5.4	62	2.1	14	51
	2002	2.7	35	1.5	4.8	27
	2003	4.5	32	2.6	7.7	42
	2004	5.4	40	2.8	10	45
	2005	2.5	32	1.5	4.3	22
	2006	7.6	40	3.9	15	59
	2007	5.8	30	3.5	9.5	48
Vesper Sparrow	1999	4.0	40	2.1	7.7	27
	2000	6.9	34	4.0	12	46
	2001	3.2	41	1.7	6.2	21
	2002	4.9	37	2.7	9.0	33
	2003	6.3	33	3.7	11	40
	2004	5.2	43	2.6	11	32
	2005	3.4	47	1.6	7.3	22
	2006	9.0	30	5.5	15	50
	2007	6.2	41	3.2	12	35
Lark Sparrow	1999	0.2	70	0.1	0.6	2
	2000	1.8	32	1.1	3.1	18
	2001	0.7	40	0.4	1.4	7
	2002	2.7	54	1.1	6.3	27
	2003	3.2	59	1.3	8.1	30
	2004	1.9	56	0.8	4.6	14
	2005	2.0	48	0.9	4.3	19
	2006	2.4	35	1.4	4.3	17
	2007	4.3	38	2.3	8.1	29
Black-headed Grosbeak	1999	3.4	42	1.7	6.7	29
	2000	7.1	41	3.7	14	60

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2001	1.5	60	0.6	3.7	12
	2002	2.6	51	1.1	5.9	23
	2003	2.4	36	1.3	4.3	19
	2004	4.2	45	2.0	8.7	32
	2005	4.4	47	2.1	9.5	36
	2006	4.1	57	1.6	10	29
	2007	4.6	43	2.3	9.3	33
Western Meadowlark	1999	0.6	35	0.4	1.1	53
	2000	2.9	29	1.8	4.6	42
	2001	0.5	39	0.2	0.8	29
	2002	0.5	40	0.2	0.9	33
	2003	0.9	33	0.5	1.5	50
	2004	1.9	47	0.9	4.1	46
	2005	1.1	33	0.6	1.9	45
	2006	0.2	48	0.1	0.5	28
	2007	0.8	28	0.5	1.3	43
Brown-headed Cowbird	1999	9.8	29	6.0	16	52
	2000	9.0	25	6.0	14	47
	2001	9.4	22	6.5	14	47
	2002	7.8	31	4.7	13	41
	2003	4.4	31	2.7	7.4	20
	2004	12	28	7.8	20	50
	2005	9.9	33	5.8	17	46
	2006	12	25	7.6	17	47
	2007	12	23	7.8	17	47
House Finch	1999	11	36	5.9	19	79
	2000	9.2	32	5.4	16	67
	2001	5.1	45	2.4	11	35
	2002	7.4	37	4.0	13	51
	2003	5.9	38	3.1	11	41
	2004	12	27	7.5	19	67
	2005	8.1	40	4.2	16	53
	2006	20	25	14	31	101
	2007	23	21	16	32	133
Pine Siskin	1999	1.3	53	0.6	3.0	6
	2000	0.0	--	--	--	0
	2001	10	43	5.1	20	33
	2002	2.0	67	0.7	5.6	8
	2003	2.8	48	1.3	6.1	13
	2004	2.2	52	1.0	5.0	6
	2005	14	35	7.9	24	43
	2006	2.1	53	0.9	4.8	8
	2007	2.9	64	1.1	7.8	10

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D; %CV = coefficient of variation of D; n = number of observations used to estimate D

Ponderosa Pine (PP)

Field staff conducted 435 point counts along 29 transects in ponderosa pine stands between 28 May and 8 July 2007 (Table 1). They recorded a total of 4,934 birds in this habitat, with an average of 12.2 birds detected at each count station (Table 2). Observers detected 81 species in total and, on average, detected 8.2 species per point count and 31.0 species per site.

Point transect data from ponderosa pine habitat yielded robust density estimates (CV<50%) for 40 species and moderately robust estimates for another four species (CV=50-75%; Table 5). MCB should be able to produce trend information within 30 years for these 44 species, which represent 54% of all species recorded from ponderosa pine in 2007 in this habitat. Ten species (Broad-tailed Hummingbird, Cassin's Finch, Cordilleran Flycatcher, Dusky Flycatcher, Grace's Warbler, Olive-sided Flycatcher, Pygmy Nuthatch, Red Crossbill, Vesper Sparrow, and Virginia's Warbler) listed as SGCN and one species (Olive-sided Flycatcher) listed as a R2SS should be monitored effectively under the MCB program in this habitat (Appendix B).

Dark-eyed Junco, Broad-tailed Hummingbird, Pygmy Nuthatch, Violet-green Swallow, and Yellow-rumped Warbler were among the most abundant species in this habitat this year. Fifteen species (Common Nighthawk, Williamson's Sapsucker, Western Wood-Pewee, Hammond's Flycatcher, Warbling Vireo, Violet-green Swallow, White-breasted Nuthatch, Pygmy Nuthatch, House Wren, Western Bluebird, Townsend's Solitaire, Grace's Warbler, Western Tanager, Brown-headed Cowbird, and Cassin's Finch) had higher estimated densities in ponderosa pine than in other habitats surveyed in 2007.

Table 5. Estimated densities of breeding birds in ponderosa pine habitat in Colorado, 1998-2007.

Species	Year	D	%CV	LCL	UCL	n
Mourning Dove	1998	1.8	33	1.0	3.1	26
	1999	1.4	38	0.8	2.7	21
	2000	7.6	25	5.0	12	93
	2001	2.5	28	1.6	3.9	36
	2002	6.4	29	3.9	10	70
	2004	10	19	7.5	14	124
	2005	3.6	28	2.2	5.7	48
	2006	15	20	11	21	174
	2007	14	23	9.2	20	185
Common Nighthawk	1998	0.6	48	0.3	1.3	8
	1999	0.8	53	0.3	1.8	10
	2000	0.6	76	0.2	2.1	7
	2001	0.5	45	0.3	1.1	7
	2002	0.7	45	0.3	1.4	7
	2004	0.4	42	0.2	0.9	5
	2005	1.9	38	1.0	3.5	23
	2006	1.0	44	0.5	2.0	10

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Broad-tailed Hummingbird	2007	0.5	38	0.3	0.9	6
	1998	91	22	63	130	71
	1999	65	24	43	97	51
	2000	69	26	44	106	45
	2001	62	29	38	100	48
	2002	68	44	33	138	42
	2004	71	33	41	121	48
	2005	98	30	59	160	70
	2006	75	26	49	115	47
Williamson's Sapsucker	2007	95	26	61	146	71
	1998	13	30	7.9	21	38
	1999	11	27	6.9	17	32
	2000	8.1	36	4.5	15	20
	2001	21	92	5.0	84	9
	2002	12	34	6.6	20	27
	2004	13	25	8.6	20	34
	2005	7.9	30	4.8	13	22
	2006	8.9	36	5.0	16	21
Hairy Woodpecker	2007	7.7	35	4.3	14	22
	1998	6.3	30	3.8	10	27
	1999	4.1	30	2.5	6.8	18
	2000	4.4	33	2.6	7.7	16
	2001	5.6	26	3.7	8.5	24
	2002	5.0	47	2.3	11	16
	2004	7.1	25	4.7	11	26
	2005	5.2	29	3.2	8.4	20
	2006	6.1	25	4.0	9.2	21
Olive-sided Flycatcher	2007	10	23	6.9	15	42
	1998	1.2	32	0.7	2.0	19
	1999	0.6	37	0.3	1.1	10
	2000	0.8	39	0.4	1.5	11
	2001	0.8	41	0.4	1.6	13
	2002	0.4	61	0.1	1.0	5
	2004	0.7	43	0.3	1.4	10
	2005	0.7	55	0.3	1.7	11
	2006	1.7	42	0.9	3.4	22
Western Wood-Pewee	2007	0.8	36	0.5	1.5	13
	1998	11	27	7.0	17	102
	1999	4.8	27	3.0	7.5	87
	2000	6.1	30	3.7	9.9	72
	2001	12	24	8.3	18	189
	2002	7.0	28	4.4	11	155
	2004	18	25	12	27	181
	2005	11	23	7.7	16	168
	2006	23	23	16	33	181
Hammond's Flycatcher	2007	14	18	10	19	185
	1998	3.5	44	1.7	7.1	13
	1999	2.4	58	1.0	6.0	9
	2000	2.5	60	1.0	6.5	8

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2001	0.3	100	0.1	1.1	1
	2002	3.7	57	1.5	9.2	11
	2004	2.4	43	1.2	4.9	8
	2005	2.5	45	1.2	5.3	8
	2006	16	29	9.7	25	47
	2007	9.0	27	5.7	14	33
Dusky Flycatcher	1998	44	35	25	76	108
	1999	39	38	21	72	132
	2000	52	28	33	82	102
	2001	33	31	19	55	88
	2002	9.2	35	5.2	16	61
	2004	17	73	5.8	52	50
	2005	24	26	16	37	82
	2006	23	45	11	47	63
	2007	25	48	12	53	98
Cordilleran Flycatcher	1998	3.3	31	2.0	5.4	21
	1999	2.0	47	1.0	4.3	13
	2000	0.9	52	0.4	2.1	5
	2001	3.5	38	1.8	6.4	22
	2002	1.6	54	0.7	3.8	8
	2004	1.6	49	0.7	3.5	9
	2005	0.7	78	0.2	2.1	4
	2006	1.0	54	0.4	2.3	5
	2007	4.8	27	3.1	7.5	30
Plumbeous Vireo	1998	6.2	33	3.6	11	41
	1999	5.8	33	3.3	10	38
	2000	11	32	6.7	19	62
	2001	12	24	7.8	17	76
	2002	14	25	9.1	21	71
	2004	7.6	24	5.0	11	44
	2005	11	28	7.1	18	66
	2006	12	26	7.5	18	61
	2007	10	28	6.5	16	66
Warbling Vireo	1998	23	24	16	35	180
	1999	16	23	11	23	152
	2000	20	21	14	29	134
	2001	20	20	14	27	158
	2002	16	24	11	24	134
	2004	14	35	7.8	24	84
	2005	12	24	7.8	18	148
	2006	36	26	23	55	218
	2007	19	26	12	29	160
Steller's Jay	1998	17	21	12	24	132
	1999	10	22	7.2	15	130
	2000	9.9	23	6.8	14	84
	2001	9.5	20	6.8	13	147
	2002	2.8	21	2.0	4.0	59
	2004	6.3	25	4.1	9.5	79
	2005	16	23	11	24	109

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Clark's Nutcracker	2006	12	32	7.4	21	78
	2007	6.4	29	4.0	10	85
	1998	2.2	26	1.4	3.3	48
	1999	0.9	34	0.5	1.5	19
	2000	0.9	46	0.4	1.9	17
	2001	0.6	39	0.3	1.1	13
	2002	1.2	43	0.6	2.4	21
	2004	2.1	38	1.1	3.9	29
	2005	0.7	29	0.4	1.2	13
	2006	1.7	32	1.0	2.9	30
Common Raven	2007	1.3	27	0.8	2.0	28
	1998	0.2	50	0.1	0.4	11
	1999	0.5	25	0.3	0.7	27
	2000	0.4	37	0.2	0.7	17
	2001	0.5	26	0.3	0.8	29
	2002	0.7	30	0.4	1.1	28
	2004	0.7	22	0.5	1.0	33
	2005	0.9	24	0.6	1.3	43
	2006	0.5	27	0.3	0.8	21
	2007	0.6	22	0.4	0.8	30
Violet-green Swallow	1998	23	29	14	37	72
	1999	9.2	31	5.5	15	29
	2000	25	33	14	42	65
	2001	19	25	13	29	50
	2002	26	30	16	43	58
	2004	48	25	32	73	82
	2005	38	28	24	61	73
	2006	62	21	43	88	128
	2007	43	22	30	61	103
Mountain Chickadee	1998	68	19	50	92	168
	1999	32	15	25	40	170
	2000	55	17	41	74	174
	2001	32	26	21	50	132
	2002	12	26	8.2	19	73
	2004	62	25	41	93	120
	2005	26	18	19	35	127
	2006	74	24	50	110	119
	2007	39	14	31	49	164
Red-breasted Nuthatch	1998	2.5	38	1.3	4.6	23
	1999	4.4	30	2.7	7.2	41
	2000	3.2	58	1.3	8.0	25
	2001	1.8	50	0.8	4.1	17
	2002	1.5	42	0.7	3.0	10
	2004	2.9	40	1.5	5.6	21
	2005	2.8	43	1.4	5.7	25
	2006	0.5	47	0.2	1.2	4
	2007	1.7	42	0.8	3.3	14
White-breasted Nuthatch	1998	15	23	11	22	62
	1999	11	27	7.0	17	66

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2000	21	23	14	31	97
	2001	12	24	8.4	18	89
	2002	7.1	32	4.2	12	46
	2004	18	21	13	26	67
	2005	11	24	7.3	16	73
	2006	30	37	16	55	76
	2007	20	22	14	29	86
Pygmy Nuthatch	1998	19	35	11	34	80
	1999	12	29	7.4	19	50
	2000	24	25	16	37	85
	2001	18	23	12	27	73
	2002	21	26	13	31	58
	2004	54	23	37	80	99
	2005	18	26	12	28	63
	2006	38	37	21	71	124
	2007	76	19	55	105	223
Brown Creeper	1998	6.7	30	4.1	11	13
	1999	8.2	26	5.3	13	16
	2000	7.4	29	4.6	12	12
	2001	3.1	39	1.6	5.9	6
	2002	1.3	69	0.4	3.8	2
	2004	7.6	48	3.5	16	12
	2005	2.2	59	0.9	5.5	4
	2006	8.4	48	3.9	18	13
	2007	7.4	44	3.6	15	12
Rock Wren	1998	0.7	47	0.3	1.5	13
	1999	0.1	71	0.0	0.3	2
	2000	0.3	79	0.1	0.8	4
	2001	0.5	56	0.2	1.3	10
	2002	0.7	61	0.3	1.8	9
	2004	0.7	66	0.2	1.9	11
	2005	0.3	60	0.1	0.7	5
	2006	1.3	57	0.5	3.4	20
	2007	0.7	67	0.2	1.9	12
House Wren	1998	26	20	19	37	90
	1999	13	27	8.4	21	44
	2000	23	24	16	35	69
	2001	11	28	6.7	17	63
	2002	14	32	8.0	23	63
	2004	15	31	8.7	24	61
	2005	18	26	12	27	100
	2006	57	24	39	84	120
	2007	25	20	18	35	116
Ruby-crowned Kinglet	1998	9.3	30	5.6	15	85
	1999	3.9	39	2.1	7.4	36
	2000	3.3	49	1.5	7.2	25
	2001	5.4	48	2.5	12	49
	2002	4.0	50	1.8	9.0	29
	2004	4.5	46	2.1	9.4	36

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2005	6.0	37	3.3	11	52
	2006	5.5	53	2.3	13	40
	2007	5.0	51	2.2	11	44
Western Bluebird	1998	11	41	5.6	21	26
	1999	7.5	36	4.2	14	18
	2000	14	45	6.5	28	27
	2001	10	32	6.0	17	23
	2002	14	45	6.9	30	23
	2004	25	31	15	41	50
	2005	32	25	21	48	69
	2006	24	33	14	41	46
	2007	22	31	13	36	44
Mountain Bluebird	1998	15	45	7.3	31	40
	1999	4.9	46	2.3	10	13
	2000	5.8	66	2.1	16	13
	2001	4.5	56	1.9	11	11
	2002	7.2	47	3.4	15	17
	2004	11	38	6.2	21	27
	2005	22	41	11	41	51
	2006	24	45	12	50	49
	2007	13	48	6.0	27	29
Townsend's Solitaire	1998	9.5	21	6.7	13	80
	1999	6.6	18	4.9	8.9	56
	2000	3.5	27	2.3	5.5	25
	2001	10	19	7.2	14	82
	2002	6.9	25	4.5	11	46
	2004	5.8	21	4.1	8.3	44
	2005	7.0	20	5.1	9.7	55
	2006	6.2	23	4.2	9.1	41
	2007	9.7	18	7.3	13	79
Hermit Thrush	1998	7.2	36	4.0	13	102
	1999	1.9	35	1.1	3.3	51
	2000	6.1	26	3.9	9.4	94
	2001	3.3	45	1.6	6.7	65
	2002	1.9	29	1.1	3.0	58
	2004	4.6	25	3.0	6.9	89
	2005	2.7	41	1.4	5.3	115
	2006	2.8	35	1.6	4.9	87
	2007	7.1	33	4.1	12	99
American Robin	1998	63	18	47	85	288
	1999	17	21	12	23	179
	2000	31	19	23	43	204
	2001	21	23	14	31	234
	2002	18	17	14	24	154
	2004	22	19	16	30	158
	2005	41	25	27	61	172
	2006	42	16	32	56	215
	2007	23	17	18	31	186
Orange-crowned Warbler	1998	6.4	36	3.6	12	28

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	1999	15	45	7.5	32	67
	2000	18	31	11	30	66
	2001	6.2	34	3.6	11	27
	2002	4.4	52	1.9	10	15
	2004	4.2	43	2.1	8.4	16
	2005	5.6	49	2.6	12	23
	2006	7.5	44	3.6	15	26
	2007	3.1	51	1.4	7.0	13
Virginia's Warbler	1998	6.5	30	4.0	11	30
	1999	16	38	8.9	31	76
	2000	17	30	10	28	65
	2001	7.9	28	5.0	13	36
	2002	3.3	54	1.4	7.9	12
	2004	9.6	29	5.9	16	39
	2005	14	30	8.4	23	58
	2006	30	29	18	48	109
	2007	11	31	6.9	19	51
Yellow-rumped Warbler	1998	39	31	24	63	177
	1999	37	17	28	50	210
	2000	27	21	19	38	156
	2001	36	28	23	56	199
	2002	31	39	17	58	100
	2004	41	19	30	57	159
	2005	28	26	18	43	111
	2006	60	25	40	91	180
	2007	40	29	25	65	181
Grace's Warbler	1998	4.8	46	2.3	10	22
	1999	8.9	38	4.8	17	41
	2000	7.6	55	3.2	18	29
	2001	8.8	43	4.4	18	40
	2002	12	39	6.6	24	44
	2004	4.2	46	2.0	8.9	17
	2005	14	33	8.3	24	60
	2006	24	45	12	51	88
	2007	27	36	15	49	120
MacGillivray's Warbler	1998	2.6	43	1.3	5.2	13
	1999	1.2	61	0.5	3.1	6
	2000	1.6	57	0.7	4.1	7
	2001	1.6	54	0.7	3.8	8
	2002	1.5	60	0.6	3.9	6
	2004	0.0	--	--	--	0
	2005	2.3	48	1.1	5.0	11
	2006	2.5	67	0.9	7.0	10
	2007	2.6	50	1.2	5.9	13
Western Tanager	1998	26	20	19	37	176
	1999	22	23	15	33	125
	2000	16	19	11	22	89
	2001	14	22	10	21	138
	2002	12	23	8.4	18	99

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2004	29	24	19	43	138
	2005	20	24	14	30	171
	2006	29	25	20	44	130
	2007	16	20	11	22	143
Green-tailed Towhee	1998	25	24	16	37	186
	1999	14	28	8.4	22	103
	2000	21	19	15	29	135
	2001	9.8	29	6.1	16	74
	2002	19	25	12	29	113
	2004	12	27	7.9	19	83
	2005	16	25	10	24	111
	2006	14	30	8.7	24	87
	2007	21	23	14	31	156
Spotted Towhee	1998	6.7	53	2.9	15	37
	1999	7.7	47	3.6	16	43
	2000	20	35	11	37	95
	2001	8.1	37	4.4	15	45
	2002	4.8	51	2.1	11	21
	2004	7.7	41	4.0	15	38
	2005	10	40	5.3	19	53
	2006	20	40	10	38	87
	2007	8.9	32	5.2	15	48
Chipping Sparrow	1998	29	18	22	40	115
	1999	25	20	18	35	99
	2000	30	20	21	42	99
	2001	26	14	20	33	102
	2002	19	21	14	27	60
	2004	36	17	27	47	119
	2005	33	21	23	47	121
	2006	42	16	32	55	130
	2007	23	22	16	33	86
Vesper Sparrow	1998	2.0	66	0.7	5.6	30
	1999	1.0	77	0.3	3.2	15
	2000	0.8	48	0.4	1.8	10
	2001	1.4	40	0.7	2.6	20
	2002	1.3	44	0.6	2.6	14
	2004	1.8	47	0.8	3.8	23
	2005	1.4	39	0.8	2.7	20
	2006	2.9	39	1.5	5.5	34
	2007	2.4	45	1.2	4.9	34
Dark-eyed Junco	1998	127	17	95	169	232
	1999	84	17	64	111	155
	2000	121	19	89	166	186
	2001	68	19	50	94	117
	2002	84	23	57	121	119
	2004	101	21	72	141	143
	2005	102	19	74	140	171
	2006	127	16	97	166	185
	2007	131	17	100	173	199

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Black-headed Grosbeak	1998	2.7	45	1.3	5.5	25
	1999	3.0	32	1.8	5.0	28
	2000	1.7	41	0.9	3.2	13
	2001	2.0	35	1.1	3.7	19
	2002	1.5	54	0.6	3.5	11
	2004	3.4	35	1.9	6.0	28
	2005	2.7	43	1.4	5.5	24
	2006	5.7	26	3.7	8.9	43
	2007	2.5	33	1.5	4.4	23
Brown-headed Cowbird	1998	14	32	8.5	24	42
	1999	12	28	7.5	19	35
	2000	9.4	33	5.5	16	23
	2001	10	33	6.1	18	30
	2002	12	29	7.3	19	25
	2004	7.0	33	4.0	12	18
	2005	10	34	5.9	18	24
	2006	27	33	16	46	58
	2007	15	35	8.5	27	43
Cassin's Finch	1998	2.0	48	1.0	4.4	7
	1999	7.6	31	4.6	13	26
	2000	5.9	48	2.7	13	17
	2001	5.9	51	2.6	13	20
	2002	1.9	55	0.8	4.4	5
	2004	3.6	67	1.3	10	8
	2005	12	37	6.3	21	33
	2006	7.0	40	3.6	13	18
	2007	9.0	33	5.3	15	24
Red Crossbill	1998	0.6	56	0.2	1.5	9
	1999	0.6	49	0.3	1.3	9
	2000	1.4	36	0.8	2.6	18
	2001	1.5	37	0.8	2.7	17
	2002	1.9	43	0.9	3.7	17
	2004	4.4	42	2.2	8.7	28
	2005	3.1	66	1.1	8.6	12
	2006	7.4	34	4.2	13	67
	2007	19	29	12	31	136
Pine Siskin	1998	31	20	22	43	106
	1999	17	21	12	24	58
	2000	16	36	8.6	29	45
	2001	17	27	11	27	59
	2002	18	25	12	28	46
	2004	18	31	11	29	39
	2005	57	18	42	77	128
	2006	30	35	16	53	77
	2007	35	24	23	52	84

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D; %CV = coefficient of variation of D; n = number of observations used to estimate D

Sage Shrubland (SA)

Field staff conducted 345 point counts along 23 transects in sage shrubland between 15 May and 12 July 2007 (Table 1). They recorded a total of 3,768 birds in this habitat, with an average of 10.9 birds detected at each count station (Table 2). Observers detected 103 species in total and, on average, detected 5.6 species per point count and 19.2 species per site.

Point transect data from sage shrubland habitat yielded robust density estimates (CV<50%) for 17 species and moderately robust estimates for another seven species (CV=50-75%; Table 6). MCB should be able to produce trend information within 30 years for these 24 species, which represent 23% of all species recorded from sage shrubland in 2007. Three species (Brewer's Sparrow, Broad-tailed Hummingbird, and Vesper Sparrow) listed as SGCN and one species (Brewer's Sparrow) listed as a R2SS should be effectively monitored under the MCB program in this habitat (Appendix B).

Brewer's Sparrow, Vesper Sparrow, Horned Lark, Green-tailed Towhee, and Sage Thrasher were among the most abundant species in this habitat this year. Eleven species (Black-billed Magpie, Sage Thrasher, Green-tailed Towhee, Cassin's Sparrow, Brewer's Sparrow, Vesper Sparrow, Sage Sparrow, Grasshopper Sparrow, Red-winged Blackbird, Western Meadowlark, and Brewer's Blackbird) had higher estimated densities in sage shrubland than in other habitats surveyed in 2007.

Table 6. Estimated densities of breeding birds in sage shrubland habitat in Colorado, 1999-2007.

Species	Year	D	%CV	LCL	UCL	n
Killdeer	1999	0.4	45	0.2	0.9	5
	2000	0.9	49	0.4	2.1	8
	2001	1.0	56	0.4	2.4	9
	2002	1.1	46	0.5	2.2	12
	2003	0.8	51	0.4	1.8	9
	2004	1.3	51	0.6	3.0	13
	2005	2.6	35	1.5	4.5	28
	2007	1.7	32	1.0	2.9	15
Mourning Dove	1999	3.7	25	2.4	5.6	57
	2000	2.6	30	1.6	4.4	31
	2001	2.6	35	1.5	4.6	37
	2002	6.4	26	4.2	9.9	96
	2003	5.1	29	3.1	8.1	76
	2004	4.5	21	3.2	6.5	62
	2005	8.1	24	5.4	12	125
	2006	3.6	29	2.2	5.9	49
Broad-tailed Hummingbird	2007	6.2	26	4.0	9.6	73
	1999	13	45	6.4	27	15
	2000	21	53	9.0	49	18
	2001	11	56	4.5	27	12

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	13	60	5.1	33	15
	2003	9.7	43	4.8	19	11
	2004	13	39	6.9	25	15
	2005	23	51	10	51	26
	2007	21	47	9.9	46	20
Northern Flicker	1999	1.2	39	0.6	2.1	31
	2000	1.1	37	0.6	2.1	23
	2001	0.7	40	0.4	1.4	18
	2002	0.3	55	0.1	0.8	9
	2003	0.6	46	0.3	1.2	16
	2004	0.1	53	0.1	0.3	4
	2005	0.2	65	0.1	0.6	6
	2007	0.4	79	0.1	1.2	8
Dusky Flycatcher	1999	1.8	57	0.7	4.4	17
	2000	1.4	90	0.4	5.3	10
	2001	1.2	36	0.7	2.1	11
	2002	2.0	64	0.7	5.3	19
	2003	2.1	62	0.8	5.5	20
	2004	2.5	59	1.0	6.3	24
	2005	1.1	51	0.5	2.6	11
	2007	4.1	51	1.8	9.2	32
Western Kingbird	1999	1.0	64	0.4	2.6	15
	2000	0.6	65	0.2	1.7	7
	2001	0.3	61	0.1	0.7	4
	2002	1.1	52	0.5	2.5	13
	2003	1.6	65	0.6	4.3	24
	2004	0.1	102	0.0	0.3	1
	2005	2.1	41	1.1	4.0	32
	2007	1.9	66	0.7	5.3	22
Warbling Vireo	1999	1.1	47	0.5	2.3	18
	2000	0.2	101	0.1	1.0	3
	2001	0.6	49	0.3	1.4	10
	2002	1.4	53	0.6	3.3	24
	2003	0.5	61	0.2	1.4	9
	2004	0.4	86	0.1	1.2	6
	2005	0.6	76	0.2	1.9	10
	2007	1.1	88	0.3	4.0	15
Pinyon Jay	1999	2.1	86	0.6	7.4	34
	2000	0.6	72	0.2	1.7	7
	2001	3.3	83	1.0	11	10
	2002	0.4	62	0.2	1.1	7
	2003	1.5	70	0.5	4.2	12
	2004	3.5	110	0.6	19	4
	2005	0.4	63	0.1	1.0	6
	2007	1.8	96	0.4	8.0	5
Black-billed Magpie	1999	0.6	39	0.3	1.1	20
	2000	0.9	42	0.4	1.8	23
	2001	0.8	44	0.4	1.5	22
	2002	0.5	47	0.2	1.0	16

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2003	0.8	42	0.4	1.7	29
	2004	0.6	36	0.3	1.0	18
	2005	1.1	48	0.5	2.4	39
	2006	1.6	44	0.8	3.3	50
	2007	2.0	36	1.1	3.7	47
Common Raven	1999	0.1	39	0.0	0.1	10
	2000	0.2	45	0.1	0.5	33
	2001	0.5	95	0.1	1.8	13
	2002	0.2	51	0.1	0.4	23
	2003	0.3	39	0.1	0.5	51
	2004	0.1	34	0.1	0.2	25
	2005	0.2	36	0.1	0.3	27
	2006	0.3	29	0.2	0.5	54
	2007	0.4	28	0.2	0.6	53
Horned Lark	1999	17	34	9.5	29	157
	2000	26	40	14	51	110
	2001	133	31	80	221	266
	2002	12	31	7.1	19	155
	2003	30	29	19	48	260
	2004	34	33	20	59	177
	2005	24	49	11	52	206
	2006	26	25	17	40	212
	2007	60	27	38	93	199
Cliff Swallow	1999	1.2	105	0.3	5.1	5
	2001	9.0	77	2.8	28	33
	2002	1.4	60	0.5	3.5	4
	2003	4.2	75	1.4	13	18
	2004	2.1	97	0.5	8.2	6
	2005	4.2	75	1.4	13	10
	2007	2.3	73	0.8	6.8	6
Rock Wren	1999	1.4	58	0.6	3.6	31
	2000	0.6	43	0.3	1.2	10
	2001	1.8	76	0.6	5.7	38
	2002	0.8	42	0.4	1.6	18
	2003	1.1	36	0.6	2.1	25
	2004	0.8	45	0.4	1.7	18
	2005	0.8	44	0.4	1.7	18
	2007	0.6	46	0.3	1.3	11
House Wren	1999	1.8	54	0.8	4.4	17
	2000	2.4	82	0.7	8.4	17
	2001	1.2	50	0.5	2.7	11
	2002	2.4	81	0.7	8.2	21
	2003	0.6	61	0.2	1.7	6
	2004	0.0	--	--	--	0
	2005	0.3	74	0.1	1.0	3
	2007	0.4	100	0.1	1.6	3
Blue-gray Gnatcatcher	1999	14	55	5.8	33	26
	2000	12	50	5.3	27	17
	2001	4.4	58	1.7	11	8

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	3.1	66	1.1	8.6	6
	2003	6.3	93	1.7	24	12
	2004	4.7	65	1.7	13	8
	2005	5.2	91	1.4	20	10
	2007	7.7	76	2.4	24	12
Mountain Bluebird	1999	1.0	34	0.6	1.7	15
	2000	2.4	41	1.2	4.7	27
	2001	1.2	42	0.6	2.3	16
	2002	0.8	40	0.4	1.6	12
	2003	2.5	28	1.6	4.0	38
	2004	1.7	44	0.8	3.5	24
	2005	1.6	43	0.8	3.2	24
	2006	3.2	67	1.1	9.1	39
	2007	2.7	30	1.7	4.5	30
American Robin	1999	3.6	27	2.3	5.6	53
	2000	3.7	35	2.1	6.7	42
	2001	2.4	32	1.4	4.1	35
	2002	2.8	32	1.7	4.8	43
	2003	2.1	34	1.2	3.8	32
	2004	1.8	33	1.1	3.2	25
	2005	2.7	39	1.4	5.2	40
	2007	2.0	40	1.0	3.9	24
Sage Thrasher	1999	2.0	42	1.0	4.0	80
	2000	4.3	53	1.9	9.7	53
	2001	2.6	36	1.4	4.7	94
	2002	7.6	28	4.8	12	144
	2003	5.5	26	3.6	8.5	158
	2004	11	31	6.7	19	172
	2005	16	31	9.7	27	261
	2007	27	25	18	41	268
Green-tailed Towhee	1999	14	32	8.6	24	127
	2000	34	27	21	53	223
	2001	21	28	13	33	177
	2002	17	27	11	26	147
	2003	12	35	6.6	21	104
	2004	17	32	10	30	155
	2005	21	33	12	36	184
	2007	39	27	25	62	286
Spotted Towhee	1999	5.0	74	1.6	15	36
	2000	4.2	53	1.8	9.9	23
	2001	2.0	57	0.8	5.0	14
	2002	2.2	61	0.8	5.7	16
	2003	3.5	88	0.9	13	25
	2004	0.8	86	0.2	2.9	6
	2005	1.8	101	0.4	7.5	12
	2007	3.4	67	1.2	9.5	20
Cassin's Sparrow	1999	3.2	55	1.3	7.7	67
	2000	1.4	100	0.3	5.9	22
	2001	1.6	72	0.5	4.7	27

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	4.8	41	2.5	9.4	103
	2003	6.7	40	3.5	13	141
	2004	3.3	41	1.7	6.4	71
	2005	5.6	41	2.9	11	119
	2007	2.0	60	0.8	5.2	35
Brewer's Sparrow	1999	61	22	42	89	324
	2000	87	20	62	123	350
	2001	71	24	48	105	352
	2002	49	20	35	69	264
	2003	88	18	66	119	472
	2004	75	17	57	100	397
	2005	98	19	72	135	515
	2007	155	17	117	205	667
Vesper Sparrow	1999	17	28	11	27	156
	2000	38	18	28	52	223
	2001	21	23	14	31	188
	2002	21	23	14	30	196
	2003	28	23	19	42	174
	2004	24	21	17	35	208
	2005	39	22	27	56	240
	2007	93	23	63	136	369
Lark Sparrow	1999	4.7	32	2.8	8.0	40
	2000	6.8	48	3.1	15	44
	2001	15	53	6.3	34	121
	2002	7.8	52	3.4	18	65
	2003	7.2	38	3.9	13	62
	2004	9.4	31	5.6	16	71
	2005	11	39	5.8	21	93
	2007	3.8	44	1.9	7.9	27
Sage Sparrow	1999	1.8	59	0.7	4.6	18
	2000	6.6	51	2.9	15	50
	2001	1.4	57	0.6	3.5	14
	2002	3.7	39	1.9	7.1	38
	2003	6.1	47	2.8	13	62
	2004	4.5	36	2.5	8.1	46
	2005	4.2	50	1.9	9.4	43
	2007	8.9	63	3.3	24	70
Lark Bunting	1999	27	45	13	56	262
	2000	3.1	81	0.9	10	63
	2001	56	45	27	115	272
	2002	8.9	52	3.9	20	143
	2003	9.4	51	4.2	21	147
	2004	10	80	3.2	34	92
	2005	3.2	59	1.3	8.0	71
	2006	22	44	11	45	189
	2007	5.1	77	1.6	16	33
Grasshopper Sparrow	1999	1.4	52	0.6	3.3	14
	2000	5.7	88	1.5	21	42
	2001	2.9	70	1.0	8.7	28

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	7.0	57	2.9	17	70
	2003	5.2	51	2.3	12	51
	2004	4.8	73	1.6	15	47
	2005	6.4	60	2.5	16	63
	2007	0.5	78	0.2	1.6	4
Red-winged Blackbird	1999	1.7	40	0.9	3.2	28
	2000	1.0	52	0.4	2.2	12
	2001	2.3	51	1.0	5.2	31
	2002	2.3	58	0.9	5.6	16
	2003	3.4	44	1.7	7.0	44
	2004	2.0	63	0.7	5.1	18
	2005	1.0	34	0.5	1.7	16
	2006	1.7	37	1.0	3.2	26
	2007	3.7	42	1.8	7.3	42
Western Meadowlark	1999	9.4	23	6.4	14	231
	2000	13	27	8.2	20	198
	2001	14	26	8.7	21	226
	2002	11	24	7.4	16	279
	2003	12	23	8.0	17	378
	2004	14	24	9.4	21	366
	2005	21	26	14	32	554
	2006	21	22	14	30	381
	2007	22	26	14	34	276
Brewer's Blackbird	1999	2.3	66	0.8	6.3	15
	2000	1.6	73	0.5	4.9	8
	2001	4.5	36	2.5	8.1	30
	2002	5.2	38	2.8	9.5	26
	2003	6.3	35	3.5	11	41
	2004	4.8	48	2.2	10	33
	2005	9.2	47	4.3	20	48
	2007	7.2	55	3.0	17	36
Brown-headed Cowbird	1999	6.5	34	3.7	11	58
	2000	4.2	31	2.5	7.0	28
	2001	2.4	46	1.2	5.1	15
	2002	7.0	33	4.1	12	52
	2003	6.7	35	3.8	12	51
	2004	6.8	32	4.0	11	47
	2005	6.3	34	3.6	11	53
	2007	4.2	44	2.1	8.5	27

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D; %CV = coefficient of variation of D; n = number of observations used to estimate D

Semidesert Shrubland (SE)

Field staff conducted 388 point counts along 26 transects in semidesert shrubland between 12 May and 4 June, 2007 (Table 1). They recorded a total of 2,960 birds in this habitat, with an average of 7.6 birds detected at each count

station (Table 2). Observers detected 83 species in total and, on average, detected 3.7 species per point count and 14.4 species per site.

Point transect data from semidesert shrubland habitat yielded robust density estimates (CV<50%) for thirteen species and moderately robust estimates for another sixteen species (CV=50-75%; Table 7). MCB should be able to produce trend information within 30 years for these 29 species, which represent 35% of all species recorded from semidesert shrubland in 2007, in this habitat. Two species listed as SGCN (Brewer's Sparrow and Lark Bunting) and one species (Brewer's Sparrow) listed as a R2SS should be effectively monitored under the MCB program (Appendix B).

Horned Lark, Lark Bunting, Brewer's Sparrow, Violet-green Swallow, and Mourning Dove were among the most abundant species in this habitat this year. Fifteen species (American Kestrel, Killdeer, Mourning Dove, Western Kingbird, Loggerhead Shrike, Horned Lark, Cliff Swallow, Barn Swallow, Northern Mockingbird, European Starling, Lark Sparrow, Lazuli Bunting, Blue Grosbeak, Common Grackle, and Bullock's Oriole) had higher estimated densities in semidesert shrubland than in other habitats surveyed in 2007.

Table 7. Estimated densities of breeding birds in semidesert shrubland habitat in Colorado, 1999-2007.

Species	Year	D	%CV	LCL	UCL	n
American Kestrel	1999	0.2	38	0.1	0.4	8
	2000	0.2	41	0.1	0.5	10
	2001	0.2	65	0.1	0.5	7
	2002	0.4	35	0.2	0.7	17
	2003	0.1	57	0.0	0.2	3
	2004	0.1	74	0.0	0.3	3
	2005	0.2	43	0.1	0.4	8
	2007	0.1	64	0.0	0.3	4
Killdeer	1999	0.4	76	0.1	1.4	3
	2000	1.0	43	0.5	2.1	7
	2001	1.8	60	0.7	4.6	11
	2002	1.1	51	0.5	2.5	8
	2003	2.8	38	1.5	5.1	19
	2004	1.1	47	0.5	2.3	6
	2005	2.7	49	1.2	5.9	18
	2007	3.4	54	1.5	8.1	21
Mourning Dove	1999	5.9	44	2.9	12	61
	2000	9.8	38	5.3	18	102
	2001	8.4	36	4.7	15	74
	2002	17	35	9.4	29	153
	2003	15	40	7.8	28	152
	2004	12	37	6.6	22	76
	2005	18	35	10	32	152
	2007	17	36	9.5	30	124
Broad-tailed Hummingbird	1999	3.5	59	1.4	8.8	5

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2000	7.0	47	3.3	15	10
	2001	0.0	--	--	--	0
	2002	4.7	50	2.1	11	7
	2003	9.8	53	4.2	23	14
	2004	20	42	10	40	24
	2005	1.3	101	0.3	5.6	2
	2007	13	55	5.5	32	17
Ash-throated Flycatcher	1999	0.3	84	0.1	1.0	4
	2000	0.3	76	0.1	0.9	4
	2001	0.9	59	0.4	2.3	11
	2002	1.0	53	0.4	2.2	13
	2003	0.9	62	0.4	2.4	12
	2004	0.3	63	0.1	0.7	3
	2005	1.5	68	0.5	4.2	20
	2007	0.9	69	0.3	2.4	9
Western Kingbird	1999	0.6	53	0.3	1.5	11
	2000	2.1	43	1.1	4.2	37
	2001	2.4	51	1.0	5.3	30
	2002	3.2	39	1.7	5.9	46
	2003	3.0	35	1.7	5.4	52
	2004	3.3	37	1.8	6.1	33
	2005	4.0	40	2.1	7.7	61
	2007	3.9	37	2.1	7.2	57
Loggerhead Shrike	1999	1.0	44	0.5	2.1	15
	2000	1.2	41	0.6	2.4	18
	2001	1.5	60	0.6	4.0	17
	2002	0.9	43	0.5	1.9	14
	2003	1.5	40	0.8	2.9	22
	2004	0.4	74	0.1	1.2	6
	2005	0.5	54	0.2	1.1	7
	2007	0.2	73	0.1	0.5	2
Black-billed Magpie	1999	0.7	42	0.3	1.3	35
	2000	0.8	40	0.4	1.6	42
	2001	1.2	43	0.6	2.5	57
	2002	1.0	36	0.5	1.7	48
	2003	1.4	44	0.7	2.9	71
	2004	1.1	47	0.5	2.4	39
	2005	0.5	36	0.3	0.9	25
	2007	0.6	34	0.3	1.0	23
Common Raven	1999	0.1	40	0.0	0.2	14
	2000	0.1	32	0.1	0.2	15
	2001	0.1	37	0.1	0.2	16
	2002	0.5	38	0.3	0.9	38
	2003	0.4	37	0.2	0.8	57
	2004	0.4	30	0.2	0.7	46
	2005	0.4	28	0.2	0.6	53
	2007	0.6	25	0.4	1.0	73
Horned Lark	1999	23	20	17	33	291
	2000	33	23	22	48	304

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2001	54	30	33	89	362
	2002	32	29	20	52	235
	2003	106	29	66	170	623
	2004	36	22	25	52	250
	2005	42	26	27	65	301
	2007	74	33	43	127	536
Violet-green Swallow	1999	5.0	82	1.5	17	10
	2000	4.5	107	1.0	20	9
	2001	9.5	66	3.5	26	16
	2002	7.3	68	2.6	21	6
	2003	1.5	83	0.4	5.1	3
	2004	9.8	67	3.5	27	5
	2005	18	72	6.0	51	20
	2007	17	54	7.3	39	22
Cliff Swallow	1999	4.5	104	1.1	19	11
	2000	14	65	5.2	38	34
	2001	12	71	4.1	35	26
	2002	9.2	51	4.1	21	20
	2003	6.6	63	2.5	18	16
	2004	3.0	63	1.1	7.9	6
	2005	17	71	5.6	52	8
	2007	6.0	65	2.2	16	7
Barn Swallow	1999	0.5	102	0.1	2.1	2
	2000	4.5	34	2.6	7.8	18
	2001	0.6	72	0.2	1.7	2
	2002	1.9	64	0.7	5.2	6
	2003	4.0	47	1.9	8.5	16
	2004	2.4	54	1.0	5.7	6
	2005	4.8	84	1.3	18	6
	2007	4.8	63	1.8	13	15
Rock Wren	1999	1.7	37	0.9	3.2	44
	2000	1.1	42	0.5	2.1	27
	2001	1.9	37	1.0	3.5	43
	2002	1.5	30	0.9	2.5	39
	2003	2.0	31	1.2	3.4	51
	2004	1.0	41	0.5	2.0	21
	2005	1.5	33	0.9	2.7	40
	2007	2.4	28	1.5	3.7	52
Northern Mockingbird	1999	3.0	75	1.0	9.1	45
	2000	2.0	32	1.2	3.4	90
	2001	1.1	45	0.5	2.3	42
	2002	2.7	39	1.5	5.1	106
	2003	3.5	36	1.9	6.2	103
	2004	1.1	44	0.5	2.2	37
	2005	3.6	43	1.8	7.3	93
	2007	1.8	37	1.0	3.2	40
Sage Thrasher	1999	2.0	45	1.0	4.1	37
	2000	1.4	41	0.7	2.7	26
	2001	2.9	51	1.3	6.7	49

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	2.7	49	1.2	6.0	52
	2003	1.5	51	0.7	3.4	28
	2004	3.1	55	1.3	7.4	46
	2005	2.2	55	0.9	5.3	43
	2007	1.1	49	0.5	2.5	19
European Starling	1999	0.2	61	0.1	0.5	5
	2000	0.3	81	0.1	1.1	8
	2001	0.3	75	0.1	0.8	5
	2002	0.9	44	0.4	1.7	20
	2003	0.8	52	0.3	1.8	19
	2004	0.5	54	0.2	1.1	7
	2005	0.6	44	0.3	1.2	15
	2007	0.4	65	0.1	1.0	8
Green-tailed Towhee	1999	1.3	57	0.5	3.2	15
	2000	1.0	84	0.3	3.3	11
	2001	2.0	68	0.7	5.8	21
	2002	1.4	76	0.4	4.3	16
	2003	3.0	78	0.9	9.6	34
	2004	0.4	60	0.2	1.1	4
	2005	0.5	51	0.2	1.1	6
	2007	3.1	82	0.9	11	32
Cassin's Sparrow	1999	2.2	54	0.9	5.2	71
	2000	2.8	44	1.3	5.6	88
	2001	0.5	77	0.2	1.7	15
	2002	0.5	94	0.1	1.9	16
	2003	3.0	61	1.1	7.7	95
	2004	0.5	78	0.1	1.5	12
	2005	0.3	81	0.1	1.1	10
	2007	0.8	57	0.3	2.0	23
Brewer's Sparrow	1999	35	26	23	54	167
	2000	51	28	33	81	187
	2001	54	34	31	93	172
	2002	21	31	13	35	193
	2003	45	42	23	88	279
	2004	32	33	19	55	135
	2005	28	40	15	54	130
	2007	21	26	14	32	134
Vesper Sparrow	1999	8.9	36	4.9	16	76
	2000	4.9	52	2.1	11	45
	2001	5.0	57	2.0	12	65
	2002	4.0	45	2.0	8.2	62
	2003	3.8	49	1.8	8.4	63
	2004	8.8	56	3.6	22	43
	2005	11	43	5.6	22	91
	2007	3.3	73	1.1	9.9	33
Lark Sparrow	1999	27	33	16	46	119
	2000	53	25	35	81	321
	2001	36	28	23	57	191
	2002	32	35	18	56	190

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2003	25	33	15	43	193
	2004	18	27	11	28	105
	2005	40	31	24	67	169
	2007	15	23	10	23	130
Sage Sparrow	1999	0.8	52	0.3	1.8	6
	2000	1.4	48	0.7	3.0	11
	2001	0.9	52	0.4	2.0	6
	2002	2.4	61	0.9	6.1	19
	2003	3.5	82	1.0	12	27
	2004	2.5	71	0.8	7.4	15
	2005	1.9	76	0.6	5.9	15
	2007	0.9	70	0.3	2.5	6
Lark Bunting	1999	11	64	4.0	30	160
	2000	11	69	4.0	33	47
	2001	2.7	52	1.2	6.3	36
	2002	1.2	89	0.3	4.4	18
	2003	5.0	69	1.7	14	61
	2004	8.7	47	4.1	19	86
	2005	2.9	65	1.1	8.0	42
	2007	27	40	14	53	292
Blue Grosbeak	1999	0.9	85	0.3	3.2	13
	2000	1.0	94	0.3	4.0	15
	2001	1.1	49	0.5	2.4	14
	2002	1.8	54	0.7	4.2	25
	2003	2.2	58	0.9	5.6	32
	2004	0.4	65	0.2	1.2	5
	2005	1.4	46	0.6	2.8	18
	2007	1.2	58	0.5	2.9	14
Red-winged Blackbird	1999	0.5	55	0.2	1.2	8
	2000	0.6	45	0.3	1.3	10
	2001	3.2	50	1.4	7.2	47
	2002	3.9	47	1.8	8.2	57
	2003	3.8	38	2.0	7.1	62
	2004	2.3	90	0.6	8.5	28
	2005	1.5	45	0.7	3.2	25
	2007	1.6	67	0.6	4.5	20
Western Meadowlark	1999	7.2	16	5.5	9.3	327
	2000	34	17	25	45	565
	2001	16	21	11	22	364
	2002	8.2	24	5.5	12	300
	2003	7.8	25	5.1	12	396
	2004	11	30	6.5	18	270
	2005	11	22	7.5	15	396
	2007	12	21	8.4	17	364
Brewer's Blackbird	1999	1.0	62	0.4	2.7	6
	2000	5.6	70	1.9	16	33
	2001	1.1	70	0.4	3.3	6
	2002	0.8	82	0.2	2.8	5
	2003	3.2	63	1.2	8.5	14

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2004	1.4	77	0.4	4.6	5
	2005	2.4	55	1.0	5.8	10
	2007	3.2	96	0.8	13	14
Common Grackle	1999	0.2	101	0.1	0.9	4
	2000	1.1	66	0.4	3.0	21
	2001	0.3	83	0.1	1.0	5
	2002	1.0	57	0.4	2.5	15
	2003	0.7	52	0.3	1.6	13
	2004	0.2	59	0.1	0.4	7
	2005	0.5	77	0.2	1.6	7
	2007	0.3	63	0.1	0.8	6
Brown-headed Cowbird	1999	0.4	71	0.1	1.2	5
	2000	2.6	46	1.2	5.5	33
	2001	2.8	45	1.4	5.9	32
	2002	3.2	44	1.6	6.6	31
	2003	2.6	36	1.4	4.6	32
	2004	1.4	55	0.6	3.5	10
	2005	2.0	37	1.1	3.7	24
	2007	0.9	44	0.4	1.8	10
Bullock's Oriole	1999	1.3	62	0.5	3.4	10
	2000	3.4	65	1.2	9.1	26
	2001	3.2	56	1.3	7.6	21
	2002	5.5	56	2.3	13	41
	2003	3.5	56	1.5	8.4	26
	2004	0.5	59	0.2	1.2	3
	2005	5.1	57	2.1	12	39
	2007	2.0	57	0.8	5.0	12

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D; %CV = coefficient of variation of D; n = number of observations used to estimate D

Spruce-Fir (SF)

Field staff conducted 383 point counts along 28 transects in spruce-fir between 29 June and 21 July 2007 (Table 1). They recorded a total of 4,620 birds in this habitat with an average of 12.1 birds detected at each count station (Table 2). Observers detected 63 species in total and, on average, detected 7.2 species per point count and 23.1 species per site.

Point transect data from spruce-fir habitat yielded robust density estimates (CV<50%) for 31 species and a moderately robust estimate for two species (CV=50-100%; Table 8). MCB should be able to produce trend information within 30 years for these 33 species, which represent 52% of all species recorded from spruce-fir in 2007. Six species listed as SGCN (American Three-toed Woodpecker, Broad-tailed Hummingbird, Cassin's Finch, Cordilleran Flycatcher, Olive-sided Flycatcher, and Red Crossbill) and two species listed as R2SS

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

(American Three-toed Woodpecker and Olive-sided Flycatcher) should be effectively monitored under the MCB program (Appendix B).

Dark-eyed Junco, Pine Siskin, Red Crossbill, Broad-tailed Hummingbird, and Mountain Chickadee were among the most abundant species in this habitat this year. Twenty species (Hairy Woodpecker, American Three-toed Woodpecker, Northern Flicker, Olive-sided Flycatcher, Cordilleran Flycatcher, Gray Jay, Steller's Jay, Clark's Nutcracker, Mountain Chickadee, Red-breasted Nuthatch, Brown Creeper, Golden-crowned Kinglet, Ruby-crowned Kinglet, Hermit Thrush, American Robin, Yellow-rumped Warbler, Dark-eyed Junco, Pine Grosbeak, Red Crossbill, and Pine Siskin) had higher estimated densities in spruce-fir than in other habitats surveyed in 2007.

Table 8. Estimated densities of breeding birds in spruce-fir habitat in Colorado, 1998-2007.

Species	Year	D	%CV	LCL	UCL	n
Broad-tailed Hummingbird	1998	20	33	11	34	13
	1999	18	41	9.5	36	11
	2000	39	36	22	70	18
	2001	24	35	13	42	14
	2002	14	42	6.9	27	8
	2004	34	35	19	60	22
	2005	46	38	25	85	29
	2006	56	34	32	98	31
Williamson's Sapsucker	2007	78	32	46	131	45
	1998	1.6	53	0.7	3.7	5
	1999	1.8	53	0.8	4.1	5
	2000	0.0	--	--	--	0
	2001	3.5	48	1.6	7.6	10
	2002	1.8	52	0.8	4.1	5
	2004	4.0	51	1.8	9.0	12
	2005	6.8	50	3.1	15	20
Hairy Woodpecker	2006	1.5	60	0.6	3.9	4
	2007	1.8	59	0.7	4.5	5
	1998	4.3	38	2.3	7.8	19
	1999	2.0	41	1.0	3.9	8
	2000	2.3	47	1.1	4.9	7
	2001	4.8	35	2.7	8.4	19
	2002	3.3	47	1.6	7.1	13
	2004	7.2	44	3.5	15	31
American Three-toed Woodpecker	2005	6.3	32	3.7	11	26
	2006	4.8	35	2.8	8.5	18
	2007	11	30	6.8	18	44
	1998	0.7	44	0.3	1.4	6
	1999	1.3	41	0.7	2.5	10
	2000	1.0	60	0.4	2.6	6
	2001	1.2	54	0.5	2.7	8
	2002	2.6	31	1.6	4.4	20
2004	3.0	38	1.6	5.7	26	

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2005	1.9	40	1.0	3.6	15
	2006	1.5	34	0.9	2.7	11
	2007	2.8	31	1.7	4.7	22
Northern Flicker	1998	0.8	40	0.4	1.6	10
	1999	2.5	29	1.5	3.9	26
	2000	2.8	41	1.4	5.6	23
	2001	2.6	31	1.5	4.2	27
	2002	2.5	35	1.4	4.5	25
	2004	1.4	35	0.8	2.5	17
	2005	2.4	29	1.5	3.8	26
	2006	3.2	34	1.8	5.5	30
	2007	3.7	27	2.4	5.8	39
Olive-sided Flycatcher	1998	0.9	33	0.6	1.6	11
	1999	0.7	54	0.3	1.6	7
	2000	1.0	44	0.5	2.1	8
	2001	0.8	40	0.4	1.5	8
	2002	0.7	40	0.4	1.3	7
	2004	1.5	43	0.8	3.1	18
	2005	0.4	61	0.1	1.0	4
	2006	1.1	37	0.6	2.1	11
	2007	1.0	44	0.5	2.0	10
Hammond's Flycatcher	1998	5.0	45	2.4	10	13
	1999	2.2	59	0.9	5.5	5
	2000	5.6	43	2.8	12	10
	2001	0.4	98	0.1	1.8	1
	2002	0.4	99	0.1	1.8	1
	2004	6.1	57	2.5	15	16
	2005	5.4	40	2.8	10	13
	2006	1.4	55	0.6	3.4	3
	2007	2.6	44	1.3	5.4	6
Cordilleran Flycatcher	1998	2.1	54	0.9	4.9	8
	1999	6.9	36	3.8	13	24
	2000	3.0	53	1.3	7.0	8
	2001	6.4	38	3.5	12	21
	2002	5.6	36	3.1	10	19
	2004	3.8	36	2.1	6.9	15
	2005	3.9	50	1.8	8.7	14
	2006	6.5	42	3.3	13	21
	2007	12	40	6.1	22	40
Warbling Vireo	1998	4.1	30	2.5	6.6	25
	1999	8.3	32	4.9	14	46
	2000	4.9	50	2.2	11	21
	2001	7.4	38	4.0	14	40
	2002	5.5	27	3.5	8.7	30
	2004	3.8	42	1.9	7.6	24
	2005	5.4	31	3.2	9.0	31
	2006	8.3	41	4.3	16	43
	2007	8.2	44	4.0	17	45
Gray Jay	1998	48	28	30	75	74

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	1999	33	25	22	50	46
	2000	46	28	29	73	49
	2001	25	26	16	38	32
	2002	41	26	27	63	54
	2004	49	25	32	74	69
	2005	23	26	15	35	28
	2006	35	27	23	56	44
	2007	56	23	38	81	73
Steller's Jay	1998	6.3	40	3.3	12	38
	1999	6.1	31	3.6	10	33
	2000	3.4	61	1.3	8.8	14
	2001	9.6	31	5.8	16	51
	2002	7.4	26	4.8	11	37
	2004	5.5	34	3.2	9.6	28
	2005	5.1	28	3.3	8.1	28
	2006	4.2	38	2.2	7.8	21
	2007	6.9	34	4.0	12	36
Clark's Nutcracker	1998	4.2	27	2.7	6.6	60
	1999	2.6	34	1.5	4.5	33
	2000	3.6	42	1.8	7.1	35
	2001	3.8	35	2.1	6.7	47
	2002	3.0	38	1.6	5.6	37
	2004	2.6	28	1.6	4.2	32
	2005	1.7	34	1.0	3.0	22
	2006	4.0	30	2.4	6.6	46
	2007	5.2	31	3.2	8.7	50
Common Raven	1998	1.1	58	0.4	2.6	28
	1999	0.2	62	0.1	0.6	5
	2000	0.4	64	0.1	1.0	7
	2001	0.6	52	0.3	1.3	12
	2002	1.2	68	0.4	3.4	10
	2004	0.9	42	0.5	1.7	20
	2005	0.6	48	0.3	1.2	10
	2006	0.7	50	0.3	1.6	13
	2007	0.5	47	0.3	1.2	12
Mountain Chickadee	1998	75	19	55	102	234
	1999	60	16	46	77	165
	2000	75	19	55	103	168
	2001	84	16	64	110	265
	2002	80	22	56	114	227
	2004	129	16	99	167	259
	2005	83	17	62	110	189
	2006	162	29	101	261	305
	2007	74	18	55	100	280
Red-breasted Nuthatch	1998	3.4	39	1.8	6.5	18
	1999	7.4	25	4.9	11	35
	2000	12	32	7.0	21	44
	2001	10	30	6.3	17	49
	2002	8.0	26	5.2	13	37

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2004	26	21	18	37	121
	2005	5.5	22	3.8	7.9	27
	2006	13	26	8.5	21	58
	2007	32	17	24	42	142
Brown Creeper	1998	26	27	17	41	29
	1999	30	28	19	48	30
	2000	35	33	21	61	27
	2001	18	34	10	32	18
	2002	5.2	52	2.3	12	5
	2004	27	30	17	44	26
	2005	18	33	11	32	19
	2006	21	37	11	38	19
	2007	39	30	23	63	38
Golden-crowned Kinglet	1998	44	19	32	60	83
	1999	28	32	17	48	43
	2000	75	22	52	107	88
	2001	46	38	25	86	35
	2002	12	49	5.4	26	27
	2004	60	50	27	133	26
	2005	24	32	14	40	45
	2006	34	39	18	64	47
	2007	26	36	14	46	74
Ruby-crowned Kinglet	1998	36	16	28	47	300
	1999	29	16	22	38	240
	2000	30	32	18	50	178
	2001	32	13	26	40	304
	2002	47	16	36	61	280
	2004	75	13	60	93	353
	2005	62	14	49	78	345
	2006	46	12	37	56	395
	2007	30	19	22	41	214
Townsend's Solitaire	1998	2.9	42	1.5	5.8	24
	1999	3.4	28	2.1	5.4	25
	2000	1.4	35	0.8	2.5	8
	2001	1.5	57	0.6	3.7	11
	2002	1.7	46	0.8	3.5	12
	2004	2.7	30	1.7	4.5	21
	2005	1.2	38	0.6	2.2	8
	2006	3.2	29	2.0	5.2	22
	2007	2.2	32	1.3	3.7	16
Hermit Thrush	1998	19	15	14	24	282
	1999	14	19	11	20	220
	2000	19	17	14	26	216
	2001	18	16	14	23	288
	2002	13	18	9.9	18	266
	2004	13	19	9.5	18	202
	2005	25	14	20	31	303
	2006	18	13	15	22	290
	2007	13	24	8.4	19	188

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
American Robin	1998	55	31	33	92	177
	1999	16	28	9.9	25	82
	2000	48	19	35	66	116
	2001	19	23	13	28	133
	2002	22	28	14	34	120
	2004	51	22	35	73	131
	2005	45	21	32	63	180
	2006	46	25	31	70	192
Yellow-rumped Warbler	2007	50	26	32	76	196
	1998	97	10	82	115	385
	1999	64	13	51	79	238
	2000	58	10	49	70	224
	2001	70	12	57	85	373
	2002	66	15	52	85	214
	2004	106	13	85	132	241
	2005	91	14	72	114	259
Wilson's Warbler	2006	96	13	77	118	328
	2007	60	20	43	85	265
	1998	22	60	8.7	55	24
	1999	24	55	10	57	24
	2000	11	72	3.5	31	8
	2001	16	53	7.2	37	16
	2002	15	68	5.2	41	14
	2004	14	67	5.1	40	15
Western Tanager	2005	9.8	68	3.5	27	10
	2006	32	50	14	69	29
	2007	14	50	6.6	31	13
	1998	2.7	43	1.4	5.6	17
	1999	4.1	41	2.1	8.1	23
	2000	4.5	54	1.9	11	19
	2001	12	53	5.1	28	66
	2002	8.5	36	4.7	15	46
Green-tailed Towhee	2004	8.7	42	4.4	17	56
	2005	6.6	35	3.7	12	37
	2006	11	33	6.6	20	59
	2007	11	50	5.0	25	61
	1998	0.2	101	0.1	0.9	2
	1999	0.3	101	0.1	1.1	2
	2000	0.2	101	0.0	0.7	1
	2001	1.3	70	0.4	3.8	10
Chipping Sparrow	2002	1.8	53	0.8	4.3	14
	2004	1.0	50	0.5	2.2	8
	2005	1.2	40	0.6	2.4	10
	2006	2.1	57	0.8	5.1	15
	2007	2.4	38	1.3	4.5	19
	1998	3.7	55	1.5	8.7	19
	1999	1.5	57	0.6	3.7	7
	2000	3.4	54	1.4	8.0	12
2001	7.3	27	4.7	12	34	

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
	2002	8.8	38	4.7	17	39
	2004	8.5	30	5.2	14	42
	2005	9.7	27	6.2	15	47
	2006	20	27	12	31	85
	2007	15	38	7.8	27	64
Lincoln's Sparrow	1998	7.0	36	3.9	13	44
	1999	4.3	31	2.5	7.2	24
	2000	8.6	34	4.9	15	37
	2001	9.3	25	6.1	14	52
	2002	6.9	24	4.6	10	38
	2004	11	29	6.9	18	69
	2005	12	30	7.1	19	67
	2006	14	28	8.5	22	71
	2007	17	31	10	29	96
White-crowned Sparrow	1998	6.0	36	3.3	11	46
	1999	2.6	35	1.5	4.7	18
	2000	4.2	37	2.3	7.7	22
	2001	10	34	5.9	18	71
	2002	6.6	38	3.6	12	42
	2004	9.4	25	6.2	14	70
	2005	7.9	32	4.6	14	54
	2006	16	26	11	25	104
	2007	10	20	7.5	15	71
Dark-eyed Junco	1998	79	10	67	93	224
	1999	70	9	60	82	177
	2000	134	10	114	158	261
	2001	102	16	78	133	256
	2002	87	10	73	104	211
	2004	128	10	108	151	336
	2005	113	11	95	136	291
	2006	149	9	128	175	345
	2007	156	10	132	186	388
Pine Grosbeak	1998	15	24	10	23	59
	1999	12	27	7.5	18	41
	2000	12	28	7.2	18	31
	2001	5.7	34	3.3	10	20
	2002	5.3	38	2.8	9.8	18
	2004	12	28	7.3	18	41
	2005	5.5	35	3.1	9.8	19
	2006	13	30	8.0	22	41
	2007	9.8	33	5.7	17	34
Cassin's Finch	1998	2.0	59	0.8	5.2	12
	1999	1.5	39	0.8	2.9	8
	2000	1.7	55	0.7	4.1	7
	2001	3.0	36	1.7	5.5	15
	2002	1.7	78	0.5	5.6	6
	2004	3.7	44	1.8	7.4	17
	2005	1.6	69	0.6	4.8	5
	2006	3.9	36	2.1	7.0	19

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Year	D	%CV	LCL	UCL	n
Red Crossbill	2007	2.3	41	1.2	4.5	12
	1998	2.1	45	1.0	4.3	11
	1999	1.9	51	0.8	4.3	9
	2000	5.2	42	2.6	10	19
	2001	3.8	53	1.6	8.8	10
	2002	7.3	38	3.9	14	17
	2004	70	29	44	112	108
	2005	11	34	6.3	19	42
	2006	19	26	12	29	82
Pine Siskin	2007	82	28	52	129	126
	1998	41	22	29	59	210
	1999	28	36	16	50	69
	2000	61	24	41	89	162
	2001	30	22	21	43	133
	2002	60	33	35	102	92
	2004	210	15	164	269	256
	2005	109	22	76	155	166
	2006	179	22	124	258	250
2007	133	14	105	168	450	

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D;
 %CV = coefficient of variation of D; n = number of observations used to estimate D

DISCUSSION AND RECOMMENDATIONS

Prospects for Population Monitoring

The habitat-stratified point transects produced excellent results with low coefficients of variation ($\leq 50\%$) for 80 bird species in at least one habitat surveyed in 2007. Thus we should be able to detect habitat-specific population trends for these species within our maximum target of 30 years. We obtained sufficient data on an additional 20 species to monitor their populations across habitat types, although in some cases, these species could be better monitored with additional transects in a certain habitat. These 100 species represent about 60% of all species observed in the six habitats surveyed in 2007, and they represent 97% of all individual birds observed. The other 40% of species (~3% of all birds observed) fall into one of the following categories:

- 1) Low-density, highly localized species (e.g., Great Blue Heron);
- 2) Low-density, widespread species (e.g., Lewis's Woodpecker);
- 3) Irregular species (e.g., Bobolink);
- 4) Vagrant breeders (e.g., Ovenbird);
- 5) Species that occur mainly outside of Colorado (e.g., Sandhill Crane);
- 6) Nocturnal species (e.g., Flammulated Owl);
- 7) Wetland-obligate species (e.g., Black Rail); and
- 8) Species more readily detectable prior to initiation of our field surveys (e.g., Say's Phoebe).

The MCB special species program has been collecting data for many of the species that are not monitored by point transects since the initiation of MCB. For several of these species techniques used in this program have located all breeding locations thereby providing a complete census. For many of the other species, the survey methods used for this program have the potential to accomplish this task. This program has shown that it is possible to monitor the population of any species that breeds in the state with adequate funding and a statistically viable sampling plan.

Species in the aforementioned groups could be monitored through additional effort using one or more of the following survey techniques:

- 1) Additional point transects in existing habitats;
- 2) Censusing small but localized populations (e.g., special species program's Black Swift surveys);
- 3) Censusing birds at nesting sites (e.g., special species program's Great Blue Heron surveys);
- 4) Species-specific call-response surveys (e.g., special species program's Burrowing Owl surveys);
- 5) Nocturnal surveys (e.g., MCB's nocturnal survey pilot study);

- 6) Wetland surveys (e.g., secretive marshbird surveys); and
- 7) Early-season (i.e., winter/spring) surveys (e.g., special species program's Barrow's Goldeneye surveys).

Perhaps the most effective way to monitor the health of bird populations, especially small ones, is to monitor reproductive output at nests. While this method can be more labor intensive than count-based monitoring, depending on the species in question and the detail of information needed, monitoring reproductive output does not necessarily imply high costs.

For species with small populations, such as Golden Eagles and Prairie Falcons, monitoring could be achieved by locating all active nests and visiting each during the spring and summer as necessary to evaluate the outcome of each. Known nests would first be identified by consulting with local biologists, birders, and other experts, and then as part of the field effort, additional suitable habitat could be searched to locate previously unrecorded nests. Ultimately, the majority of active nests would be included in the monitoring scheme. Because relatively few nests exist for these species, this type of monitoring would probably require the equivalent effort of what is required for habitat-based monitoring (i.e., one additional person in the field during the spring and early summer).

For some low-density but widespread species, such as Northern Goshawk and Burrowing Owl, a brief call-response survey could be conducted along each transect after its completion to detect the presence of this or other similar species across the areas already covered by the habitat-stratified point transects. A high-powered, yet highly portable playback system would be required for each observer, but other than this expense, relatively few additional expenses would be incurred.

Because of the already extensive surveys efforts undertaken each year under the MCB program, implementing additional field techniques to target other high-priority species can be done cost-effectively. Rocky Mountain Bird Observatory is open to discussing these options with the funders of this MCB program in the future.

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APPENDIX A. BIRDS DETECTED ON POINT TRANSECTS – SPECIES AND TOTALS.

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Canada Goose			8	83	35		1	37	28	57	76	256	110	137	77	126
Wood Duck							0	0	7	2	2	7	10	0	0	0
Gadwall							0	1	17	25	34	44	54	53	0	0
American Wigeon							0	1	9	3	1	1	11	5	0	0
Mallard	2			4	1		4	47	42	111	53	152	159	108	17	7
Blue-winged Teal							0	1	10	7	2	10	7	28	0	0
Cinnamon Teal							0	3	19	22	25	29	8	34	0	0
Northern Shoveler							0	0	5	2	3	6	5	19	0	0
Northern Pintail							0	2	1	4	3	0	4	11	0	0
Green-winged Teal	3						0	0	4	8	27	10	7	17	2	3
Canvasback							0	0	0	4	0	0	0	0	0	0
Redhead					4		0	0	6	28	0	29	2	21	0	4
Ring-necked Duck	1						0	3	11	3	8	20	7	6	0	1
Greater Scaup							0	0	0	0	0	0	0	4	0	0
Lesser Scaup	3						0	0	0	32	27	5	8	11	3	3
Common Goldeneye							0	0	0	1	0	2	0	0	0	0
Hooded Merganser							0	0	1	0	0	0	0	0	0	0
Common Merganser	1						0	7	5	13	2	45	13	5	3	1
Ruddy Duck							0	10	17	27	12	27	19	21	0	0
Chukar		13			1		0	5	1	0	0	2	1	2	5	14
Ring-necked Pheasant			1	27	13		0	16	24	20	25	33	41	68	3	41
Greater Sage-Grouse				4			0	0	1	6	4	1	4	4	5	4
Gunnison Sage-Grouse				3			0	0	0	0	0	0	0	0	0	3
White-tailed Ptarmigan							0	7	6	7	14	8	14	18	0	0
Dusky Grouse		1	2	2		8	8	4	26	15	24	21	61	49	9	13

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Greater Prairie-Chicken				2			0	0	11	7	5	6	0	14	0	2
Wild Turkey		2	5		1		7	5	3	2	14	2	10	12	16	8
Scaled Quail					14		0	11	26	2	25	21	16	20	0	14
Gambel's Quail		1			18		0	6	5	8	0	15	13	7	0	19
Northern Bobwhite							0	7	1	24	3	30	30	3	0	0
Pied-billed Grebe							0	0	6	5	1	8	2	12	1	0
Eared Grebe							0	9	10	74	8	4	14	20	0	0
Western Grebe				2			0	0	1	1	9	3	1	7	0	2
Clark's Grebe							0	0	0	2	1	0	1	0	0	0
American White Pelican							0	1	1	90	1	12	14	14	0	0
Double-crested Cormorant							0	0	1	6	0	6	3	10	0	0
American Bittern							0	0	2	1	7	6	3	3	0	0
Great Blue Heron				3	6		0	23	32	32	7	54	54	27	2	9
Great Egret							0	0	1	0	1	0	0	0	0	0
Snowy Egret							0	2	6	6	5	1	5	2	0	0
Cattle Egret							0	0	1	0	0	1	1	0	0	0
Green Heron							0	0	2	4	1	1	1	0	0	0
Black-crowned Night-Heron							0	2	7	21	17	10	25	3	2	0
White-faced Ibis							0	1	14	17	12	1	16	170	0	0
Turkey Vulture	2	4	3		10		3	24	23	31	42	81	129	38	23	19
Osprey	2		2				1	1	0	3	0	1	7	0	0	4
Mississippi Kite							0	0	6	0	0	0	0	0	0	0
Bald Eagle							0	4	0	1	0	1	0	1	2	0
Northern Harrier				2	4		0	9	13	20	14	15	9	26	1	6
Sharp-shinned Hawk					1	1	1	3	3	4	9	6	10	10	4	2
Cooper's Hawk		7	2	1	2		10	9	8	9	10	6	15	13	6	12
Northern Goshawk			1			1	4	8	9	9	1	0	6	4	5	2
Swainson's Hawk				3			0	12	14	22	36	25	24	26	7	3
Red-tailed Hawk	5	14	12	9	10	1	23	44	72	66	69	62	66	80	48	51

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ferruginous Hawk				1			0	9	4	11	13	5	2	6	1	1
Golden Eagle		2	1	3	4		3	16	13	22	22	24	17	23	5	10
American Kestrel		3	3	16	8		3	46	42	34	59	54	52	51	22	30
Peregrine Falcon		1		1			0	1	2	2	1	0	3	2	3	2
Prairie Falcon					1		1	0	3	2	3	11	6	4	1	1
Black Rail							0	0	0	1	0	4	7	2	0	0
Virginia Rail							0	0	2	5	15	5	9	16	0	0
Sora						1	0	3	5	13	4	11	3	24	0	1
American Coot				2			0	12	26	51	28	81	43	121	0	2
Sandhill Crane							0	2	5	6	2	47	4	0	5	0
Killdeer		2		21	22		0	93	67	147	84	160	135	129	8	45
Mountain Plover							0	0	4	8	5	3	2	0	0	0
Black-necked Stilt							0	0	0	1	0	1	0	6	0	0
American Avocet							0	7	26	12	24	33	14	10	0	0
Spotted Sandpiper	20			5		3	5	78	69	101	30	143	109	48	9	28
Solitary Sandpiper							0	0	0	0	0	0	0	3	0	0
Greater Yellowlegs							0	0	0	1	0	0	0	0	0	0
Willet							0	0	0	1	2	1	2	3	0	0
Lesser Yellowlegs							0	0	0	14	0	0	0	0	0	0
Upland Sandpiper							0	4	12	4	2	5	2	11	0	0
Long-billed Curlew					1		0	7	2	2	8	8	4	11	0	1
Wilson's Snipe	9			6	2	1	2	11	11	18	23	38	35	69	29	18
Wilson's Phalarope							0	6	3	19	53	39	29	17	0	0
Franklin's Gull							0	1	0	0	0	0	0	2	0	0
Ring-billed Gull							0	2	1	0	1	0	10	6	1	0
California Gull			1				0	3	0	4	0	4	2	6	1	1
Black Tern							0	0	1	0	0	0	0	0	0	0
Forster's Tern							0	13	5	4	4	0	23	4	0	0
Rock Pigeon			1	6	9		0	26	0	9	34	47	17	29	0	16

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Band-tailed Pigeon		2	6			1	11	7	7	5	4	12	12	16	3	9
Eurasian Collared-Dove							0	0	0	0	0	0	1	1	0	0
Mourning Dove	18	156	237	102	175	2	30	497	607	576	782	931	1108	993	528	690
Yellow-billed Cuckoo							0	0	4	4	1	1	1	0	0	0
Greater Roadrunner							0	2	1	3	1	0	0	1	0	0
Barn Owl							0	0	0	0	0	0	0	1	0	0
Flammulated Owl							0	0	0	0	1	0	0	1	0	0
Great Horned Owl		2	1		2		3	10	4	6	1	4	5	6	3	5
Northern Pygmy-Owl			8			1	0	1	0	1	1	1	1	3	0	9
Burrowing Owl							0	33	4	18	12	9	5	13	1	0
Long-eared Owl							0	0	2	3	0	0	0	3	3	0
Short-eared Owl							0	0	0	0	1	0	0	0	0	0
Boreal Owl							0	0	0	0	0	0	1	0	0	0
Common Nighthawk		6	13	5	4		15	41	41	48	59	38	72	77	21	28
Common Poorwill							0	1	0	0	0	1	4	3	0	0
Black Swift							0	0	0	200	3	12	2	0	0	0
Chimney Swift							0	0	1	0	1	4	0	1	0	0
White-throated Swift	1	55	6	19	3		5	18	45	57	45	40	144	121	35	84
Black-chinned Hummingbird		39	2		2		0	31	33	20	17	33	46	36	13	43
Calliope Hummingbird							0	0	0	0	0	0	1	0	0	0
Broad-tailed Hummingbird	147	57	80	29	18	51	210	437	526	443	405	319	501	614	274	382
Rufous Hummingbird						4	0	1	0	2	1	1	7	19	2	4
Belted Kingfisher	1					1	1	26	12	27	10	25	25	5	1	2
Lewis's Woodpecker		1					2	3	6	13	4	6	3	3	0	1
Red-headed Woodpecker				2			0	1	10	9	1	9	3	4	0	2
Red-bellied Woodpecker							0	0	0	2	0	3	3	1	0	0
Williamson's Sapsucker	11		42			11	74	75	66	109	102	26	157	148	52	64
Red-naped Sapsucker	44		9	4		7	68	90	113	92	142	89	216	208	63	64
Ladder-backed Woodpecker							0	0	0	0	1	2	0	1	0	0

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Downy Woodpecker	3		4				8	16	20	24	45	22	53	26	5	7
Hairy Woodpecker	13	9	61			70	117	68	194	133	129	57	198	190	95	153
Am. Three-toed Woodpecker	4					34	13	14	52	16	37	4	63	55	28	38
Northern Flicker	38	27	112	30	4	49	163	499	551	399	270	152	322	371	259	260
Olive-sided Flycatcher	6		20			11	76	61	128	63	60	27	82	75	52	37
Western Wood-Pewee	28	6	236	7	1	14	269	428	355	586	402	238	545	440	251	292
Willow Flycatcher	25						0	4	14	11	24	13	8	18	12	25
Least Flycatcher							0	0	0	0	0	0	1	0	0	0
Hammond's Flycatcher	8	9	41			7	72	52	73	69	64	108	86	85	85	65
Gray Flycatcher		290		24	1		0	202	192	167	188	197	196	183	208	315
Dusky Flycatcher	118	37	117	50	2	2	194	379	425	555	493	357	555	509	210	326
Cordilleran Flycatcher	32	1	34			46	59	221	118	213	157	60	180	120	67	113
Black Phoebe							0	2	2	2	0	3	7	0	0	0
Eastern Phoebe							0	0	0	1	1	0	1	2	0	0
Say's Phoebe		12	2	12	13		0	15	31	21	36	39	64	19	3	39
Ash-throated Flycatcher		145	6	7	13		1	68	47	113	101	150	118	150	153	171
Great Crested Flycatcher				1			0	0	1	3	0	0	18	0	0	1
Cassin's Kingbird		6					0	9	22	6	12	16	2	9	0	6
Western Kingbird		3		27	61		0	79	84	139	158	240	154	208	30	91
Eastern Kingbird				3	2		0	58	37	86	21	101	82	25	0	5
Loggerhead Shrike				5	10		0	34	25	28	33	33	21	24	0	15
Bell's Vireo							0	0	1	0	0	0	0	0	0	0
Gray Vireo		41		3	1		0	6	3	16	6	25	41	30	25	45
Plumbeous Vireo		129	81	3			44	138	165	227	188	123	225	195	144	213
Warbling Vireo	124	10	172	32		50	1080	1255	1168	1458	1048	1020	1081	1352	488	388
Red-eyed Vireo							0	0	1	4	0	0	1	1	1	0
Gray Jay	12					109	108	70	129	63	122	10	162	71	79	121
Steller's Jay	13	9	106	2		55	235	423	297	451	308	104	280	322	127	185
Blue Jay					1		0	18	34	51	2	50	31	6	0	1

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Western Scrub-Jay		69	1	1	5		0	121	105	112	72	83	56	64	85	76
Pinyon Jay		134	3	34	9		0	207	132	231	188	208	281	203	151	180
Clark's Nutcracker	7	35	31	3		78	176	186	143	212	258	96	229	333	163	154
Black-billed Magpie	11	17	8	62	29	2	9	293	162	193	165	238	219	191	101	129
American Crow	2	3	49	19			20	61	70	63	110	86	110	101	42	73
Chihuahuan Raven					3		0	3	5	6	26	8	17	22	0	3
Common Raven	24	89	34	135	93	16	91	144	200	380	373	333	405	454	526	391
Horned Lark				290	672		0	1459	1014	1408	1621	1807	1745	2386	229	962
Purple Martin	2		1	3	3	3	2	11	4	4	7	21	23	36	20	12
Tree Swallow	39		21	8	1	1	47	65	68	64	457	171	143	148	101	70
Violet-green Swallow	81	47	142	19	39	25	220	315	436	518	449	369	616	814	695	353
N. Rough-winged Swallow		2	1	1	3		1	97	36	42	28	95	97	42	0	7
Bank Swallow							0	319	28	168	23	124	170	16	5	0
Cliff Swallow	13	2	1	8	33		1	549	166	904	234	352	605	339	34	57
Barn Swallow		2		1	18		0	97	103	28	42	91	62	70	25	21
Black-capped Chickadee	1	2	1	2			4	187	131	87	127	96	125	72	12	6
Mountain Chickadee	76	103	195	6		307	600	804	959	919	789	251	858	806	616	687
Juniper Titmouse		104		1			0	47	59	79	54	69	53	36	48	105
Bushtit		61	6				0	40	51	19	60	52	105	83	77	67
Red-breasted Nuthatch	7	1	16	1		165	70	241	258	224	198	115	394	214	93	190
White-breasted Nuthatch	1	79	103	1		9	87	210	221	170	138	47	196	179	128	193
Pygmy Nuthatch		1	422				89	67	102	103	118	0	293	88	150	423
Brown Creeper	7		29			59	72	99	115	76	82	37	121	96	69	95
Rock Wren	3	76	13	20	59		14	187	123	155	159	214	165	174	105	171
Canyon Wren		27	1		3		0	22	10	10	8	12	14	24	17	31
Bewick's Wren		144					0	244	190	153	120	202	197	159	256	144
House Wren	35	3	131	12		5	410	550	662	783	534	641	732	567	208	186
Winter Wren							0	0	0	0	0	0	0	1	0	0
Marsh Wren							0	18	39	71	83	122	38	38	0	0

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
American Dipper	8						5	3	1	11	11	8	10	6	3	8
Golden-crowned Kinglet	9			1		90	148	120	192	61	71	22	62	56	93	100
Ruby-crowned Kinglet	169	12	47	3		240	490	571	613	856	739	395	976	930	727	471
Blue-gray Gnatcatcher		190	13	21	9		5	211	211	178	248	198	284	239	166	233
Eastern Bluebird							0	0	2	3	0	5	0	0	0	0
Western Bluebird		2	71				26	30	43	40	67	11	103	107	59	73
Mountain Bluebird	14	102	43	53	11	11	87	181	190	173	288	314	406	373	297	234
Townsend's Solitaire	5	22	93			21	132	206	101	238	159	58	179	165	85	141
Veery	2						1	2	6	11	3	1	5	4	0	2
Swainson's Thrush	20					8	3	20	48	31	49	43	111	29	24	28
Hermit Thrush	80	42	119	1		288	560	555	725	767	715	355	897	875	521	530
American Robin	306	80	217	48	3	223	831	1179	1401	1451	1198	900	1587	1554	951	877
Gray Catbird	1			1			0	1	24	21	10	20	31	11	0	2
Northern Mockingbird		7		4	47		0	124	162	54	197	157	81	142	2	58
Sage Thrasher				293	24	1	0	123	91	161	207	217	241	315	247	318
Brown Thrasher				1	3		0	8	6	23	4	21	14	4	0	4
Curve-billed Thrasher					2		0	2	3	1	1	0	1	5	0	2
European Starling				3	10		1	97	28	123	46	182	183	173	0	13
American Pipit							0	335	475	538	458	552	629	503	4	0
Cedar Waxwing			9				0	11	7	18	22	26	20	16	13	9
Orange-crowned Warbler	10	2	16	4		3	151	225	260	253	218	215	263	262	80	35
Virginia's Warbler	3	107	74	14			35	326	248	242	241	251	358	352	188	198
Yellow Warbler	96	1		5			9	288	291	275	143	279	296	218	52	102
Chestnut-sided Warbler							0	1	0	0	0	0	0	0	0	0
Magnolia Warbler							8	0	0	0	0	0	1	1	0	0
Yellow-rumped Warbler	99	38	224	6		297	935	1044	1019	1362	851	469	983	1029	657	664
Black-throated Gray Warbler		384		2			0	200	197	226	193	196	220	218	235	386
Hermit Warbler							0	0	0	0	0	2	0	0	0	0
Grace's Warbler			134				22	45	31	46	60	1	22	80	99	134

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Black-and-white Warbler							0	0	1	1	0	0	0	0	0	0
American Redstart							0	0	0	1	1	0	0	0	0	0
Ovenbird							0	0	1	3	3	0	4	3	1	0
MacGillivray's Warbler	73	1	16	13		15	46	190	295	328	263	174	205	231	57	118
Common Yellowthroat	2						0	31	65	150	77	183	154	106	2	2
Wilson's Warbler	175						37	106	112	196	190	143	238	192	183	197
Yellow-breasted Chat					1		0	55	60	88	4	54	58	10	0	1
Western Tanager	25	45	181	1	2	72	277	468	481	651	464	356	598	648	256	326
Green-tailed Towhee	15	79	168	330	38	19	242	812	1224	973	875	627	1003	1050	271	649
Spotted Towhee	1	202	84	31	8		41	836	863	683	447	493	626	468	244	326
Canyon Towhee							0	6	2	0	8	3	3	0	0	0
Cassin's Sparrow		1		60	27		0	214	322	159	281	463	297	336	24	88
Rufous-crowned Sparrow					3		0	0	0	5	4	3	3	2	0	3
Chipping Sparrow	57	235	105	30	9	71	182	457	648	570	517	412	721	661	512	507
Clay-colored Sparrow							0	1	0	0	0	1	0	2	0	0
Brewer's Sparrow	39	56		782	170	1	2	626	710	697	635	881	761	886	179	1048
Field Sparrow							0	4	0	4	0	0	4	5	0	0
Black-chinned Sparrow							0	0	0	0	0	0	0	1	0	0
Vesper Sparrow	9	46	36	436	34		34	345	366	410	434	357	402	497	531	561
Lark Sparrow		41		41	170		2	265	572	443	469	336	318	402	82	252
Black-throated Sparrow		6		2	6		0	5	15	2	15	2	2	9	7	14
Sage Sparrow				80	6		0	25	77	38	88	101	82	75	31	86
Lark Bunting		2		73	423		0	1401	858	1222	505	1338	899	998	217	498
Savannah Sparrow	51		2	6		1	0	41	52	86	53	67	83	59	83	60
Grasshopper Sparrow				16	1		0	154	230	175	158	213	146	277	9	17
Fox Sparrow	29					2	2	48	46	31	29	39	67	96	55	31
Song Sparrow	84		4	2	1		3	284	242	184	161	170	173	96	92	91
Lincoln's Sparrow	549		4	3		123	170	409	549	697	620	587	931	864	617	679
White-crowned Sparrow	331		1	31		89	88	654	791	863	781	791	1248	1285	528	452

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Dark-eyed Junco	163	23	293	6		479	828	978	1378	1019	979	461	1382	1170	762	964
McCown's Longspur							0	84	6	26	87	107	179	130	0	0
Chestnut-collared Longspur							0	1	0	0	0	0	0	3	0	0
Northern Cardinal							0	0	0	0	0	0	0	1	0	0
Rose-breasted Grosbeak							0	0	0	2	0	0	1	0	0	0
Black-headed Grosbeak	24	42	30	11	1	4	40	218	234	247	141	284	336	284	91	112
Blue Grosbeak					19		4	44	53	49	34	59	48	34	9	19
Lazuli Bunting	45	13	4	5	1	8	5	61	86	60	27	62	78	98	56	76
Indigo Bunting							0	6	0	6	0	1	5	0	0	0
Indigo x Lazuli Bunting Hybrid							0	0	0	1	0	1	0	0	0	0
Dickcissel							0	0	2	8	0	1	5	11	0	0
Bobolink							0	0	0	0	0	1	0	0	0	0
Red-winged Blackbird	3	3	19	56	26		7	250	289	529	621	926	659	701	66	107
Western Meadowlark	3	48	14	358	432		4	1445	1644	1407	1503	1857	1441	2249	443	855
Yellow-headed Blackbird				4			2	45	83	223	159	279	110	187	1	4
Brewer's Blackbird	10	18		58	28	1	2	83	63	117	117	159	153	204	85	115
Common Grackle			1	4	7		0	37	82	104	50	150	135	54	2	12
Great-tailed Grackle							0	2	2	1	3	14	1	21	0	0
Brown-headed Cowbird	32	59	54	44	10		68	327	402	469	450	450	552	382	172	199
Orchard Oriole				2			0	18	24	46	2	56	46	15	0	2
Bullock's Oriole	1	3	1	8	15		0	62	63	89	82	154	86	74	4	28
Baltimore Oriole							0	0	4	5	0	8	1	5	1	0
Scott's Oriole		1					0	2	0	0	0	0	0	0	0	1
Brown-capped Rosy-Finch							0	8	28	13	25	31	80	52	0	0
Pine Grosbeak	7					49	85	54	103	46	50	17	95	57	73	56
Cassin's Finch	8	11	38	1		13	36	87	97	72	41	40	97	119	79	71
House Finch		185		10	13		0	110	84	60	68	81	128	90	150	208
Red Crossbill	35	5	283	7		449	150	32	102	148	248	73	923	285	241	779
White-winged Crossbill							8	2	0	0	13	0	11	1	18	0

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Number of each species detected in each habitat in 2007 ¹						Total # of individuals observed per year (in all habitats surveyed) ²									
	HR	PJ	PP	SA	SE	SF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Pine Siskin	404	20	143	3	1	713	714	557	643	826	684	213	1499	1261	669	1284
Lesser Goldfinch		21	3		3		0	12	26	31	20	14	59	26	5	27
American Goldfinch	21	2	5	4	7		3	52	57	49	17	65	89	19	7	39
Evening Grosbeak	2	8	4			21	45	38	25	96	53	23	14	36	29	35
House Sparrow					7	1	0	18	4	5	2	9	14	6	0	8
Aberts Squirrel			5				0	0	0	0	0	0	0	2	6	5
Red Squirrel	35	3	15	1		210	0	0	0	0	0	0	106	359	58	264

¹Habitats: HR=High-elevation Riparian; PJ=Pinyon-Juniper, PP=Ponderosa Pine; SA=Sage Shrubland; SE=Semidesert Shrubland; SF=Spruce-Fir.

²The number of habitats surveyed each year varies.

APPENDIX B. SPECIES ACCOUNTS FOR SPECIES OF MANAGEMENT INTEREST DETECTED ON POINT TRANSECTS.

In this section we present one-page accounts for bird species detected on point transects in 2007 that are of management interest, as designated by either the USFS, the U.S. Fish and Wildlife Service (USFWS), the CDOW, or PIF. For the USFS, we include species designated as Region 2 Sensitive Species (R2SS). For the USFWS, we include species designated as Birds of Conservation Concern for Bird Conservation Region 16 & 18 (BCR16 and 18; USFWS 2002). For the Colorado Division of Wildlife, we include species designated as State Threatened or Endangered, or Species of Greatest Conservation Need (Colorado Division of Wildlife 2006). For PIF, we include species in the PIF Species Assessment Database for Bird Conservation Region 16 and 18 (PIF Species Assessment Database 2005).

The geographic distribution maps in the following accounts depict locations and number of points per transect at which the species was detected in 2007. Note that the location of dots does not indicate precise location of the point at which the species was observed, but rather the access point of the transect on which the species was observed. Also keep in mind that these maps reflect species' distribution across the sites we surveyed and should not necessarily be construed to suggest anything about the species' distribution across the state.

In each table we provide two numbers pertaining to number of observations for each species: N, number of individuals observed, and n, number of independent observations used to estimate density for each species. These numbers may differ because often several individuals are detected in a single observation (a cluster), and some outlying observations (birds detected at exceptionally long distances from the observer) are truncated during analyses. Also, number of individuals observed (N) includes flyovers and between-point detections. This is also why total number of birds in Appendix B is greater than the totals in Table 2.

Greater Sage-Grouse

(*Centrocercus urophasianus*)

BLM Sensitive Species

State Special Concern - T & E Species List

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

PIF Species of Continental and Regional Concern – BCR 16

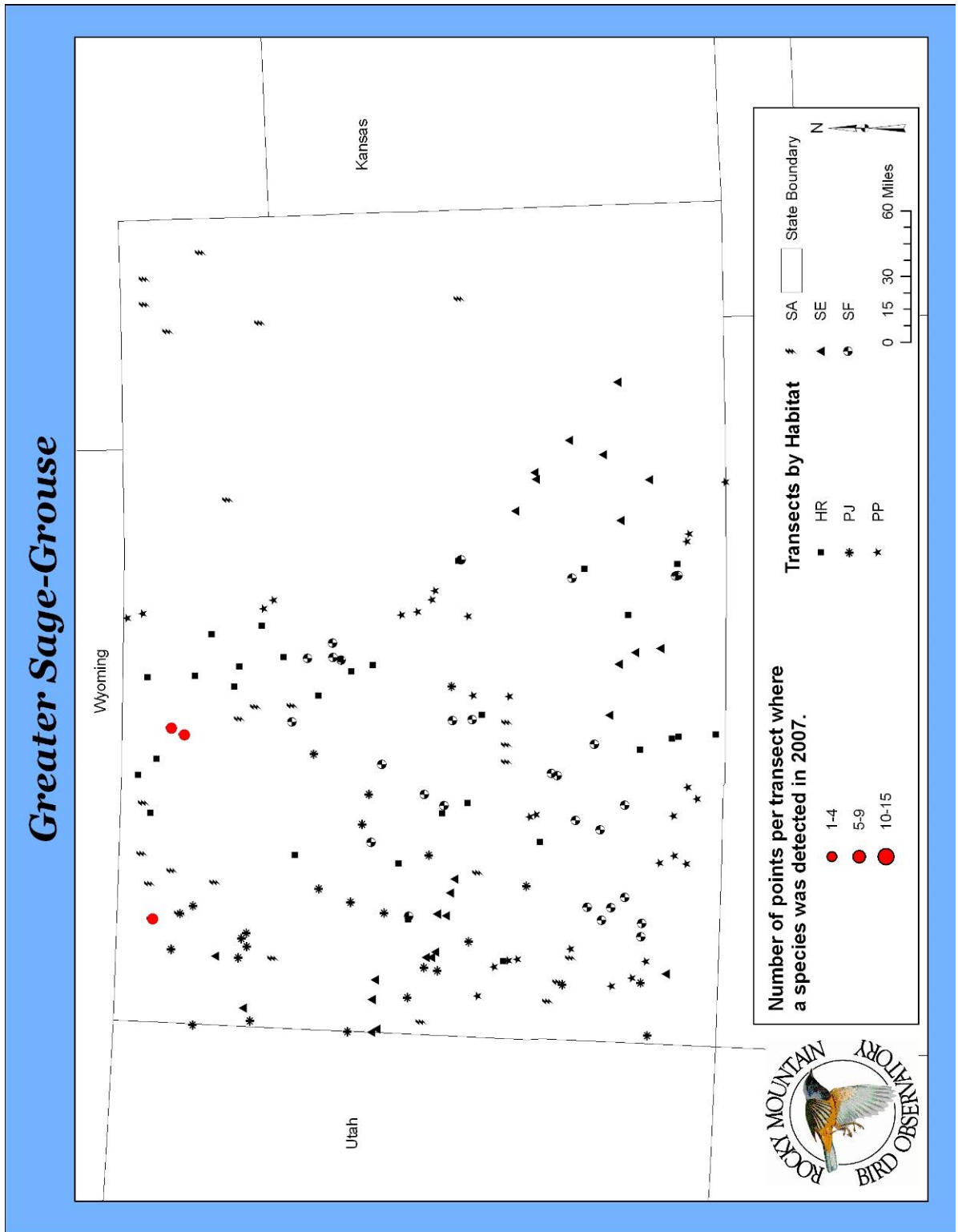
Greater Sage-Grouse is found in large, contiguous stands of sagebrush with a grass component (Kingery 1998). In 2007, we detected four Greater Sage-Grouse on sage shrubland transects – one on SA03 and SA05 and two on SA30.

This monitoring project does not target Greater Sage-Grouse or any gallinaceous birds whose populations are monitored by the CDOW. Although we do regularly detect this species on point transects, it is usually between point counts during the line transect portion of a transect. Using the line transect data, however, we may be able to improve our power to detect a trend for this species in at least sage shrubland habitats.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Greater Sage-Grouse on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	4

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Greater Sage-Grouse on transects in Colorado, 2007.

Gunnison Sage-Grouse

(*Centrocercus minimus*)

BLM Sensitive Species

State Special Concern - T & E Species List

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

PIF Species of Continental and Regional Concern – BCR 16

USFWS Bird of Conservation Concern – BCR 16

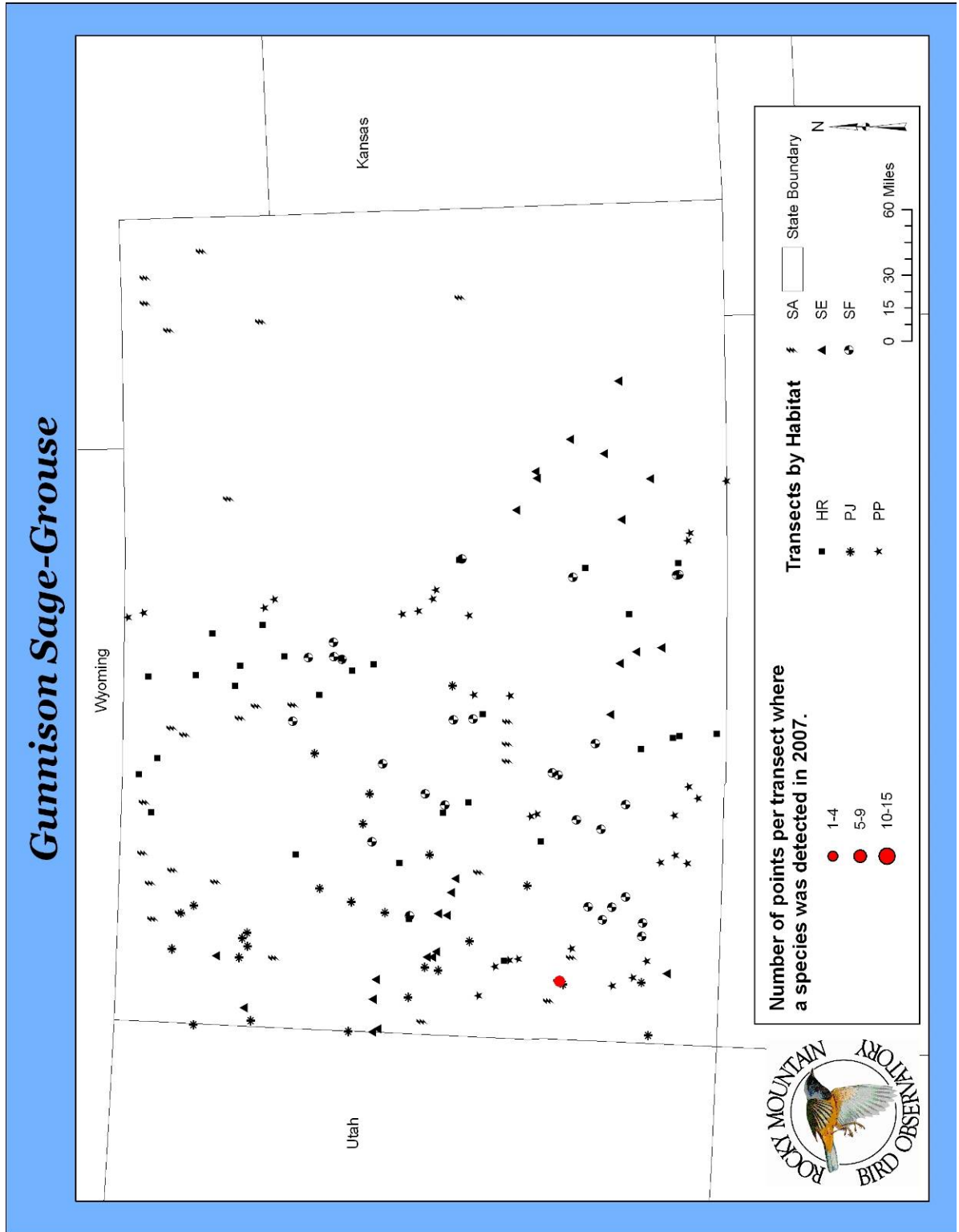
Gunnison Sage-Grouse, which is nearly a Colorado endemic, prefers large, contiguous stands of sagebrush (Righter et al. 2004). In 2007, we detected three Gunnison Sage-Grouse in sage shrubland on one MCB transect – SA26 – which traverses Dry Creek Basin SWA and the adjacent BLM land.

This monitoring project does not target the Gunnison Sage-Grouse or any gallinaceous birds in Colorado whose populations are monitored by the CDOW. Although we do regularly detect this species on point transects, it is usually between point counts on the line transect portion of the survey. Using the line transect data, however, we may be able to improve our power to detect a trend for this species in at least sage shrubland and grassland habitats.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Gunnison Sage-Grouse on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Gunnison Sage-Grouse on transects in Colorado, 2007.

Dusky Grouse

(*Dendragapus obscurus*)

CDOW - Species of Greatest Conservation Need

PIF Species of Continental Concern – BCR 16

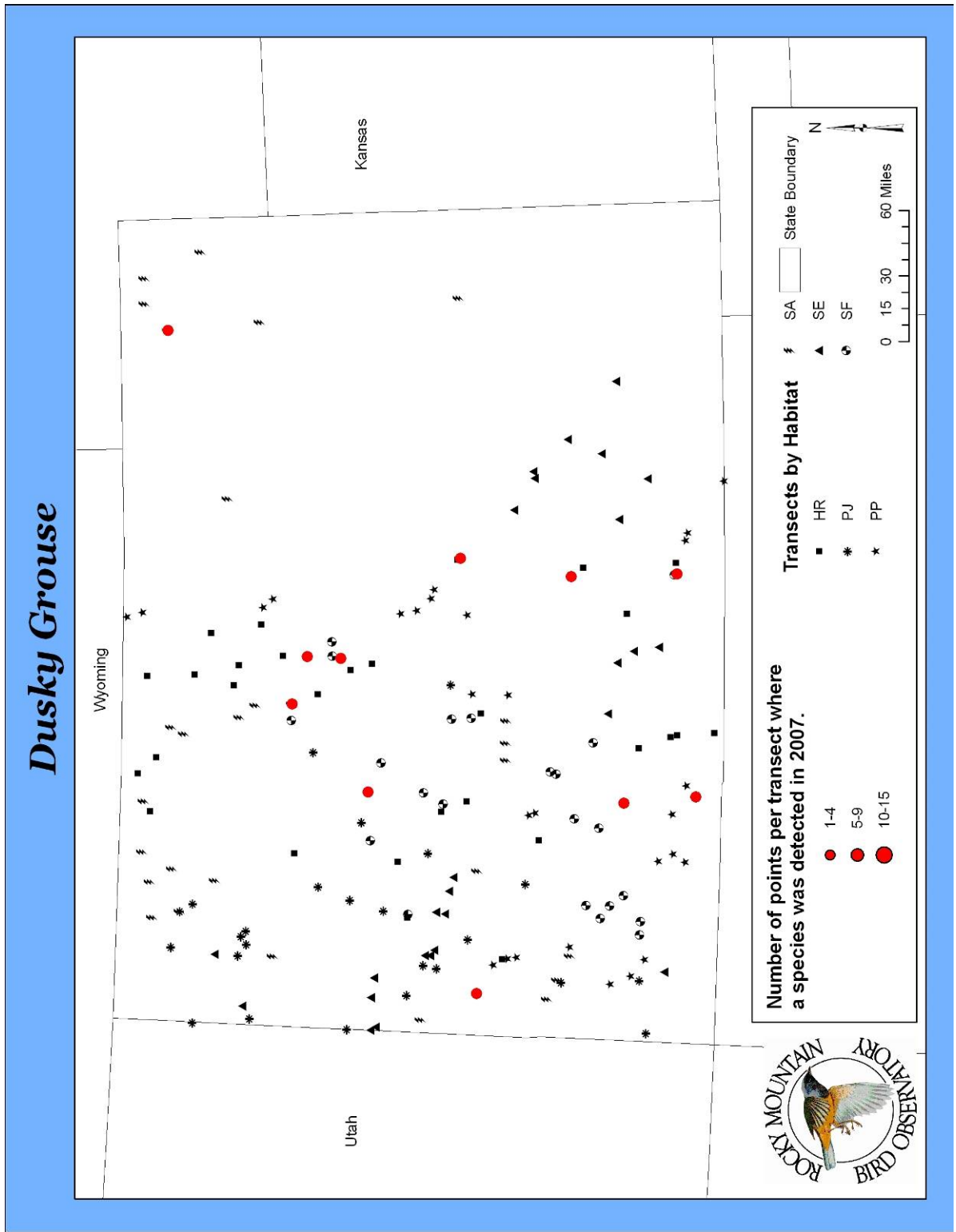
Dusky Grouse can usually be found in coniferous forests or shrubby lowlands in summer, with some individuals moving to higher elevations in the fall and winter (Righter et al. 2004). In 2007, we detected 13 Dusky Grouse in four habitats on eleven MCB transects – PJ17, PP11, PP17, SA06, SA29, SF02, SF15, SF17, SF20, SF21, and SF28. We have also detected the species on PP11 and SF21 in previous years.

Dusky Grouse often are detected along transects and less frequently at point-count stations. The number of detections of Dusky Grouse is too few to effectively monitor this species under MCB in any one habitat or across habitats. Using the line transect data, however, and all of the detections across years, we may be able to improve our power to detect a trend for this species in a few habitats.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Dusky Grouse on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	1
PP	ID	--	--	--	--	2
SA	ID	--	--	--	--	2
SF	ID	--	--	--	--	8

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Dusky Grouse on transects in Colorado, 2007.

Greater Prairie-Chicken

(*Tympanuchus cupido*)

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

PIF Species of Continental and Regional Concern – BCR 18

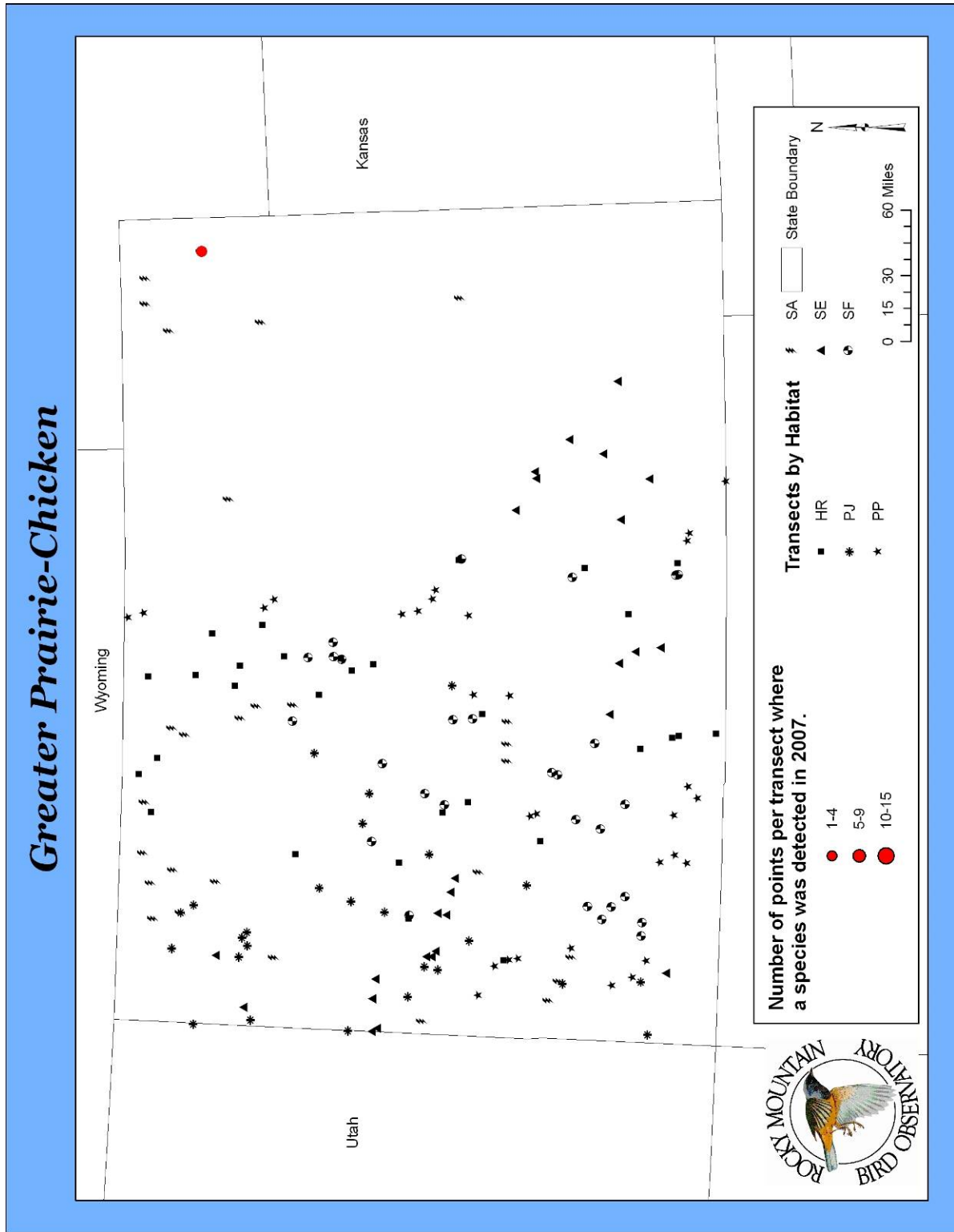
Greater Prairie-Chicken breeds in the sandsage prairie of northeast Colorado (Kingery 1998). In 2007, we detected two Greater Prairie-Chickens in sage shrubland habitat on one MCB transect – SA18.

This monitoring project does not target Greater Prairie-Chicken or any gallinaceous birds in Colorado whose populations are monitored by the CDOW. Although we do regularly detect this species on point transects, it is usually between point counts on the line transect portion of the survey. Using the line transect data, however, we may be able to improve our power to detect a trend for this species in at least sage shrubland habitat.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Greater Prairie-Chicken on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Greater Prairie-Chicken on transects in Colorado, 2007.

Scaled Quail

(*Callipepla squamata*)

CDOW - Species of Greatest Conservation Need

PIF Species of Continental and Regional Concern – BCR 16 & 18

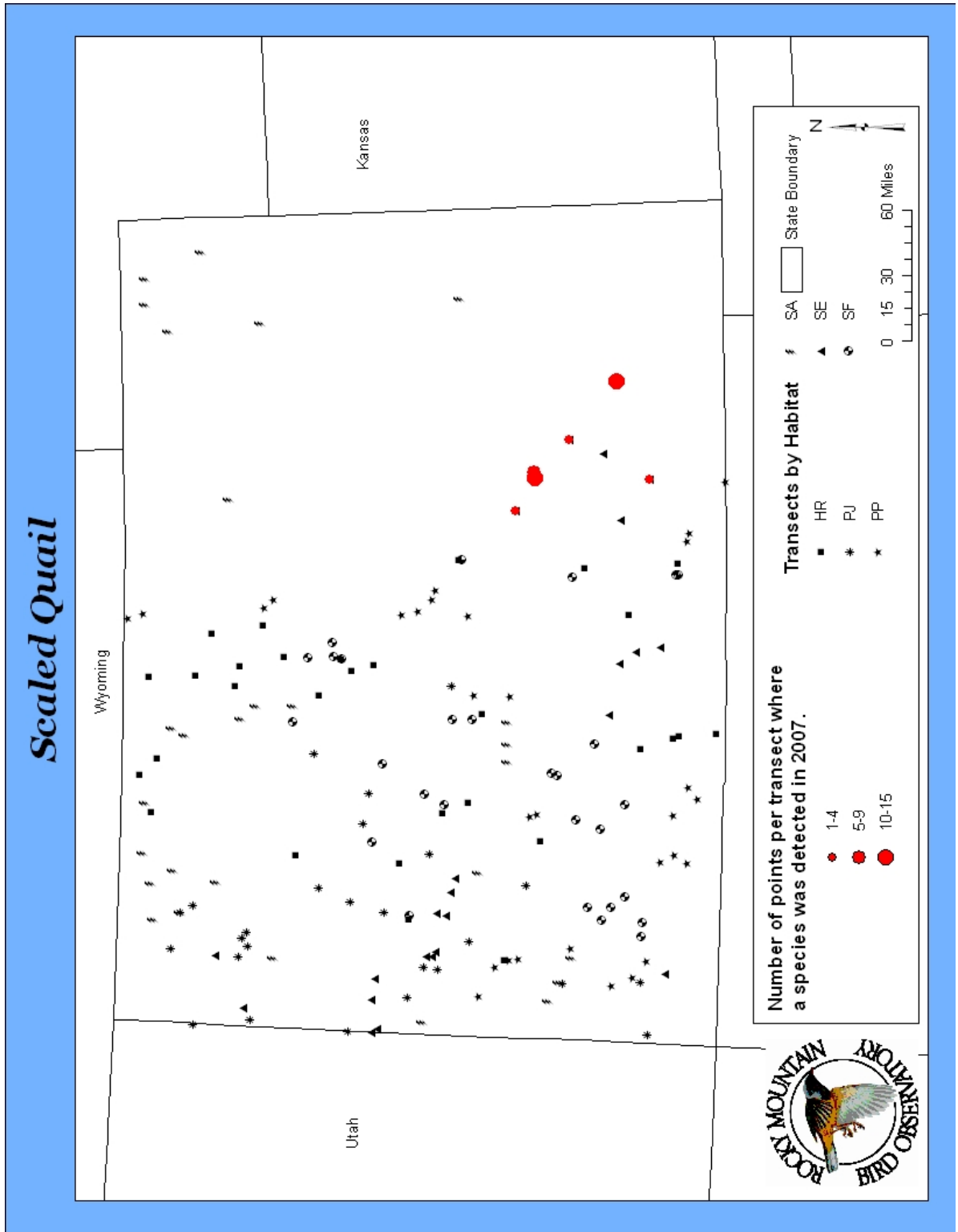
Scaled Quail can be found in southeast Colorado in areas with scattered cacti and shrubs (Kingery 1998). In 2007, we detected 14 Scaled Quail in semidesert shrubland habitat on six MCB transects.

This monitoring project does not target Scaled Quail or any gallinaceous birds whose populations are monitored by the CDOW. Although we do regularly detect this species on point transects, it is usually between point counts on the line transect portion of the survey. Using the line transect data, however, we may be able to improve our power to detect a trend for this species in at least semidesert shrubland habitat.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Scaled Quail on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SE	ID	--	--	--	--	14

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Scaled Quail on transects in Colorado, 2007.

Northern Harrier

(*Circus cyaneus*)

CDOW - Species of Greatest Conservation Need
 USFS Region 2 Sensitive Species
 PIF Species of Regional Concern – BCR 18
 USFWS Bird of Conservation Concern

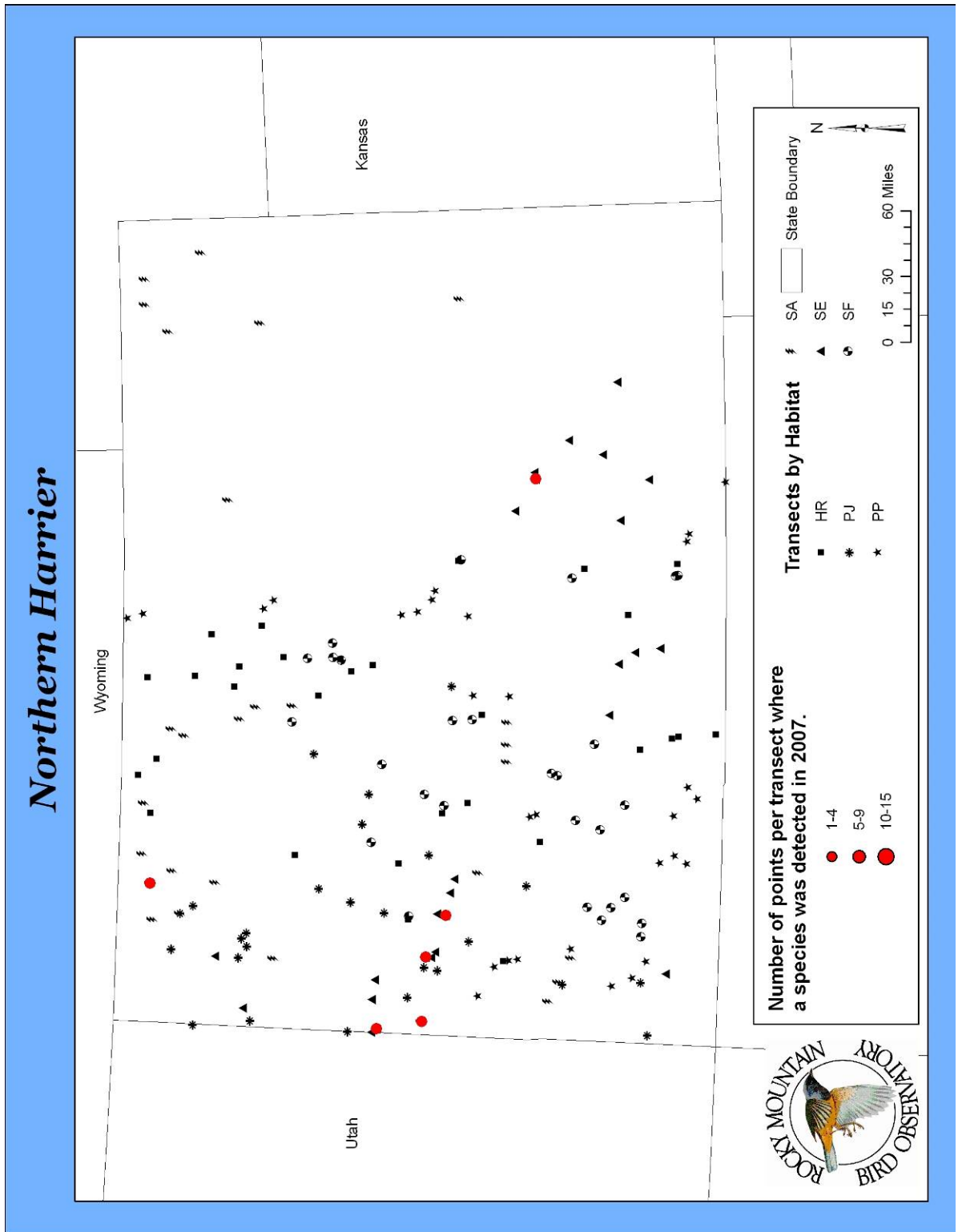
Northern Harriers occupy several habitats in Colorado including open grasslands and brushlands, agricultural lands, and marshes (Kingery 1998). In 2007, we detected six Northern Harriers in two habitats on MCB transects -- two on sage shrubland transects and four on semidesert shrubland transects.

Data from all habitat-based point transects will not be sufficient to track population trends of Northern Harriers over time.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Northern Harrier on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	2
SE	ID	--	--	--	--	4

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Northern Harrier on transects in Colorado, 2007.

Northern Goshawk

(Accipiter gentilis)

BLM Sensitive Species

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

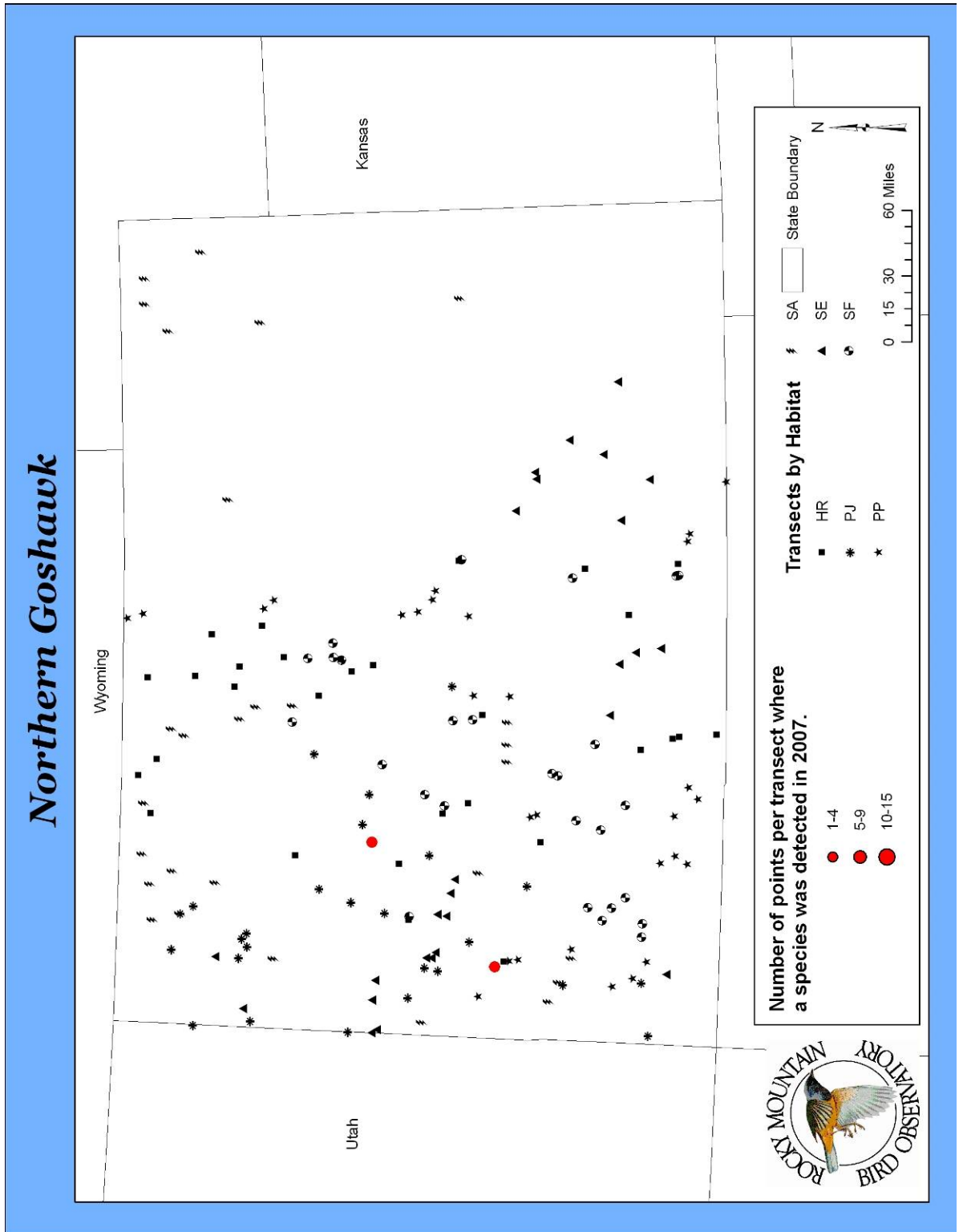
Northern Goshawks inhabit primarily extensive, old-growth forests for nesting and foraging (Audubon 2002). In 2007, we detected two Northern Goshawks in two habitats on MCB transects -- one on a ponderosa pine transects (PP02) and one on a spruce-fir transect (SF03).

Data from all habitat-based point transects will not be sufficient to track population trends of Northern Goshawks over time. However, RMBO implemented a pilot study in 2006 that used a call-playback technique developed by the USFS to monitor Northern Goshawk. This study was conducted in several National Forests throughout Colorado, Wyoming, and the Black Hills. Effective monitoring will likely require such intensive and focused efforts, implemented region-wide.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Northern Goshawk on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PP	ID	--	--	--	--	1
SF	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Northern Goshawk on transects in Colorado, 2007.

Swainson's Hawk

(*Buteo swainsoni*)

CDOW - Species of Greatest Conservation Need

PIF Species of Continental and Regional Concern – BCR 16

PIF Regional Stewardship Species and Continental Concern – BCR 18

USFWS Bird of Conservation Concern – Nationally

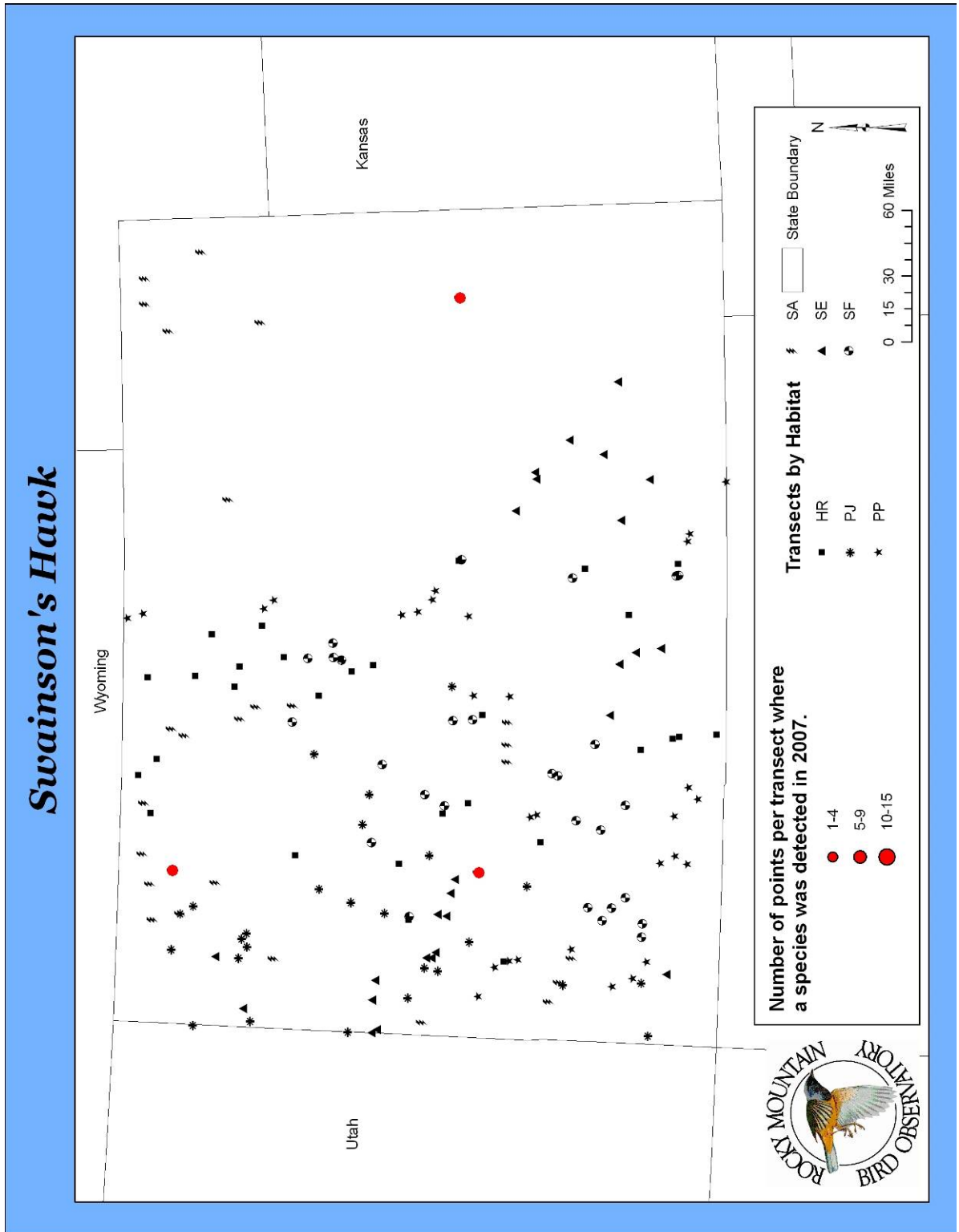
In Colorado, Swainson's Hawks nest primarily in the eastern prairies but will also nest in shrublands and agricultural areas throughout the state. Interestingly, several pairs of this species nest annually at high elevation on the Grand Mesa in western Colorado (Richter et al. 2004). In 2007, we detected three Swainson's Hawks in sage shrubland habitat.

Data from all habitat-based point transects will not be sufficient to track population trends of Swainson's Hawk over time.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Swainson's Hawk on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Swainson's Hawk on transects in Colorado, 2007.

Ferruginous Hawk

(*Buteo regalis*)

BLM Sensitive Species

State Special Concern - T & E Species List

CDOW - Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 16

PIF Regional Stewardship Species and Species of Regional Concern – BCR 18

USFS Region 2 Sensitive Species

USFWS Bird of Conservation Concern – Nationally

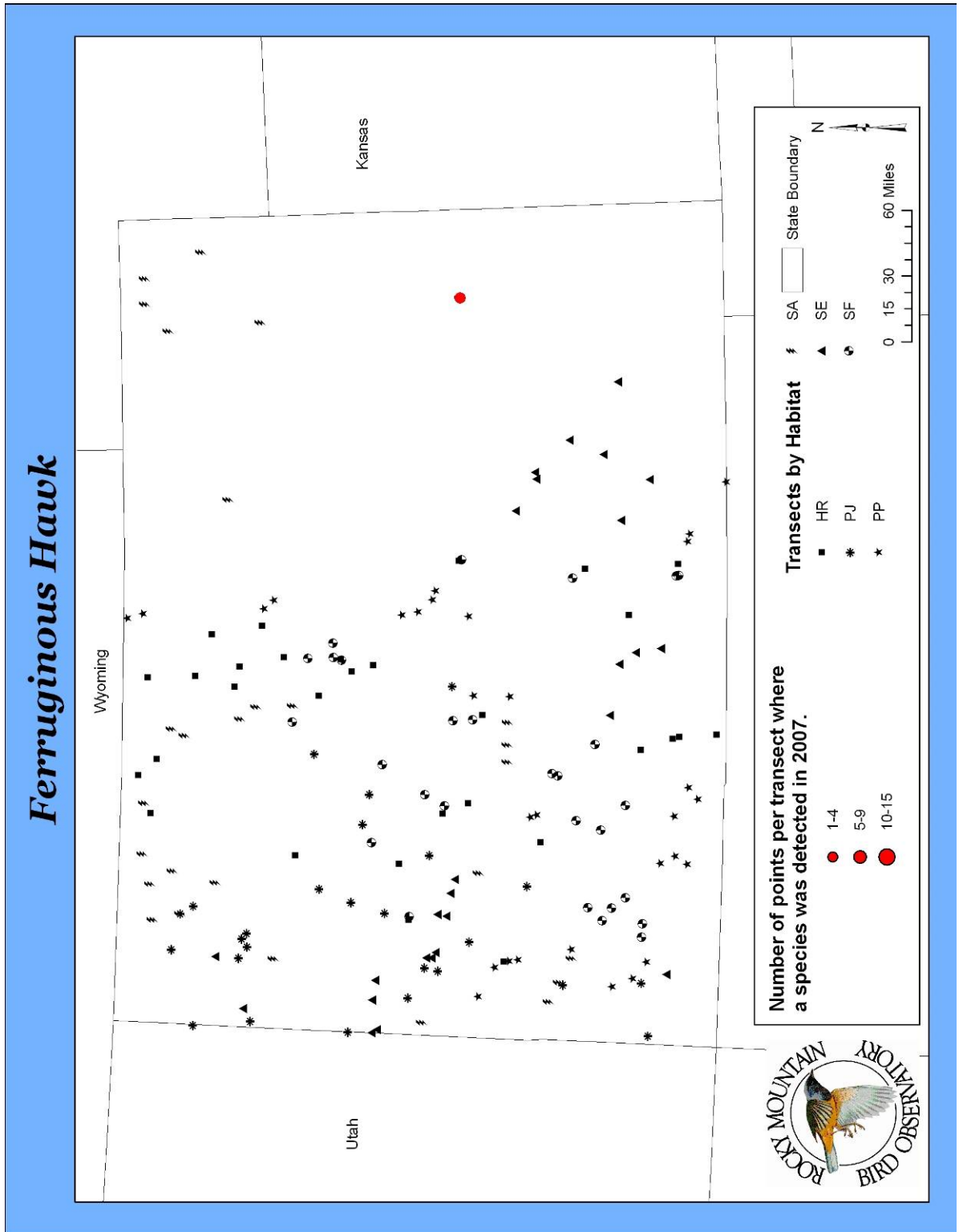
In Colorado, Ferruginous Hawks most commonly nest in the eastern prairies but also in semidesert shrubland, and rarely in pinyon-juniper habitat in the western part of the state. In 2007, we detected one Ferruginous Hawk on a sage shrubland transect - SA16.

The Ferruginous Hawk, like other raptor species, is difficult to monitor under MCB using the point-transect protocol, because of its low density and large territory size. Adding transects, especially in grassland and semi-desert shrubland, may yield better information for Ferruginous Hawk.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Ferruginous Hawk on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Ferruginous Hawk on transects in Colorado, 2007.

Golden Eagle

(*Aquila chrysaetos*)

CROW - Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 16

USFWS Bird of Conservation Concern – BCR 16

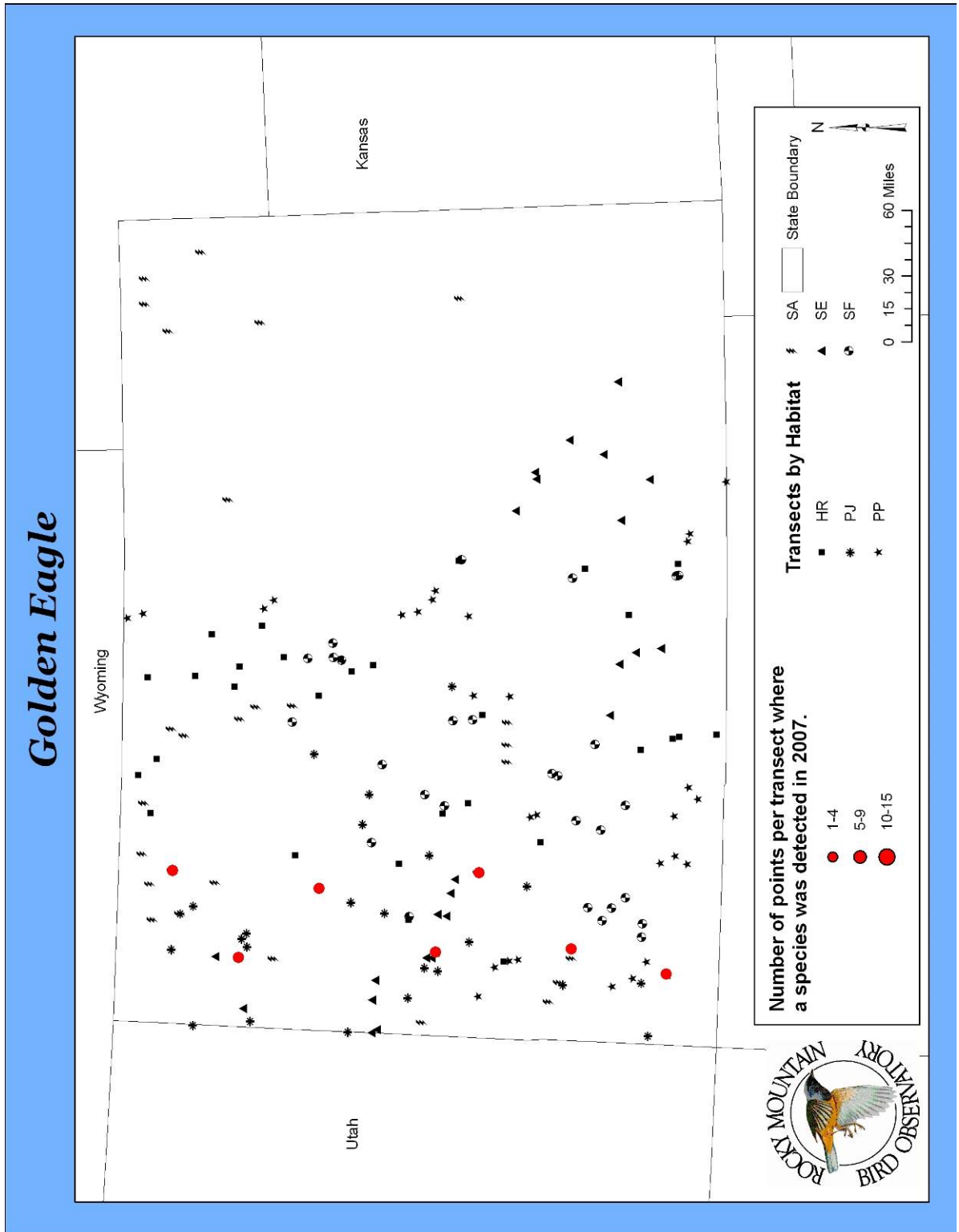
Golden Eagles inhabit a wide variety of habitats and nest on cliffs and in trees in Colorado. Because of their size, Golden Eagles need vast expanses of hunting space, usually over open habitats including grassland, sagebrush, farmlands, and even tundra. In 2007, we detected ten Golden Eagles in four habitats on MCB transects - two in pinyon-juniper, one in ponderosa pine, three in sage shrubland, and four in semidesert shrubland.

The Golden Eagle, like other raptor species, is difficult to monitor under MCB using the point-transect protocol, because of its low density and large territory size. Adding transects, especially in open habitats, may also yield better information for Golden Eagle and allow us to detect trends sooner. However, effective monitoring will likely best be accomplished through locating and monitoring nests in Colorado. Such an effort could be incorporated into the MCB special-species program, especially if combined with similar efforts for other raptor species (e.g., Prairie Falcon).

Total number of independent detections, number of individuals, and habitat-specific density estimates for Golden Eagle on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	2
PP	ID	--	--	--	--	1
SA	ID	--	--	--	--	3
SE	ID	--	--	--	--	4

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Golden Eagle on transects in Colorado, 2007.

Peregrine Falcon

(*Falco peregrinus*)

State Special Concern - T & E Species List

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

USFWS Bird of Conservation Concern - BCR 16, 18 and Nationally

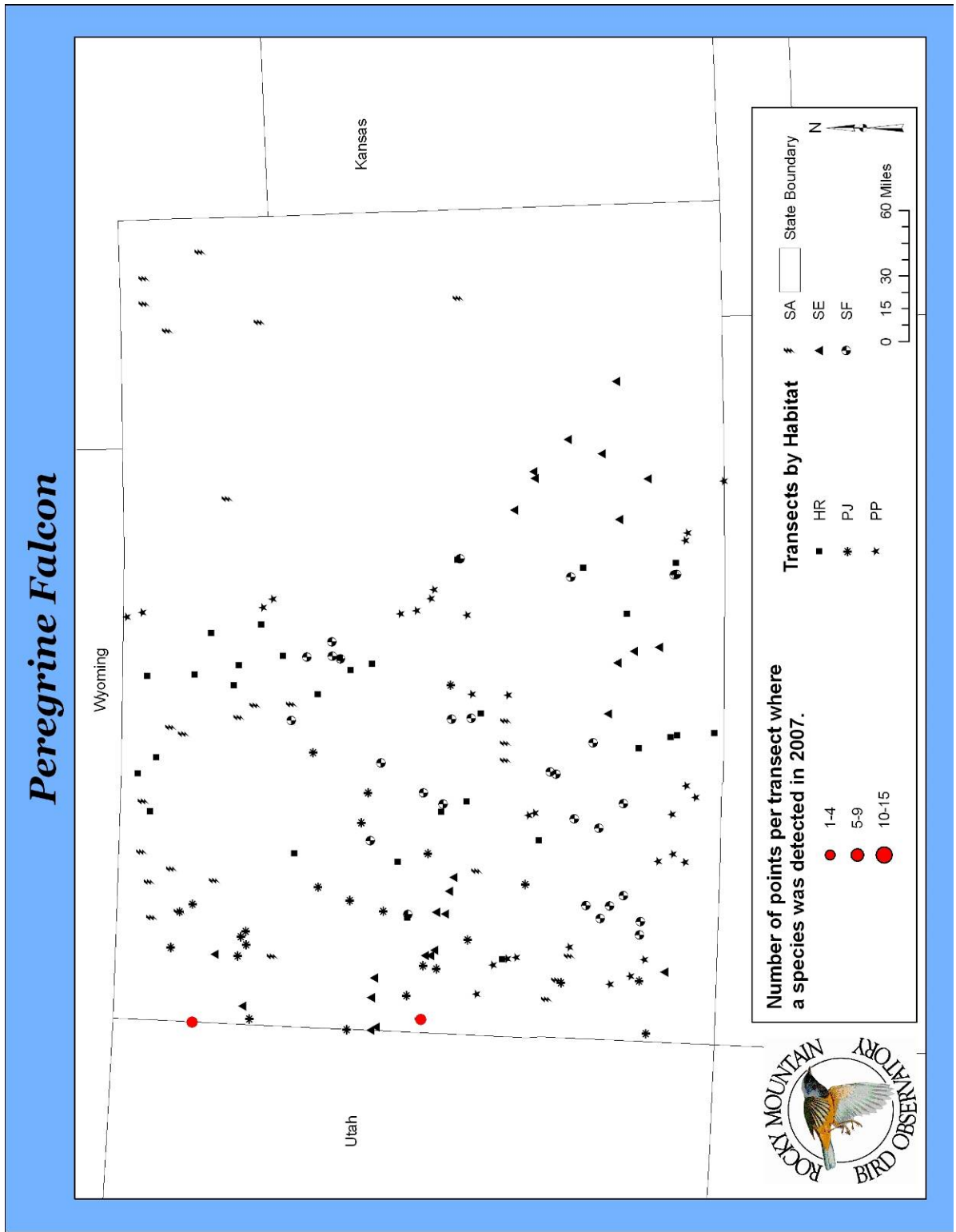
Peregrine Falcons nest on ledges of high cliffs. They require large areas, usually near water, in which to hunt. In 2007, we detected two Peregrine Falcons on MCB transects in two habitats, one in pinyon-juniper and one in sage shrubland.

The Peregrine Falcon, like other raptor species, is difficult to monitor under MCB using the point-transect protocol, because of its low density and large territory size. Alternatively, locating and monitoring Peregrine Falcon nests could be incorporated into the MCB special species program, especially if combined with similar efforts for other cliff-nesting species (e.g., Prairie Falcon).

Total number of independent detections, number of individuals, and habitat-specific density estimates for Peregrine Falcon on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	1
SA	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Peregrine Falcon on transects in Colorado, 2007.

Prairie Falcon

(*Falco mexicanus*)

CDOW - Species of Greatest Conservation Need
 PIF Species of Regional Concern – BCR 16 & 18
 USFWS Bird of Conservation Concern – Nationally

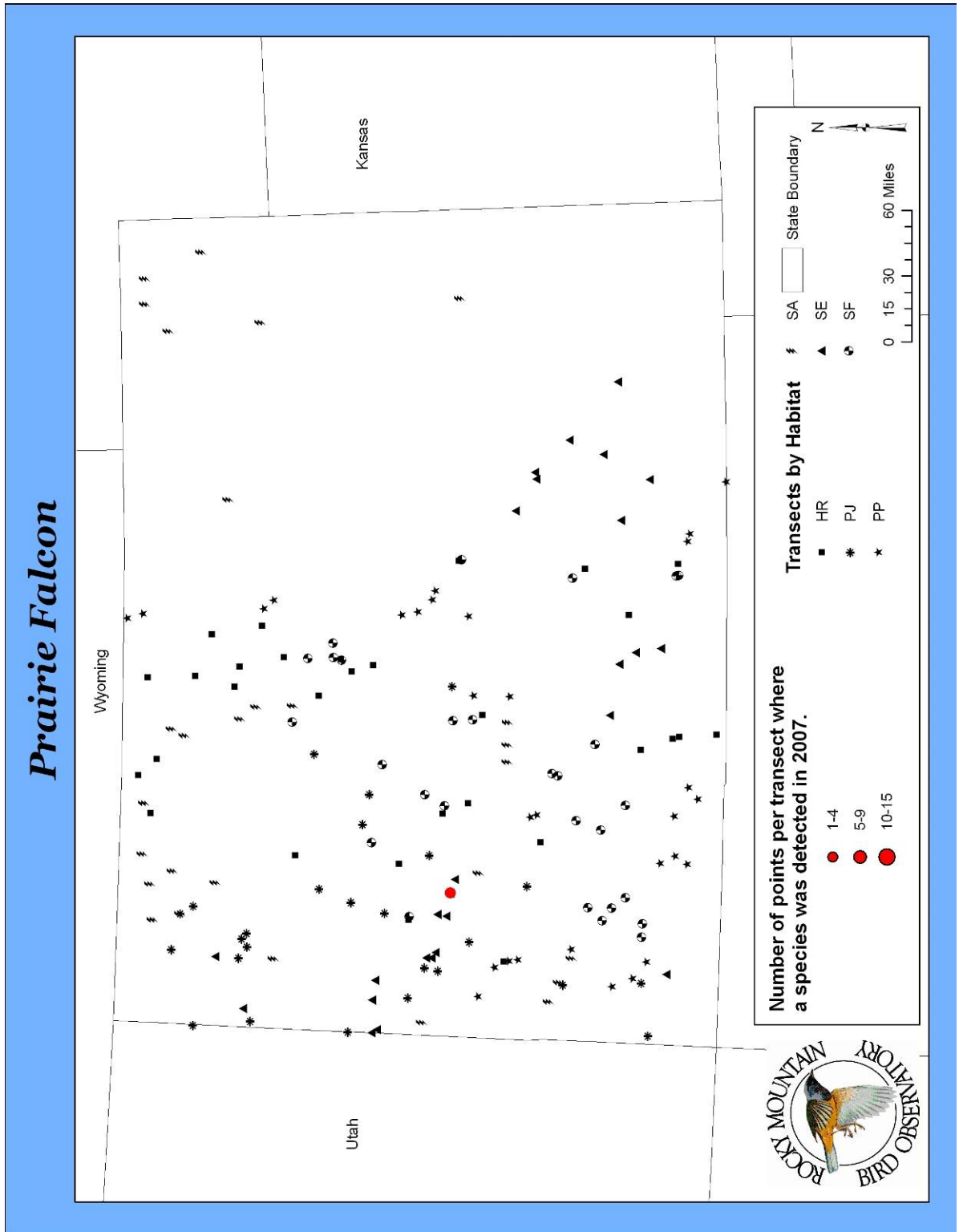
Prairie Falcons can be found in any open habitat with cliffs, including alpine tundra, throughout Colorado. In 2007, we detected one Prairie Falcon on a semidesert shrubland transect, SE02.

The Prairie Falcon, like other raptor species, is difficult to monitor under MCB using the point-transect protocol, because of its low density and large territory size. Therefore, it is unlikely that we will be able to effectively monitor Prairie Falcons in any individual habitat or across habitats under MCB. Effective monitoring will likely best be accomplished through locating and monitoring nests in Colorado. Such an effort could be incorporated into the MCB special-species program, especially if combined with similar efforts for other cliff-nesting species (e.g., Peregrine Falcon).

Total number of independent detections, number of individuals, and habitat-specific density estimates for Prairie Falcon on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SE	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transsect locations and detections of Prairie Falcon on transects in Colorado, 2007.

Band-tailed Pigeon
 (Patagioenas fasciata)
 CDOW - Species of Greatest Conservation Need
 PIF Species of Continental Concern – BCR 16

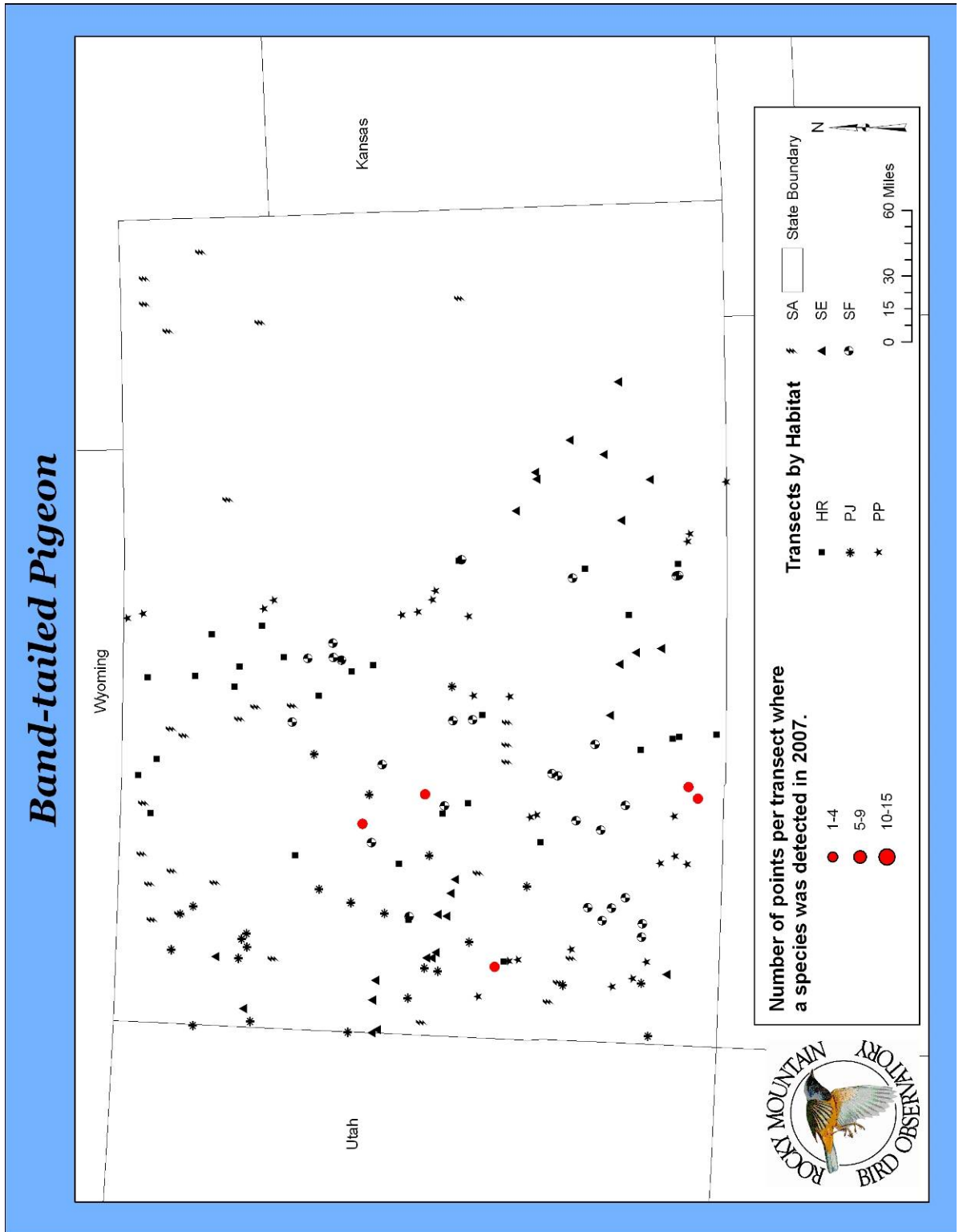
Band-tailed Pigeon prefers to nest in mid-elevation coniferous forests or in Gambel's oak shrublands, and usually near water. It feeds primarily on wild nuts such as pinyon pine nuts or acorns of Gambel's oak. In 2007, we detected nine Band-tailed Pigeons in three habitats.

With the current level of effort, it is unlikely we will be able to monitor this species through point transects under MCB. However, using data from all years, we may be able to calculate a global detection function for this species and thereby generate annual density estimates in at least mixed conifer habitat that can be used for population-trend monitoring. Adding transects, especially in mixed conifer habitat, may improve our ability to monitor the Band-tailed Pigeon.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Band-tailed Pigeon on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	2
PP	ID	--	--	--	--	6
SF	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Band-tailed Pigeon on transects in Colorado, 2007.

Common Nighthawk
(*Chordeiles minor*)
PIF Species of Regional Concern – BCR 16 & 18

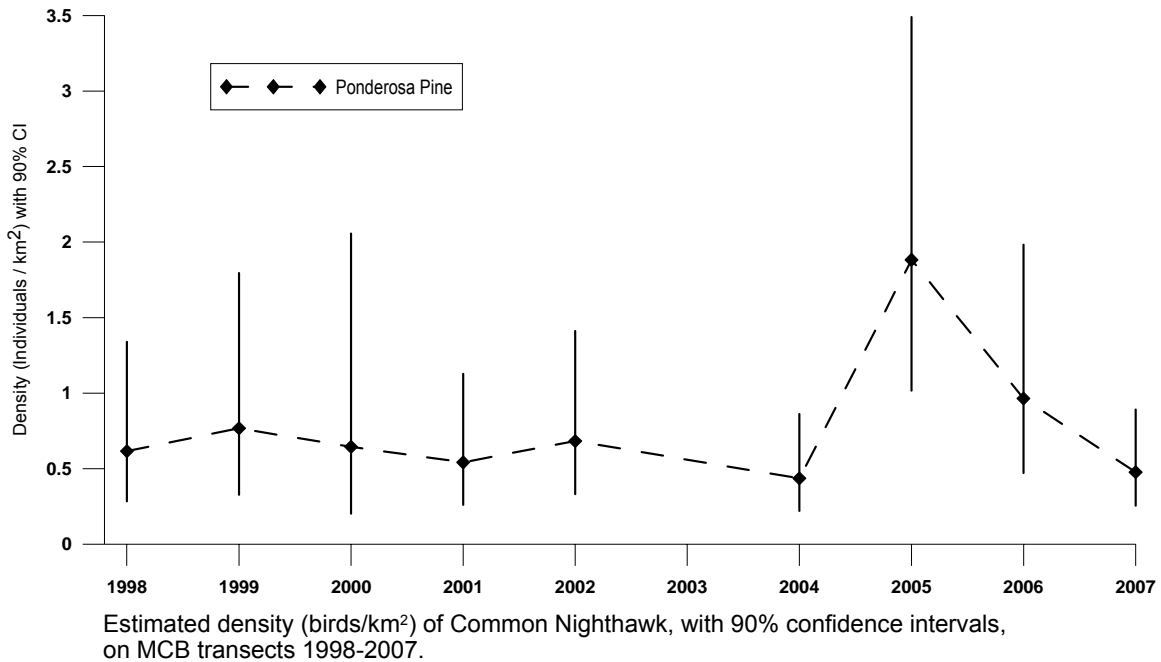
Common Nighthawks lay their eggs in a scrape on bare ground in any open habitat. In 2007, we recorded 28 Common Nighthawks in four habitats on MCB transects.

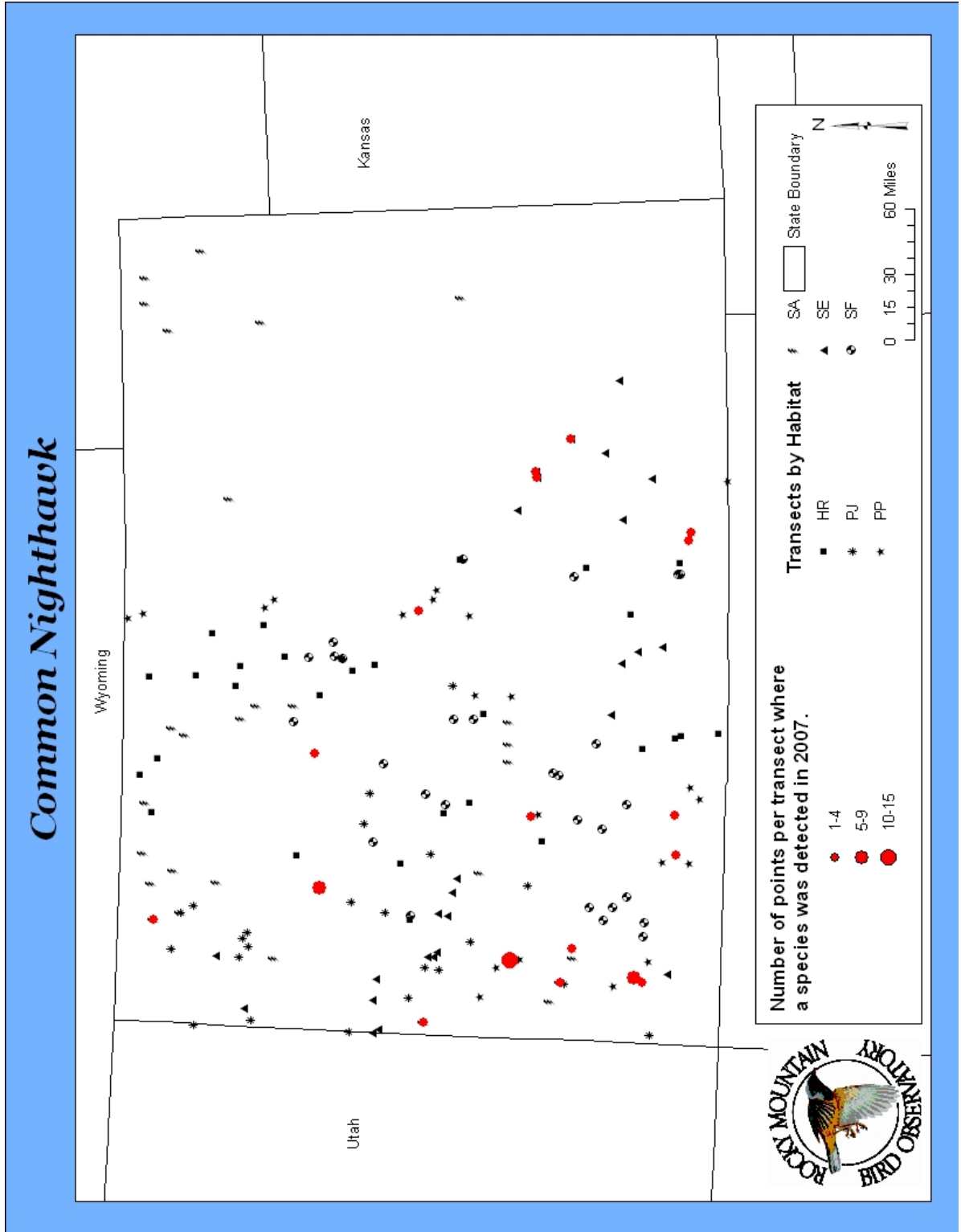
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for the Common Nighthawk within 35 years in ponderosa pine habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Common Nighthawk on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	6
PP	0.5	0.3	0.9	38%	6	13
SA	ID	--	--	--	--	5
SE	ID	--	--	--	--	4

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Common Nighthawk on transects in Colorado, 2007.

White-throated Swift
(*Aeronautes saxatalis*)

CDOW – Species of Greatest Conservation Need
PIF Regional Stewardship Species and Continental Concern – BCR 16
PIF Regional Stewardship Species – BCR 18

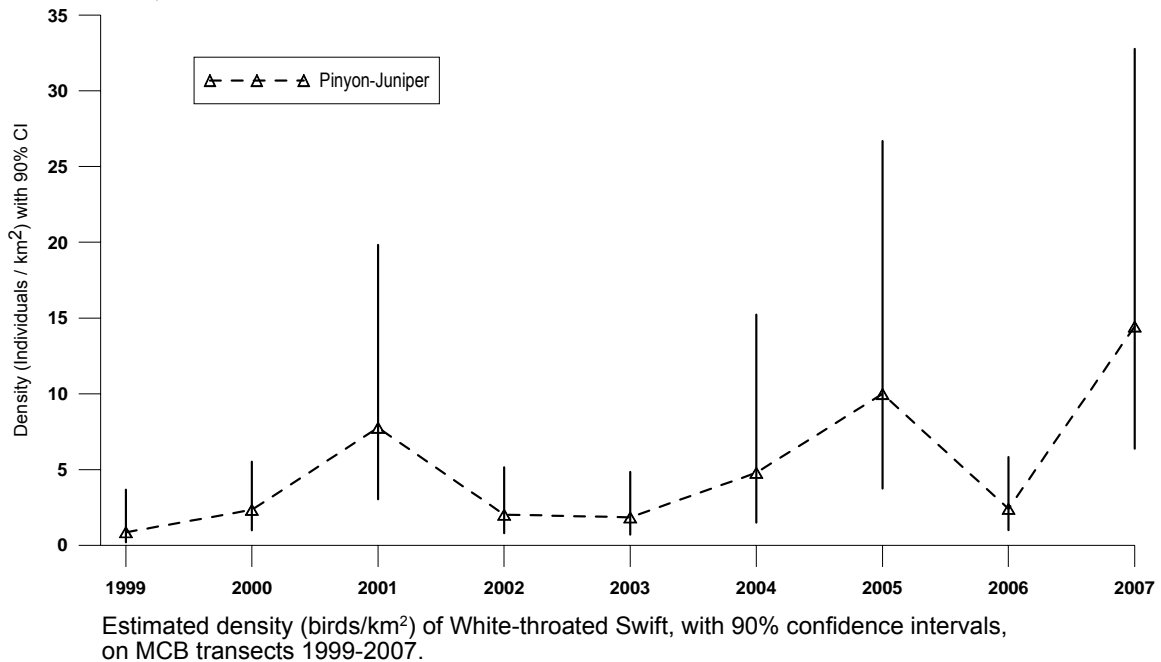
White-throated Swift nests on large cliffs that have deep cracks inaccessible to predators. This species is found in the central mountains and in western Colorado almost exclusively. In 2007, we detected 84 White-throated Swifts in five habitats on MCB transects.

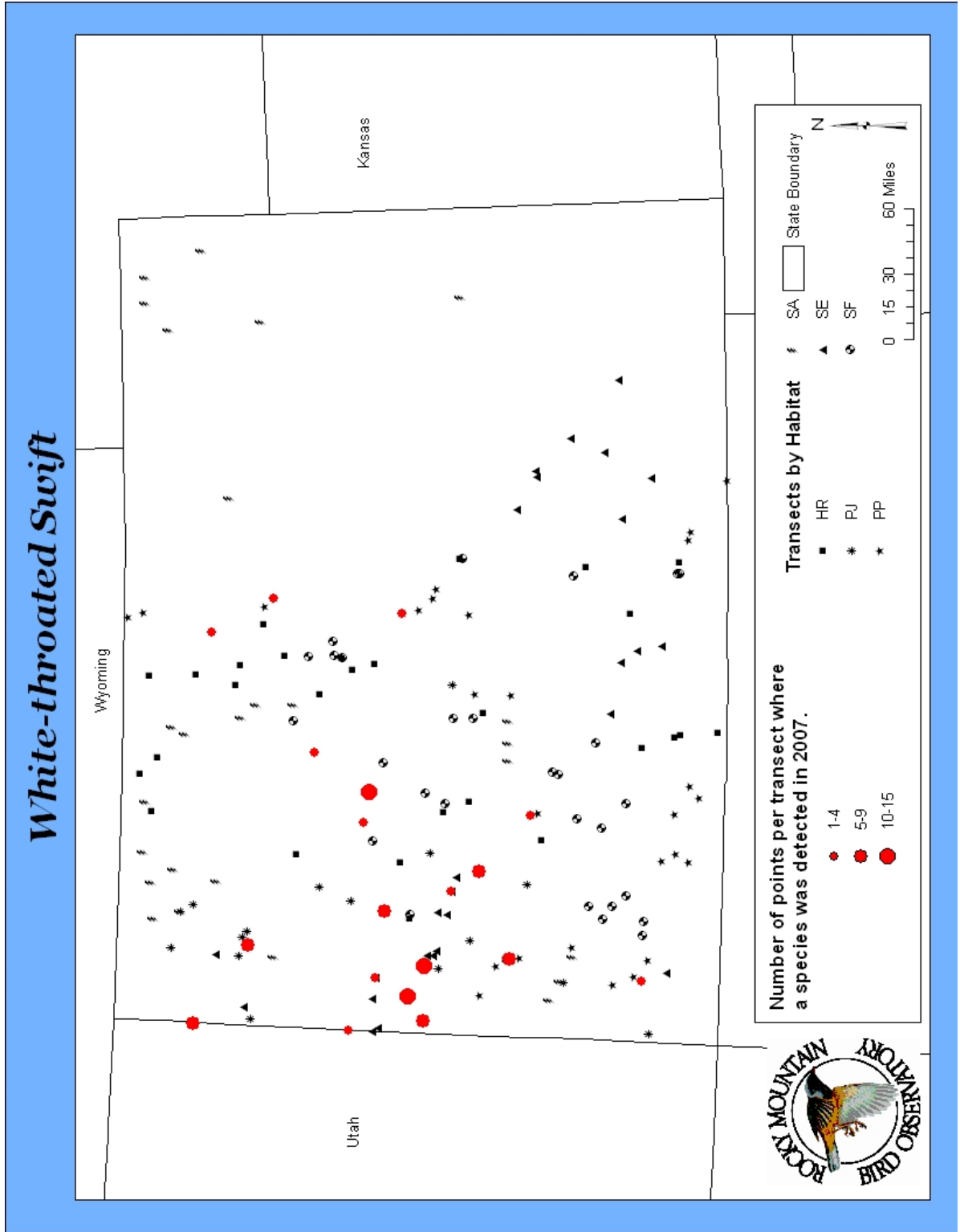
Power simulation indicates that it will take over 40 years to be able to detect a 3% average annual population change with 80% power for White-throated Swift in pinyon-juniper habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for White-throated Swift on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	1
PJ	14	6.4	33	52	24	55
PP	ID	--	--	--	--	6
SA	ID	--	--	--	--	19
SE	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of White-throated Swift on transects in Colorado, 2007.

Black-chinned Hummingbird
(*Archilochus alexandri*)
CDOW – Species of Greatest Conservation Need

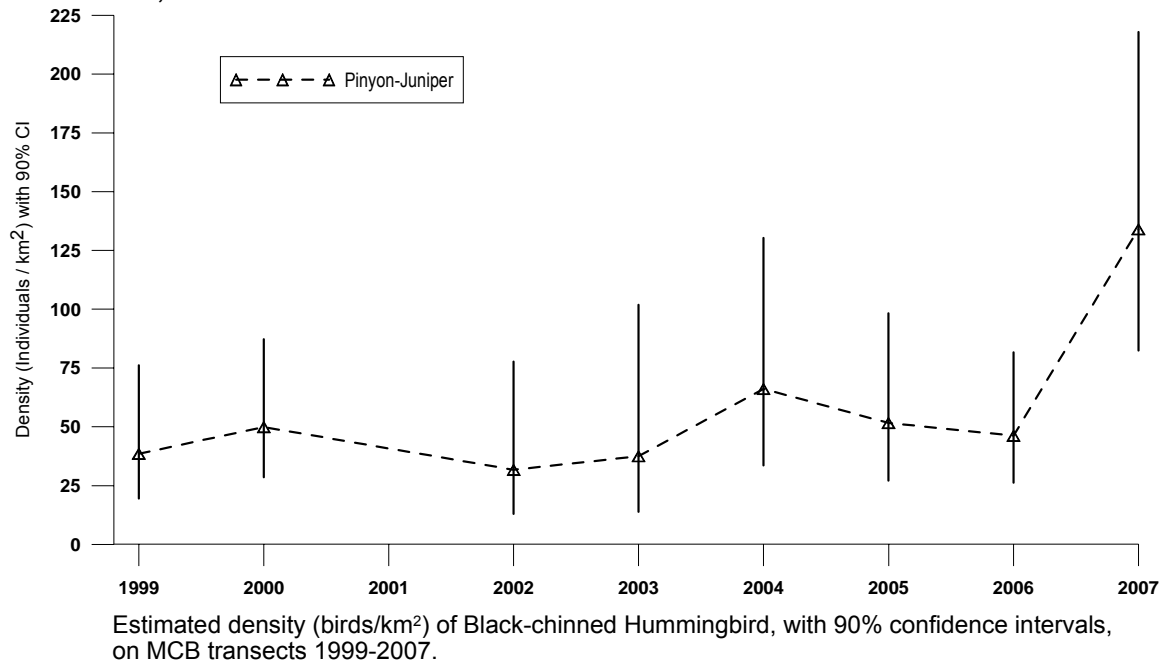
Black-chinned Hummingbird breeds most frequently in pinyon-juniper habitat, but is also found in low- and mid-elevation riparian habitat, Gambel's oak shrubland, and urban areas. This species ranges all the way from the southern border to the northern border in western Colorado, but has a much more limited range on the east side of the state. In 2007, we detected 43 Black-chinned Hummingbirds in three habitats on MCB transects.

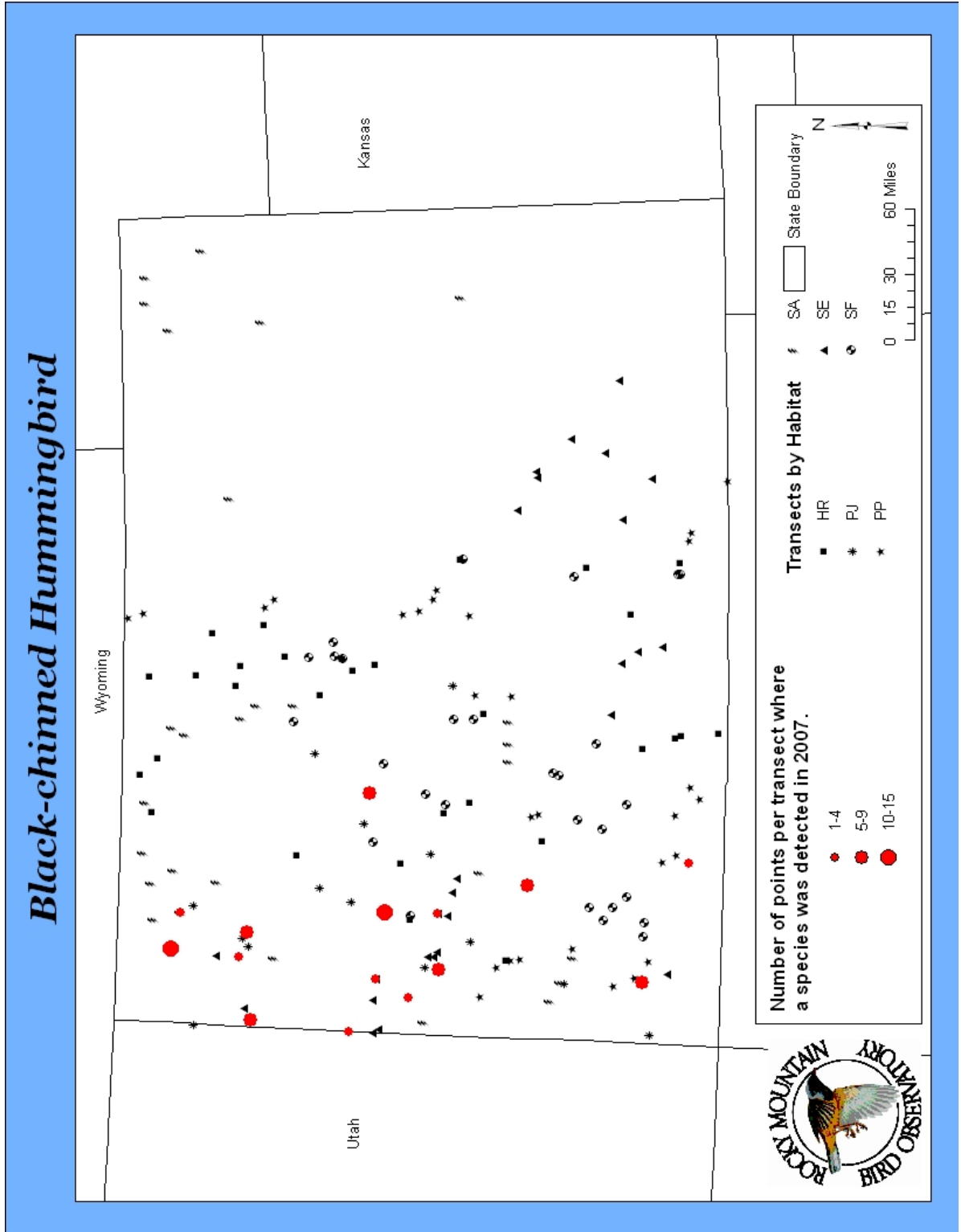
Power simulation indicates that it will take over 40 years to be able to detect a 3% average annual population change with 80% power for Black-chinned Hummingbird in pinyon-juniper habitat using point transect data. Adding transects, especially in pinyon-juniper habitat, may improve our ability to monitor this species.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Black-chinned Hummingbird on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	134	82	218	29	32	39
PP	ID	--	--	--	--	2
SE	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Black-chinned Hummingbird on transects in Colorado, 2007.

Broad-tailed Hummingbird
(*Selasphorus platycercus*)

CDOW – Species of Greatest Conservation Need
PIF Regional Stewardship Species – BCR 16

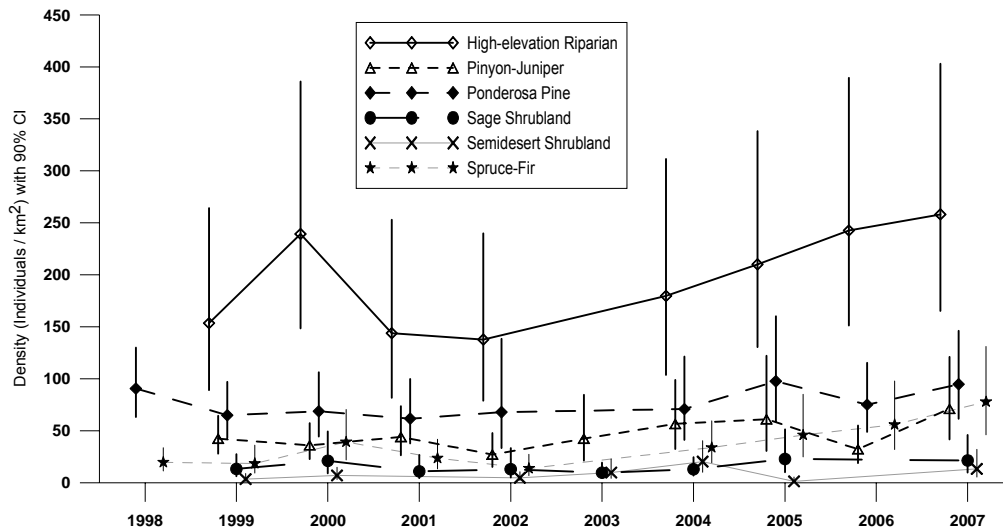
Broad-tailed Hummingbird is the most abundant hummingbird species in Colorado and breeds in montane shrubland, ponderosa pine, mixed conifer, spruce-fir, and mid- to high-elevation riparian habitats. We detected 382 Broad-tailed Hummingbirds in five habitats on MCB transects in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Broad-tailed Hummingbird within 25 years in high-elevation riparian habitat, in 30 years in pinyon-juniper, and ponderosa pine habitats, and more than 40 years in spruce-fir habitat using point transect data.

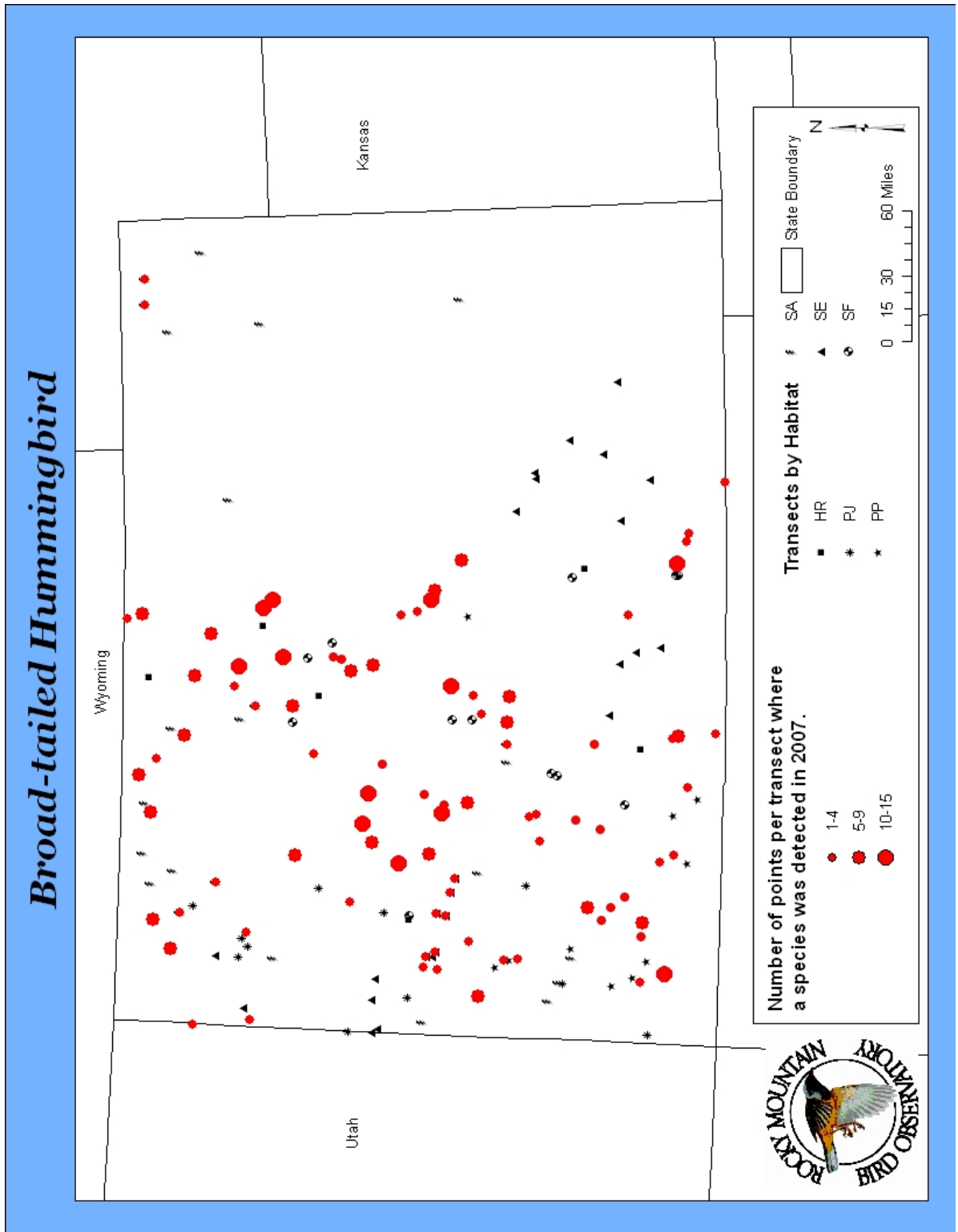
Total number of independent detections, number of individuals, and habitat-specific density estimates for Broad-tailed Hummingbird on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	258	165	403	27	135	147
PJ	71	42	121	32	42	57
PP	95	61	146	26	71	80
SA	21	9.9	46	47	20	29
SE	13	5.5	32	55	17	18
SF	78	46	131	32	45	51

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data



Estimated density (birds/km²) of Broad-tailed Hummingbird, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Broad-tailed Hummingbird on transects in Colorado, 2007.

Rufous Hummingbird

(*Selasphorus rufus*)

CDOW – Species of Greatest Conservation Need

USFWS Bird of Conservation Concern - Nationally

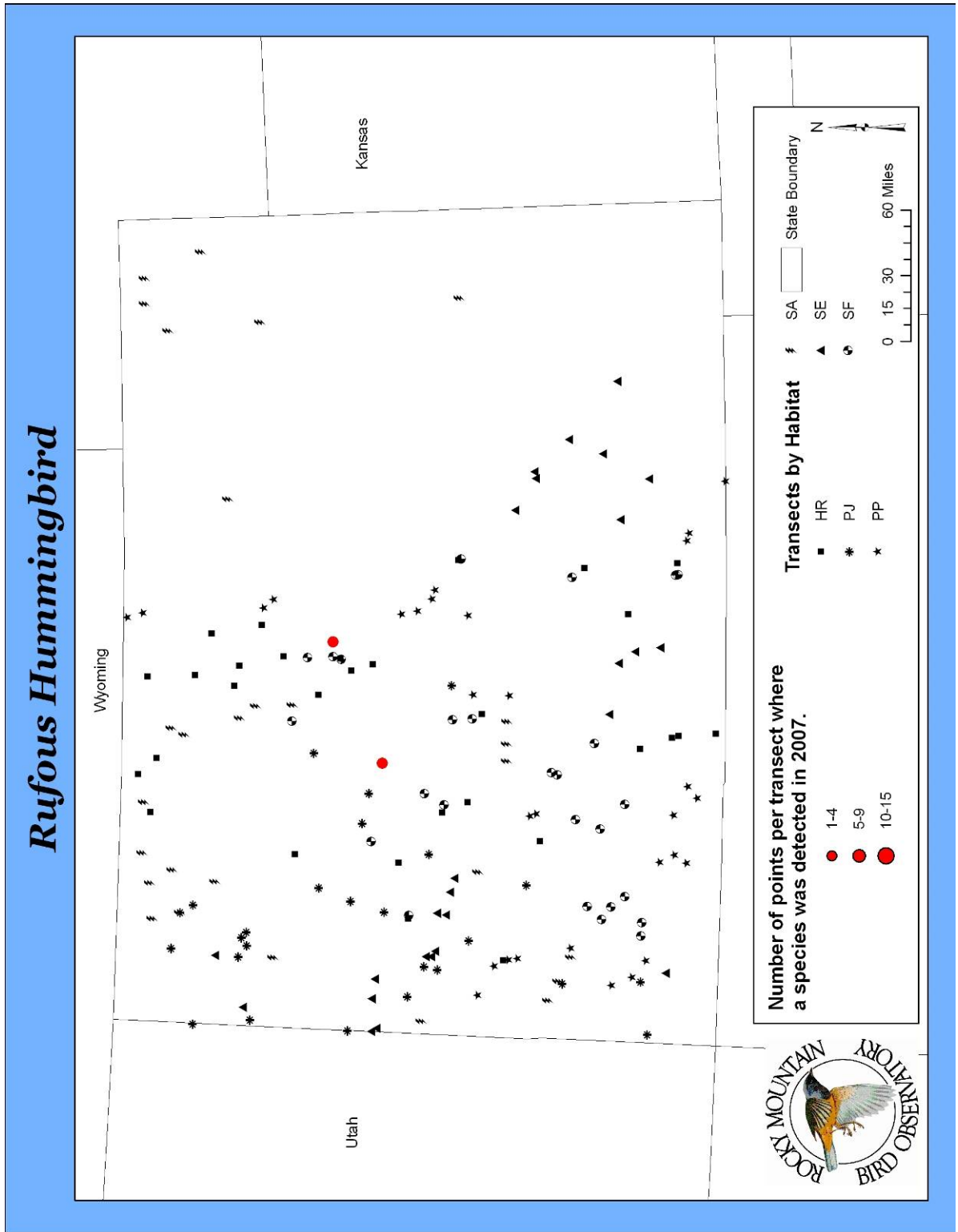
Rufous Hummingbirds do not breed in Colorado, but we detect them on high-elevation transects towards the end of the season when they are migrating south. Data collected on transects could possibly prove interesting and indicate the success of the breeding season for this species in their northern breeding grounds. In 2007, we detected four Rufous Hummingbirds on spruce-fir transects.

Because this species does not breed in Colorado, we will not be able to monitor the Rufous Hummingbird through point transects under MCB.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Rufous Hummingbird on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SF	ID	--	--	--	--	4

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Rufous Hummingbird on transects in Colorado, 2007.

Lewis's Woodpecker

(*Melanerpes lewis*)

CDOW – Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

PIF Species of Continental and Regional Concern – BCR 16 &18

USFWS Bird of Conservation Concern

*Also see special species section

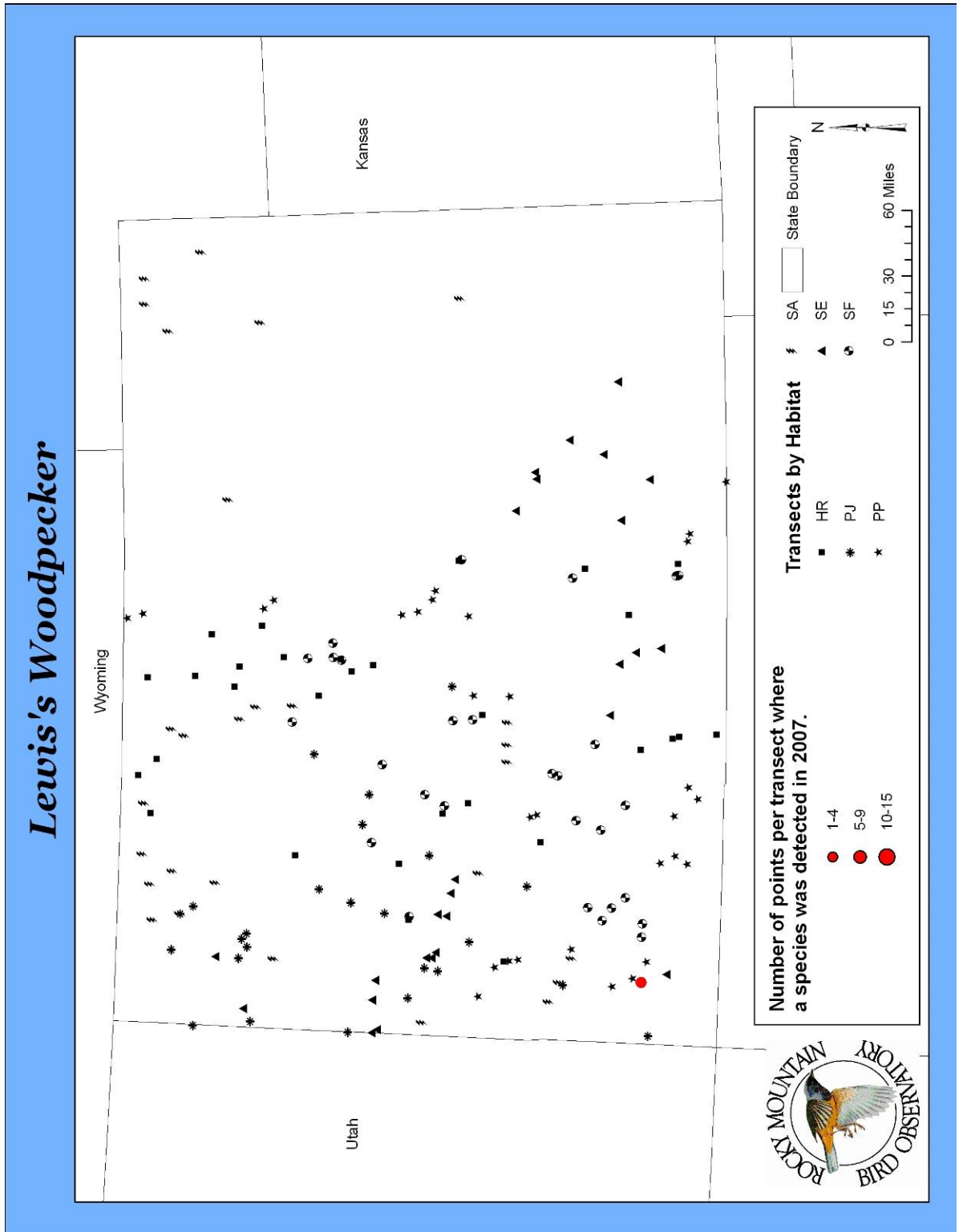
Lewis's Woodpecker breeds in the foothills east of the Front Range, in southeast Colorado along the Arkansas River, in pinyon-juniper habitat in southeast Colorado, and in southwest Colorado. However, breeding locations are far apart and transects do not yield much information for this species. In 2007, we detected one Lewis's Woodpecker on a pinyon-juniper transect.

In 2004, as a part of the MCB special species program, several road-based transects were randomly selected and conducted in the known range of this species in an attempt to establish an effective monitoring protocol. However, these efforts proved unsuccessful as observers were unable to record sufficient numbers to justify repeating the transects. The special species project has recorded many nesting locations and revisiting these areas periodically may prove to be the best method to monitor this species.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Lewis's Woodpecker on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Lewis's Woodpecker on transects in Colorado, 2007.

Red-headed Woodpecker
 (Melanerpes erythrocephalus)
 PIF Species of Continental and Regional Concern – BCR 18
 USFWS Bird of Conservation Concern

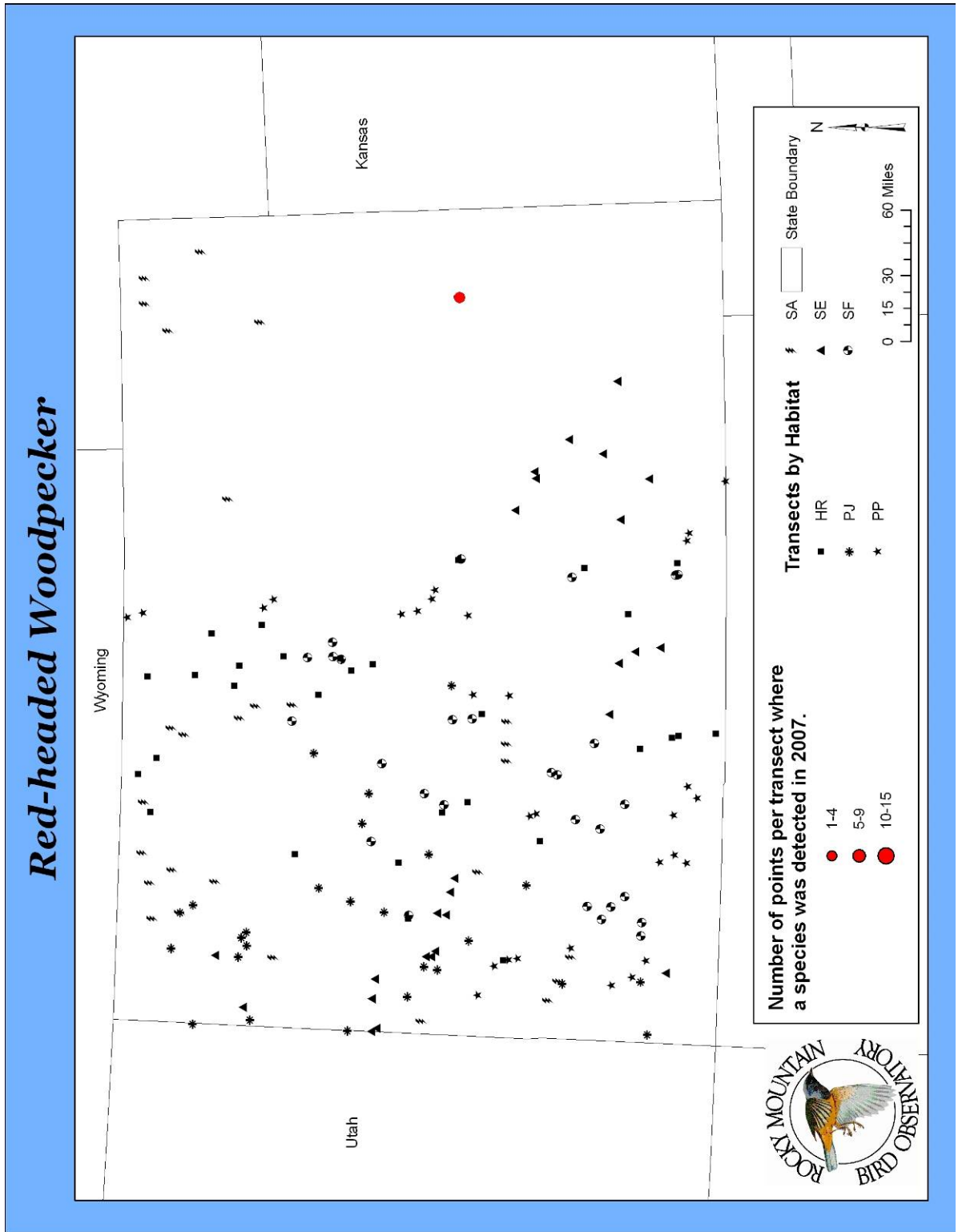
Red-headed Woodpecker breeds in the eastern side of Colorado in riparian habitat and urban parks (Kingery 1998). Interestingly, a breeding pair was discovered in the 2002 Hayman Burn this summer. We detected two Red-headed Woodpeckers on sage shrubland transects in 2007.

With the current level of effort, it is unlikely we will be able to monitor this species through point transects under MCB. One potential method to gather more information on this species is to determine a way to survey low-elevation riparian habitat in the eastern half of the state.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Red-headed Woodpecker on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transsect locations and detections of Red-headed Woodpecker on transects in Colorado, 2007.

Williamson's Sapsucker
(*Sphyrapicus thyroideus*)

CDO - Species of Greatest Conservation Need
PIF Species of Continental and Regional Stewardship Species – BCR 16
USFWS Bird of Conservation Concern – Nationally

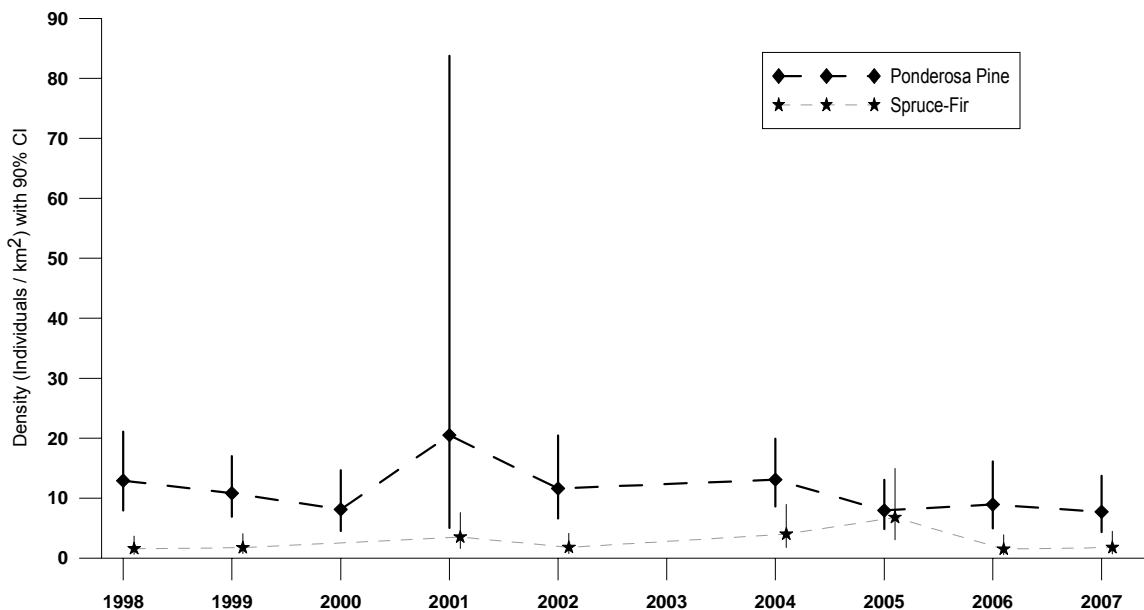
Williamson's Sapsucker nests in a variety of habitats, but prefers mid-elevation coniferous forests. It also occasionally breeds in stands of pure aspen. In 2007, we detected 64 Williamson's Sapsuckers in three habitats on MCB transects and provide a density estimate for two habitats.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Williamson's Sapsucker within 30 years in ponderosa pine habitat and more than 40 years in spruce-fir habitat using point transect data.

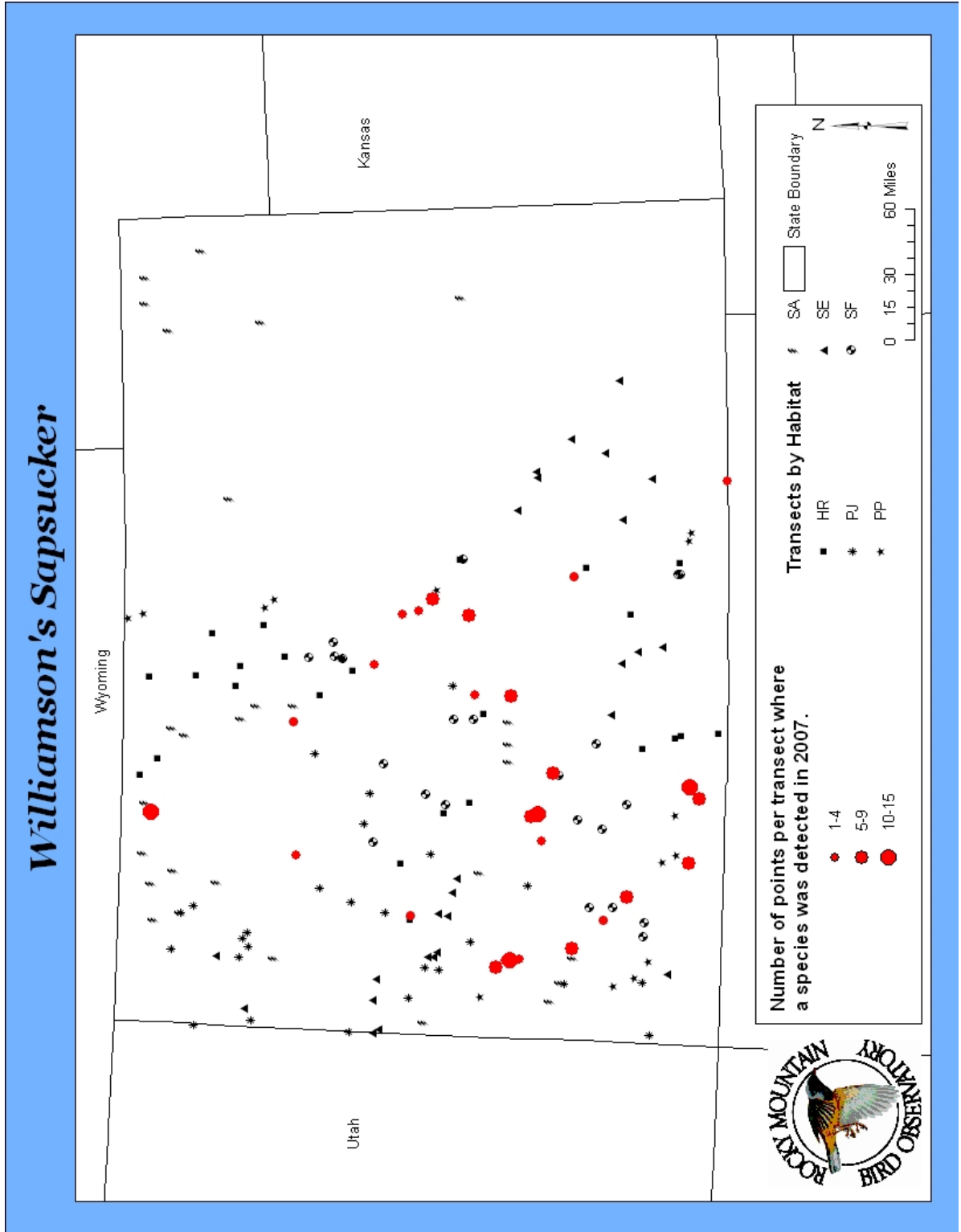
Total number of independent detections, number of individuals, and habitat-specific density estimates for Williamson's Sapsucker on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	11
PP	7.7	4.3	14	35	22	42
SF	1.8	0.7	4.5	59	5	11

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Williamson's Sapsucker, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Williamson's Sapsucker on transects in Colorado, 2007.

Red-naped Sapsucker
(*Sphyrapicus nuchalis*)

CDOW - Species of Greatest Conservation Need
USFWS Bird of Conservation Concern - Nationally

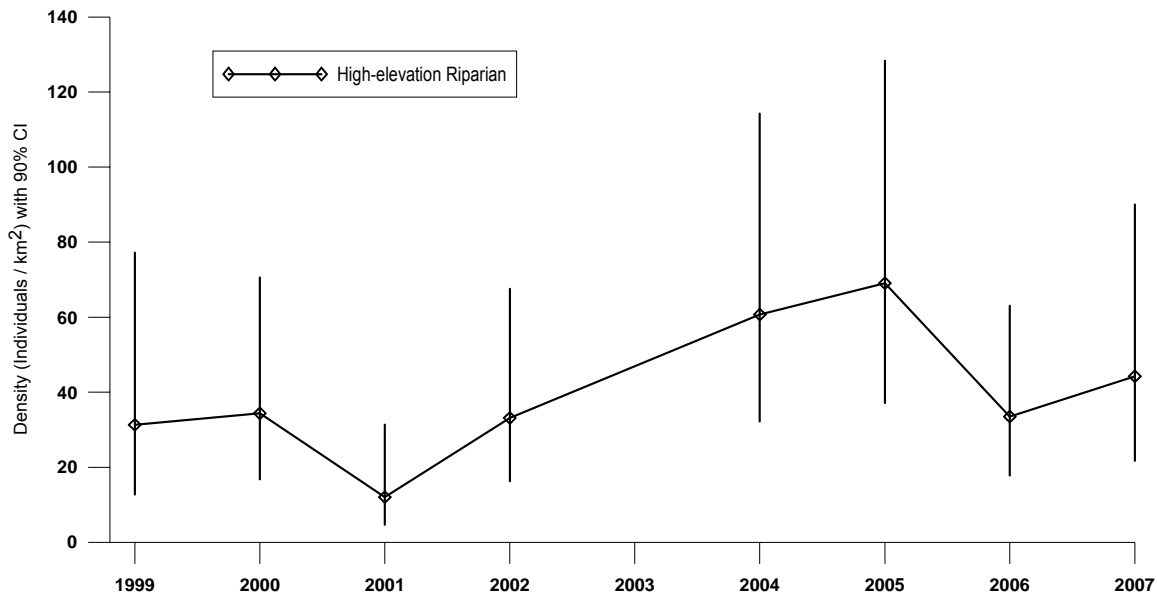
Red-naped Sapsucker nests primarily in aspen and occasionally in other high-elevation forested habitats. During the breeding season, it is frequently encountered foraging in shrubby areas, especially high-elevation riparian habitat. In 2007, we detected 64 Red-naped Sapsuckers in four habitats on MCB transects and calculated density estimates in two habitats.

Power simulation indicates that we would not be able to detect a 3% average annual population change with 80% power for Red-naped Sapsucker within 40 years in high-elevation riparian habitat using point transect data.

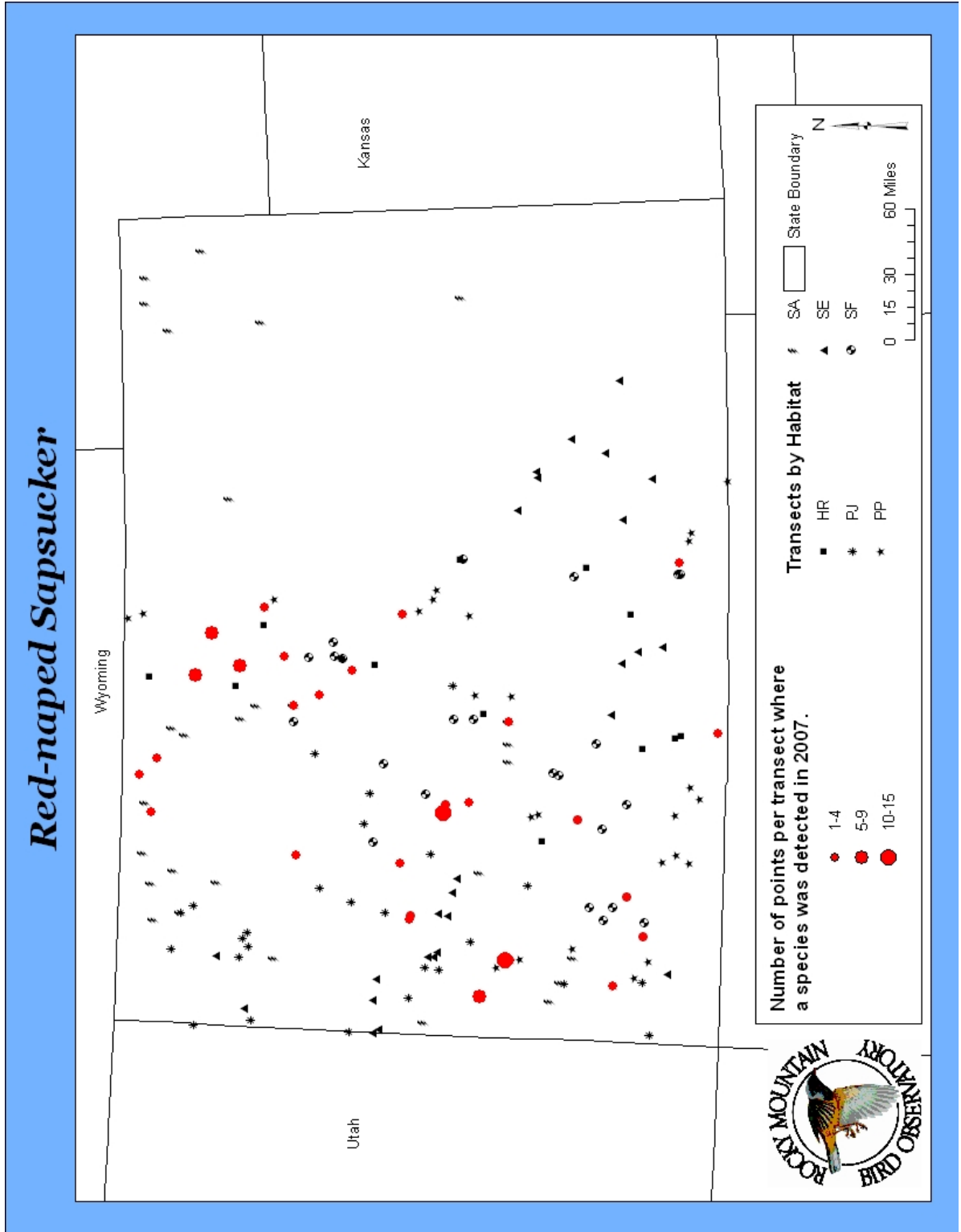
Total number of independent detections, number of individuals, and habitat-specific density estimates for Red-naped Sapsucker on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	44	22	90	45	32	44
PP	ID	--	--	--	--	9
SA	ID	--	--	--	--	4
SF	ID	--	--	--	--	7

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Red-naped Sapsucker, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Red-naped Sapsucker on transects in Colorado, 2007.

American Three-toed Woodpecker
 (Picoides tridactylus)
 CDOW – Species of Greatest Conservation Need
 USFS Region 2 Sensitive Species

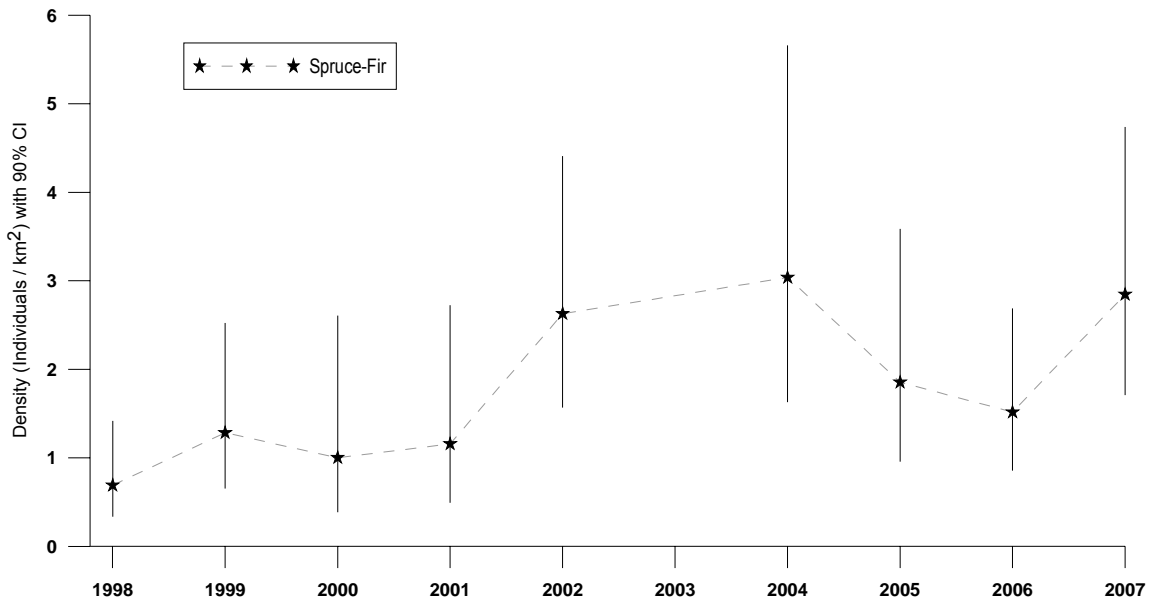
American Three-toed Woodpecker is found primarily in spruce-fir habitat, and also in mixed conifer, ponderosa pine, and aspen habitats. It is especially abundant in areas with insect outbreaks, including post-fire bark beetle invasions. We detected 38 American Three-toed Woodpeckers in two habitats on MCB transects in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for American Three-toed Woodpecker within 35 years in spruce-fir habitat using data collected only on point counts. However, if data collected on line transect are included in analyses, we would be able to detect the same trend within 30 years in spruce-fir habitat.

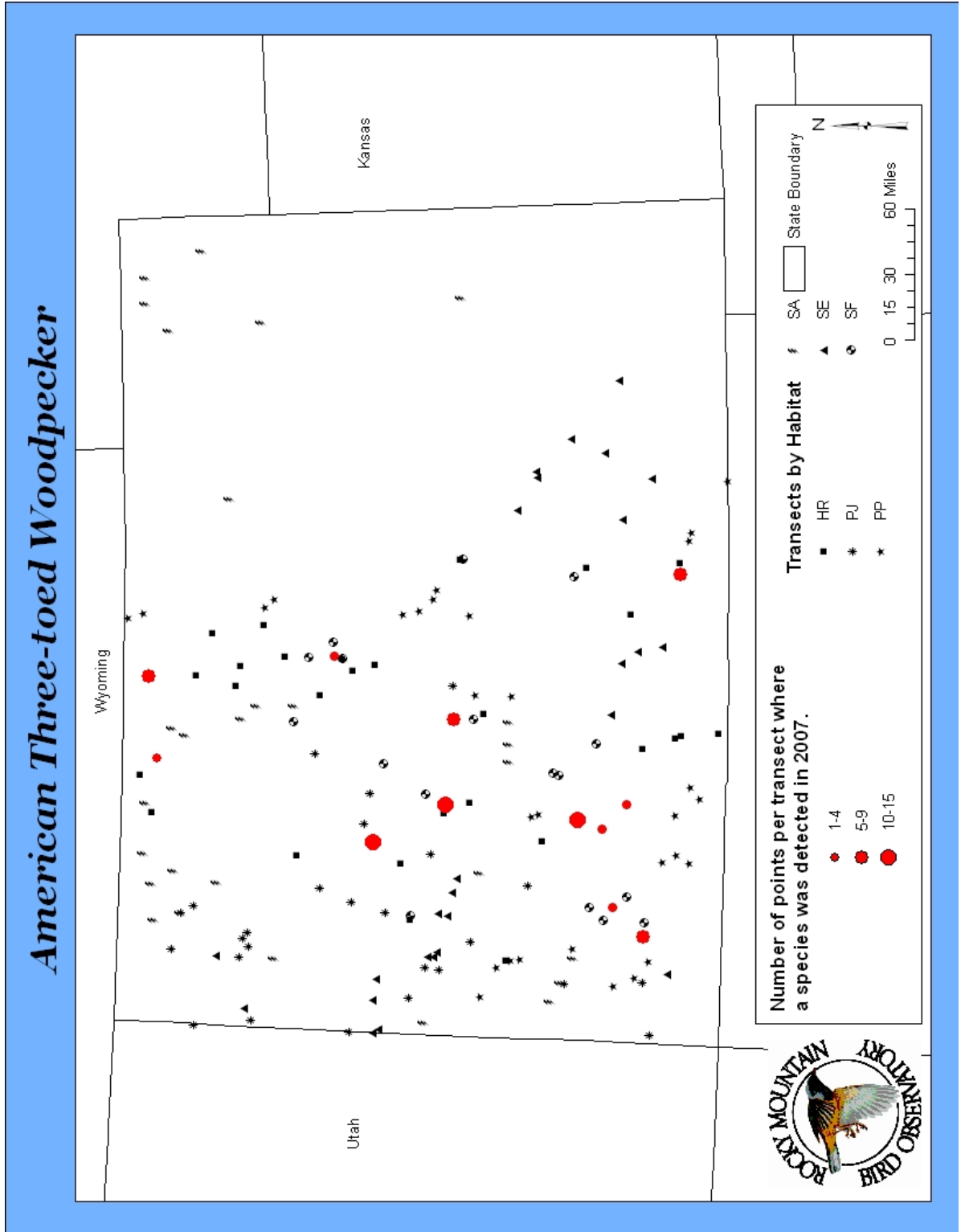
Total number of independent detections, number of individuals, and habitat-specific density estimates for American Three-toed Woodpecker on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	4
SF	2.8	1.7	4.7	31	22	34

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of American Three-toed Woodpecker, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of American Three-toed Woodpecker on transects in Colorado, 2007.

Olive-sided Flycatcher

(*Contopus cooperi*)

CDOW - Species of Greatest Conservation Need

PIF Species of Continental Concern – BCR 16

USFS Region 2 Sensitive Species

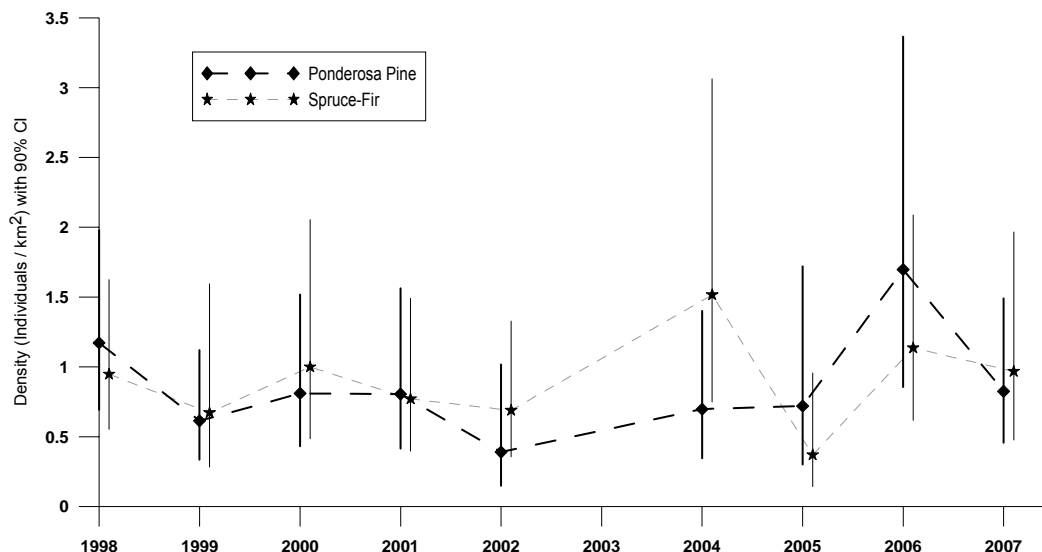
Olive-sided Flycatchers occur throughout the Rocky Mountain region, but are never abundant. On rare occasions the species will utilize low-elevation pinyon-juniper stands for nesting, but prefers high-elevation coniferous forests. In 2007, we detected 37 Olive-sided Flycatchers in three habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Olive-sided Flycatcher within 30 years in ponderosa pine habitat and within 35 years in spruce-fir habitat using data collected only on points. However, if data collected between points, on line transect, are included in analyses we would be able to detect the same trend within 25 years in spruce-fir habitat.

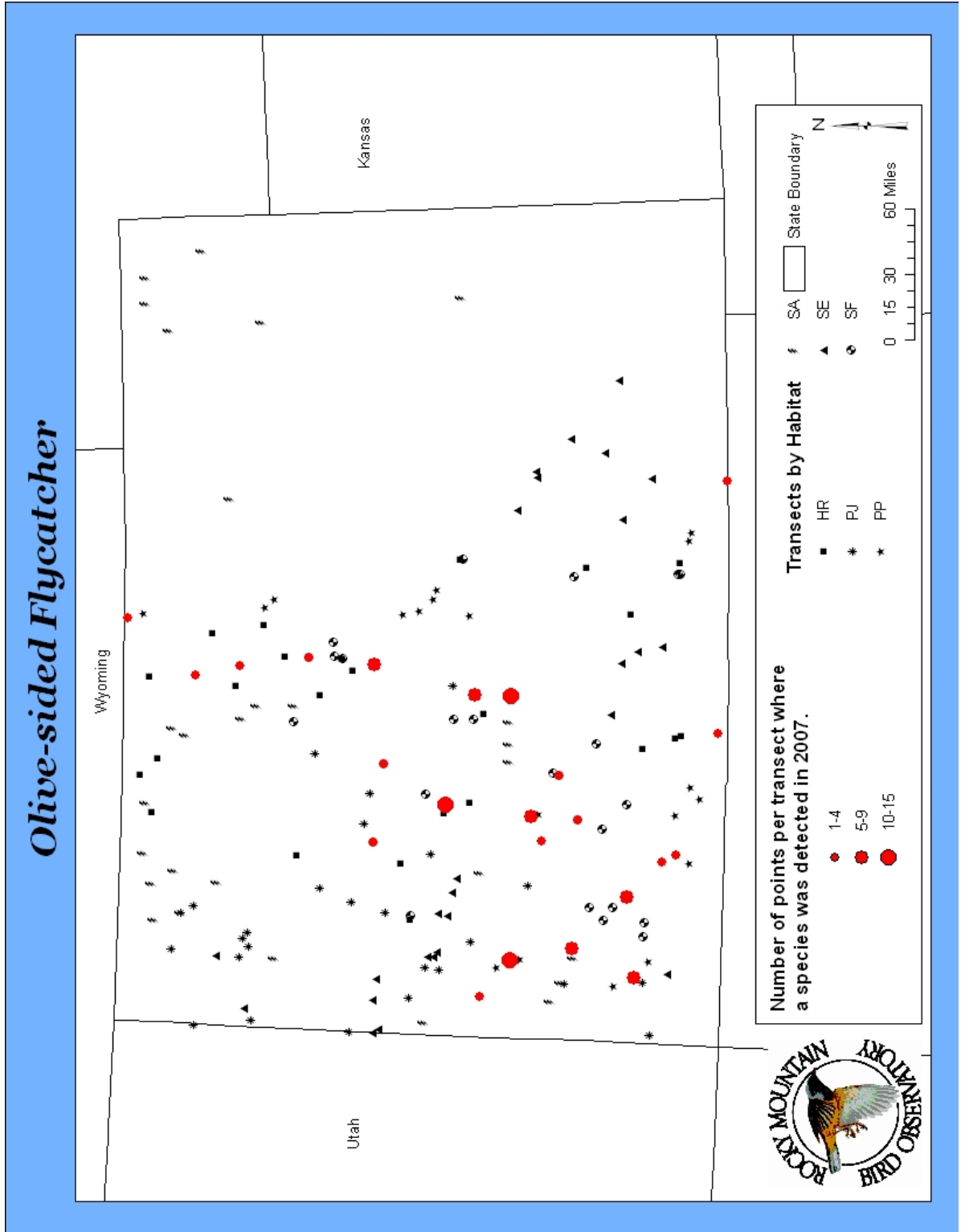
Total number of independent detections, number of individuals, and habitat-specific density estimates for Olive-sided Flycatcher on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	6
PP	0.8	0.5	1.5	36	13	20
SF	1.0	0.5	2.0	44	10	11

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Olive-sided Flycatcher, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Olive-sided Flycatcher on transects in Colorado, 2007.

Willow Flycatcher
(*Empidonax traillii*)

Federally and State Endangered Species Lists
CDOW – Species of Greatest Conservation Need
PIF Species of Continental and Regional Concern – BCR 16

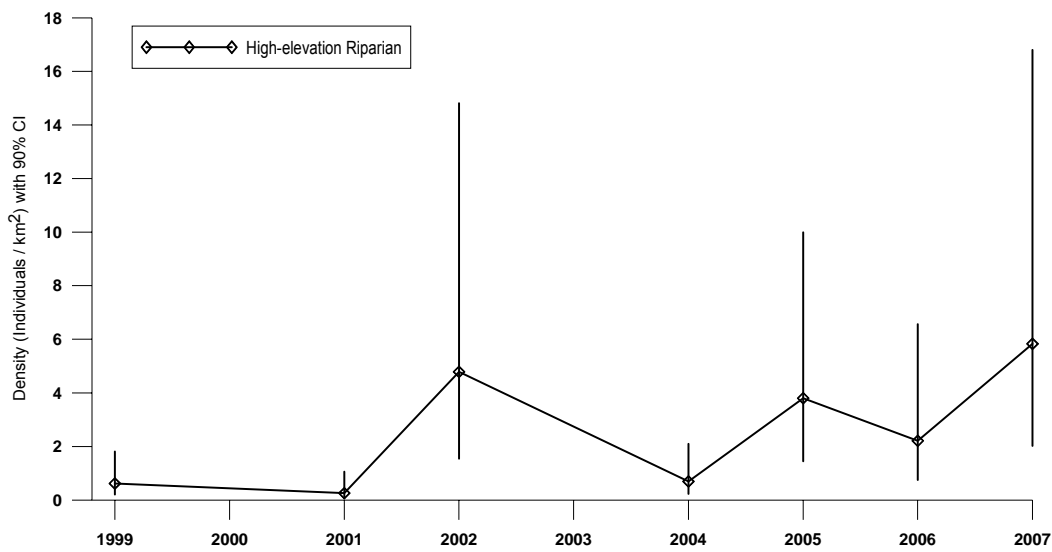
Willow Flycatchers can be found wherever there are thick willow stands growing in riparian areas at both low and high elevations in the western half of Colorado. In 2007, we detected 25 Willow Flycatchers in high-elevation riparian habitat; 18 of the detections were from HR13. The southwestern subspecies of Willow Flycatcher (*E.t. extimus*) is a Federally listed Endangered Species. It is possible that this subspecies breeds in the San Luis Valley and in other locations on the west slope of Colorado. The main reasons for the precipitous decline of this subspecies are the loss of riparian habitat and increased cowbird nest parasitism.

Power simulation indicates that it will take over 40 years to be able to detect a 3% average annual population change with 80% power for Willow Flycatcher in high-elevation riparian habitat using point transect data.

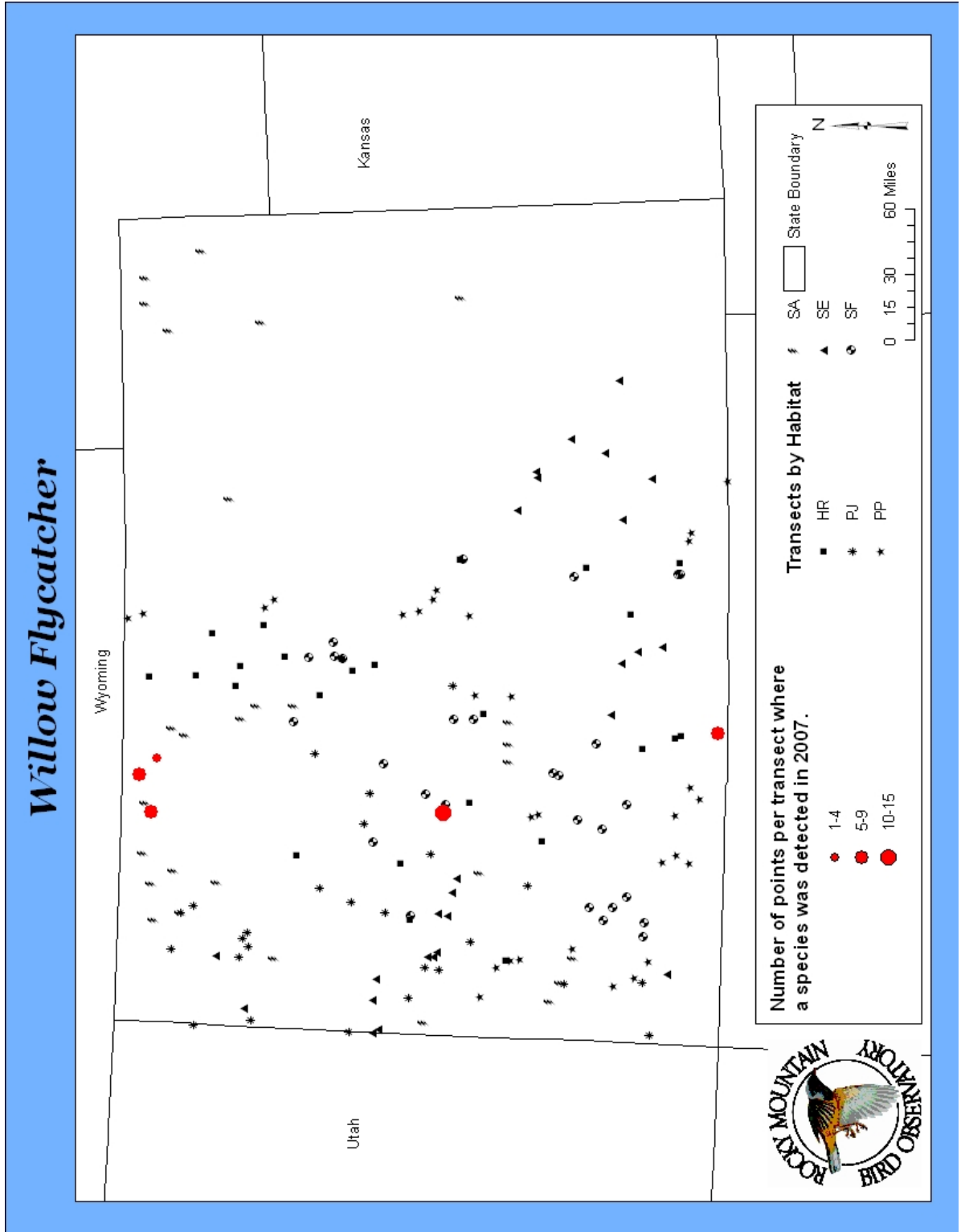
Total number of independent detections, number of individuals, and habitat-specific density estimates for Willow Flycatcher on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	5.8	2.0	17	69	25	25

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Willow Flycatcher, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Willow Flycatcher on transects in Colorado, 2007.

Gray Flycatcher
(*Empidonax wrightii*)
CDOW – Species of Greatest Conservation Need

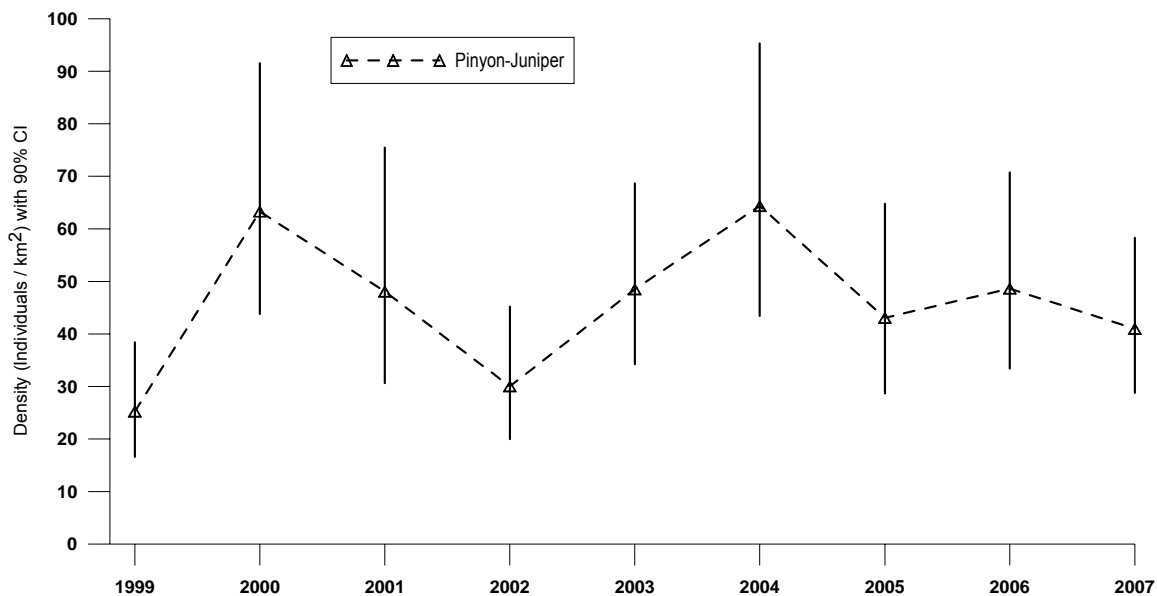
Gray Flycatcher is a pinyon-juniper specialist that rarely is found in other habitats. This species is considered vulnerable because it relies almost exclusively on pinyon-juniper habitat. We recorded 315 Gray Flycatchers in three habitats on MCB transects in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Gray Flycatcher within 20 years in pinyon-juniper habitat using point transect data.

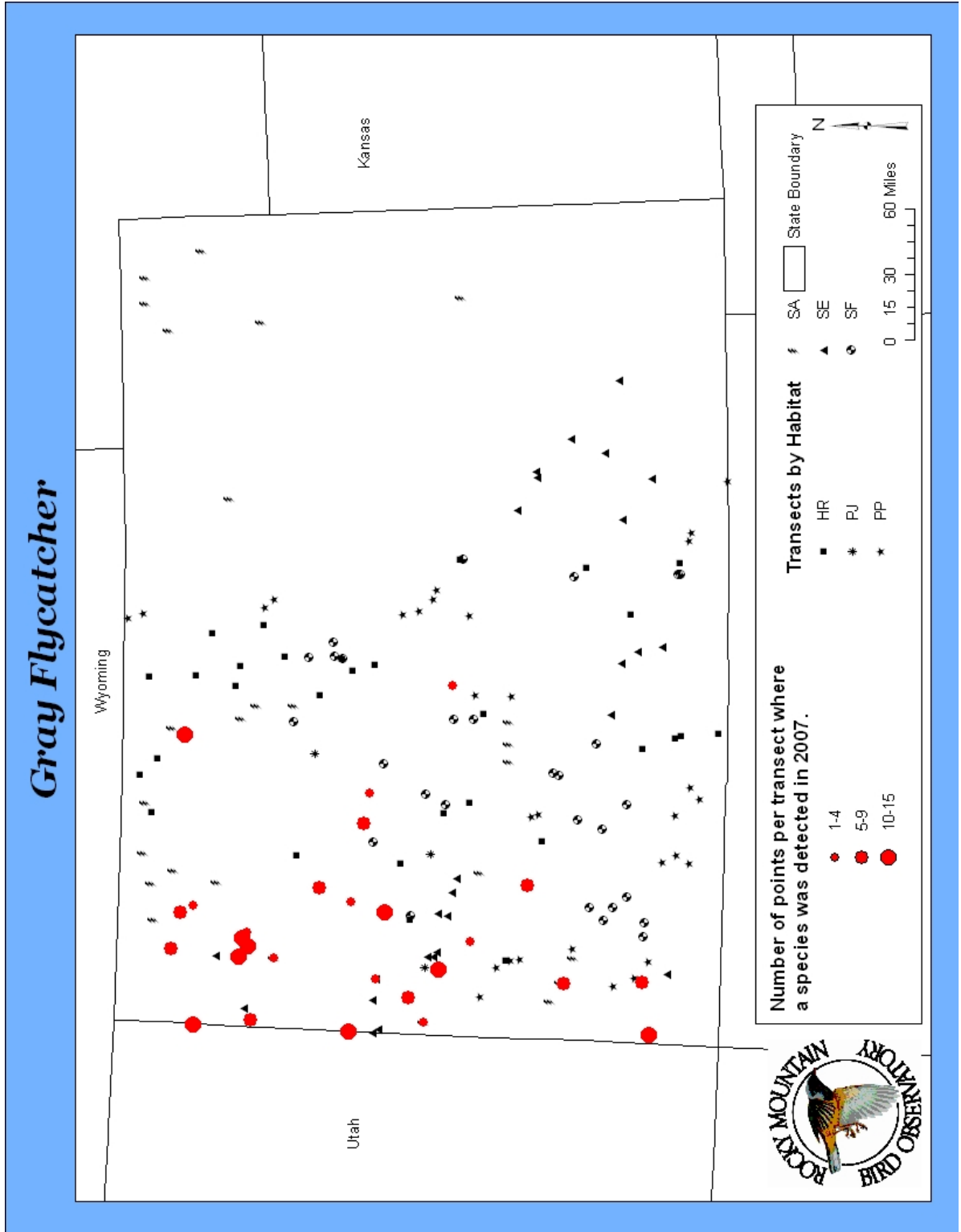
Total number of independent detections, number of individuals, and habitat-specific density estimates for Gray Flycatcher on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	41	29	58	21	207	290
SA	ID	--	--	--	--	24
SE	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Gray Flycatcher, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Gray Flycatcher on transects in Colorado, 2007.

Dusky Flycatcher
(*Empidonax oberholseri*)
CDOW – Species of Greatest Conservation Need

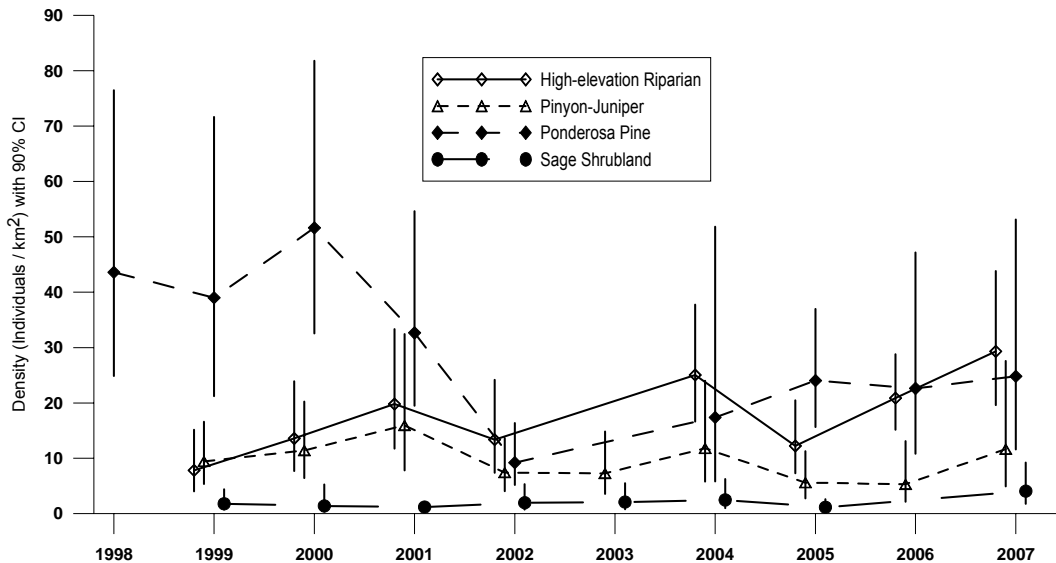
Dusky Flycatcher nests in a variety of habitats, including oak shrubland, high-elevation riparian, aspen, and coniferous forests with a shrubby component (Kingery 1998). We recorded 326 Dusky Flycatchers and calculated density estimates in four habitats on the MCB project in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Dusky Flycatcher within 25 years in ponderosa pine habitat and within 35 years in high-elevation riparian, pinyon-juniper, and sage shrubland habitats using point transect data.

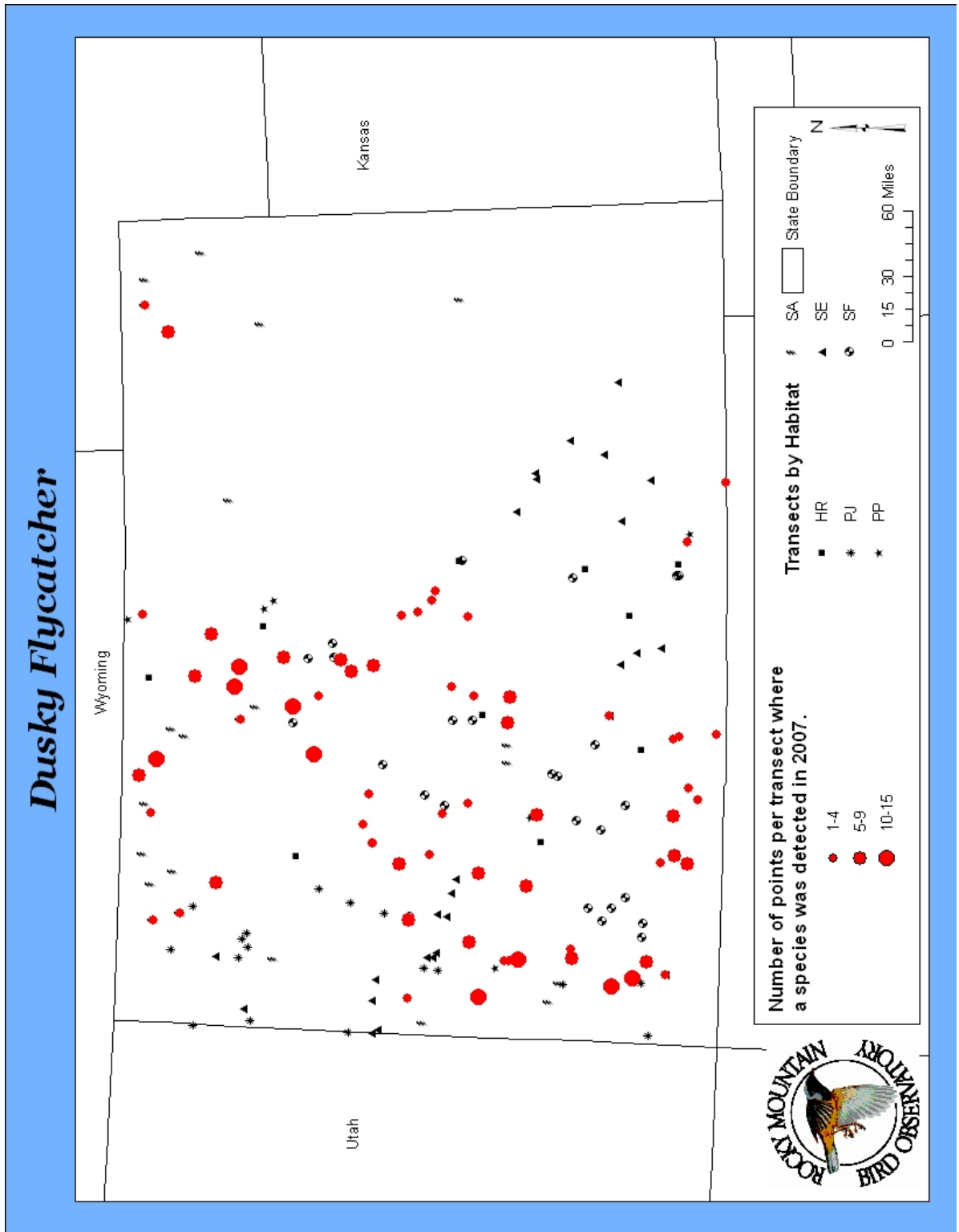
Total number of independent detections, number of individuals, and habitat-specific density estimates for Dusky Flycatcher on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	29	20	44	24	105	118
PJ	12	4.9	28	54	33	37
PP	25	12	53	48	98	117
SA	4.1	1.8	9.2	51	32	50
SE	ID	--	--	--	--	2
SF	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Dusky Flycatcher, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Dusky Flycatcher on transects in Colorado, 2007.

Cordilleran Flycatcher

(*Empidonax occidentalis*)

CDOW – Species of Greatest Conservation Need

PIF Regional Stewardship Species – BCR 16

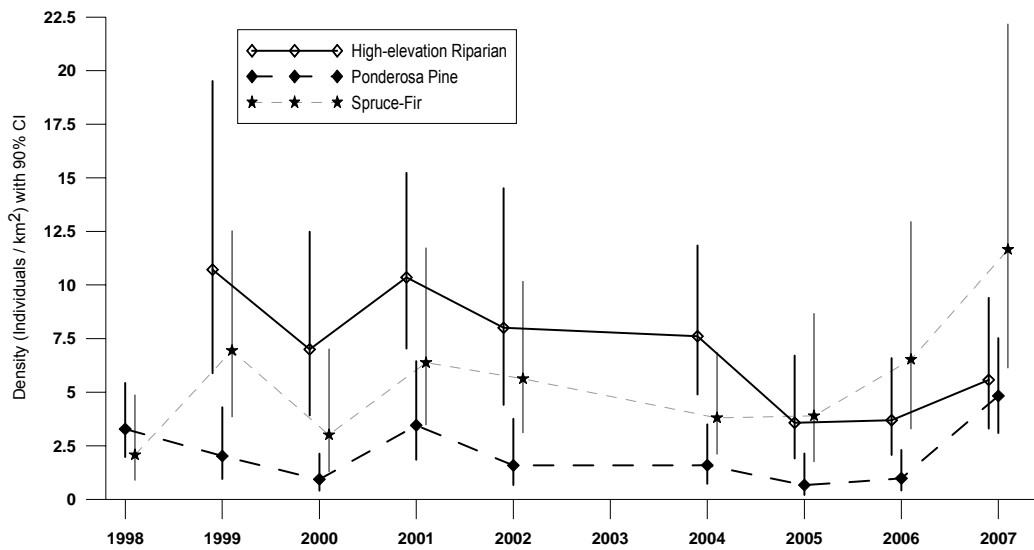
Cordilleran Flycatcher nests in forested areas where cliffs or rocky ledges are present and is often found in riparian areas with many vertical surfaces. Sometimes it is found in cliffy arroyos in pinyon-juniper habitat that have some element of deciduous vegetation. In 2007, we recorded 113 Cordilleran Flycatchers in four habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Cordilleran Flycatcher within 35 years in high-elevation riparian, ponderosa pine, and spruce-fir habitats using point transect data.

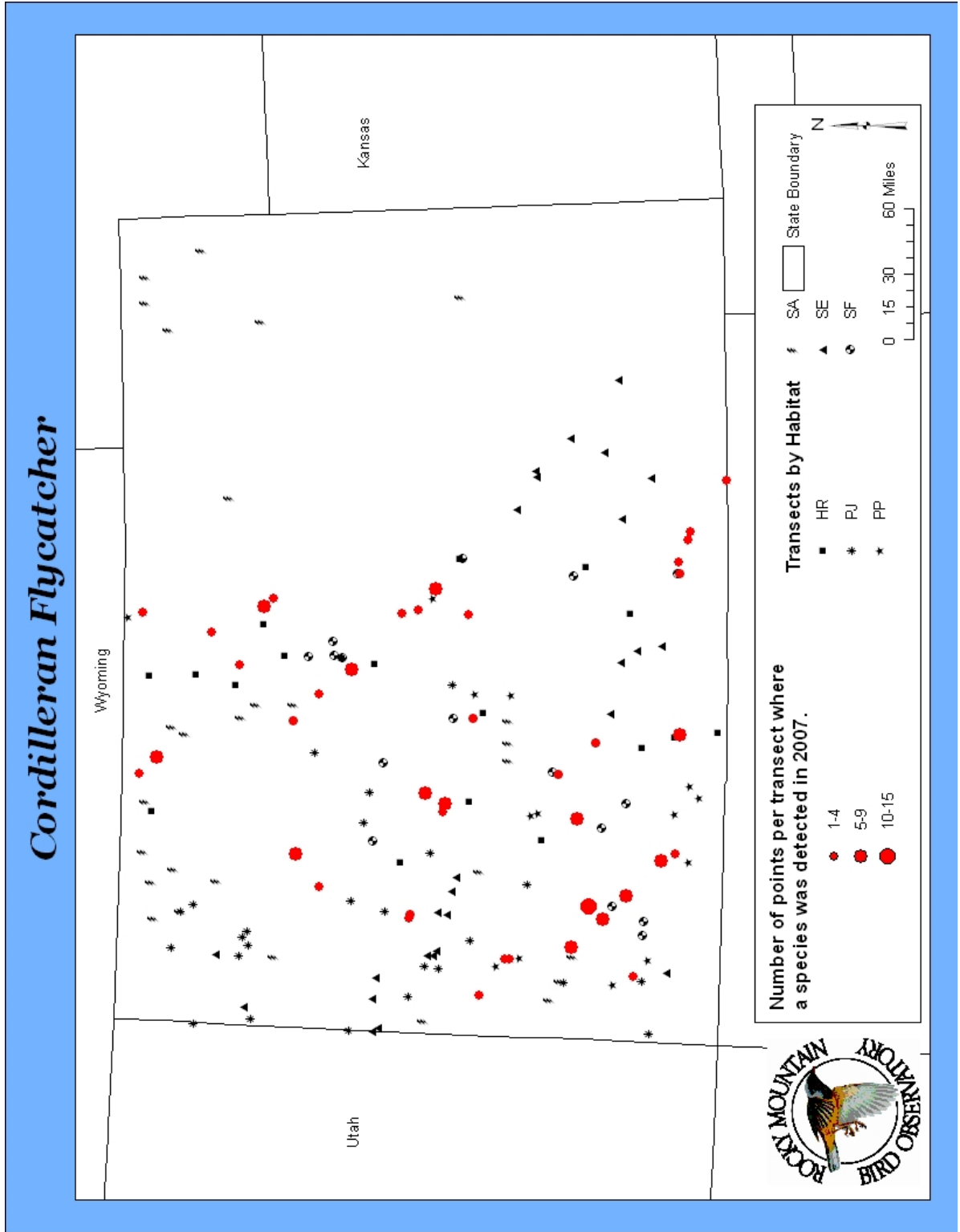
Total number of independent detections, number of individuals, and habitat-specific density estimates for Cordilleran Flycatcher on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	5.6	3.3	9.4	32	27	32
PJ	ID	--	--	--	--	1
PP	4.8	3.1	7.5	27	30	34
SF	12	6.1	22	40	40	46

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Cordilleran Flycatcher, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Cordilleran Flycatcher on transects in Colorado, 2007.

Say's Phoebe
(*Sayornis saya*)

PIF Regional Stewardship Species – BCR 16 & 18

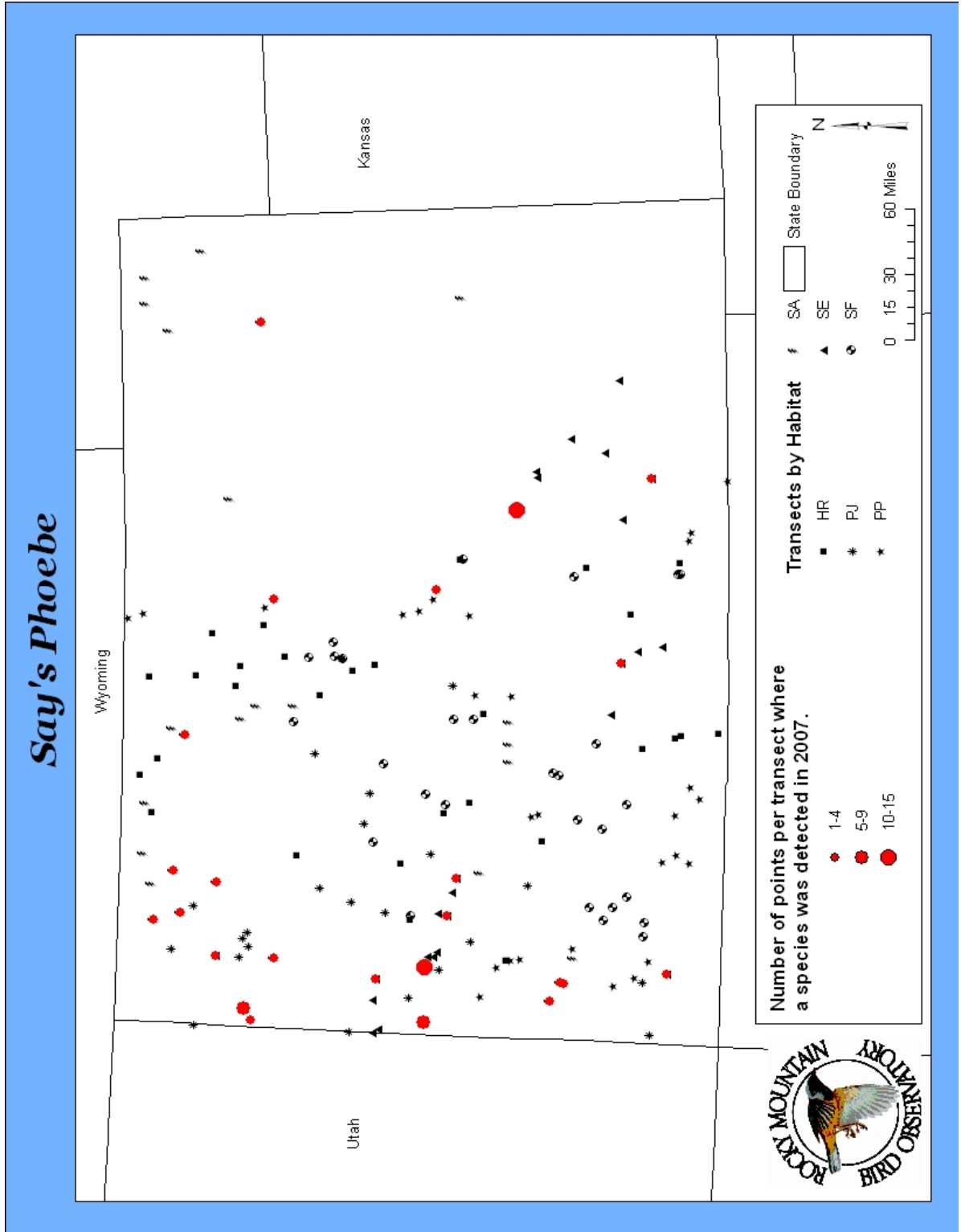
Say's Phoebe nests most frequently in rocky areas where there are niches to hide its nest, as well as in barns or other human structures. This species arrives on its breeding grounds earlier than most other migrants and as a result, we may miss the period when it is most actively singing. In 2007, we detected 39 Say's Phoebes in four habitats.

In a few more seasons, using data from all years, we may be able to calculate a global detection function for this species and thereby generate annual density estimates in semidesert shrubland habitat that can be used for population-trend monitoring. Adding transects, especially in semidesert shrubland habitat, may improve our ability to monitor Say's Phoebe.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Say's Phoebe on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	12
PP	ID	--	--	--	--	2
SA	ID	--	--	--	--	12
SE	ID	--	--	--	--	13

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Say's Phoebe on transects in Colorado, 2007.

Loggerhead Shrike

(*Lanius ludovicianus*)

CDOW - Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 16 & 18

USFS Region 2 Sensitive Species

USFWS Bird of Conservation Concern – Nationally

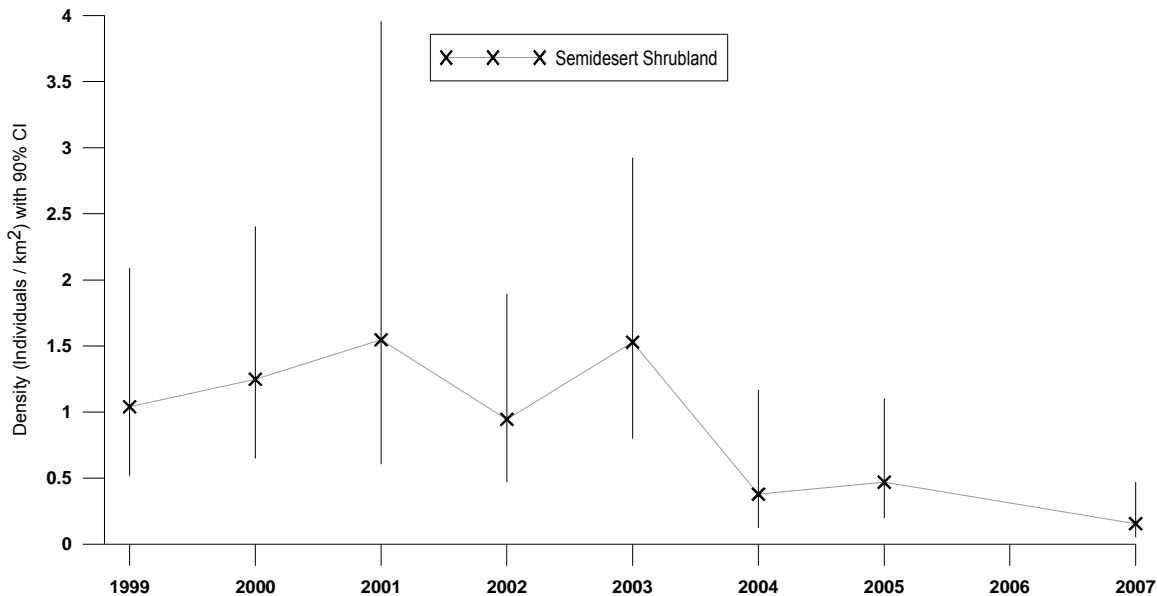
Loggerhead Shrike prefers open country that has shrubs or trees of sufficient size in which to perch and nest. In 2007, we detected 15 Loggerhead Shrikes in two habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Loggerhead Shrike within 30 years in semidesert shrubland habitat using point transect data.

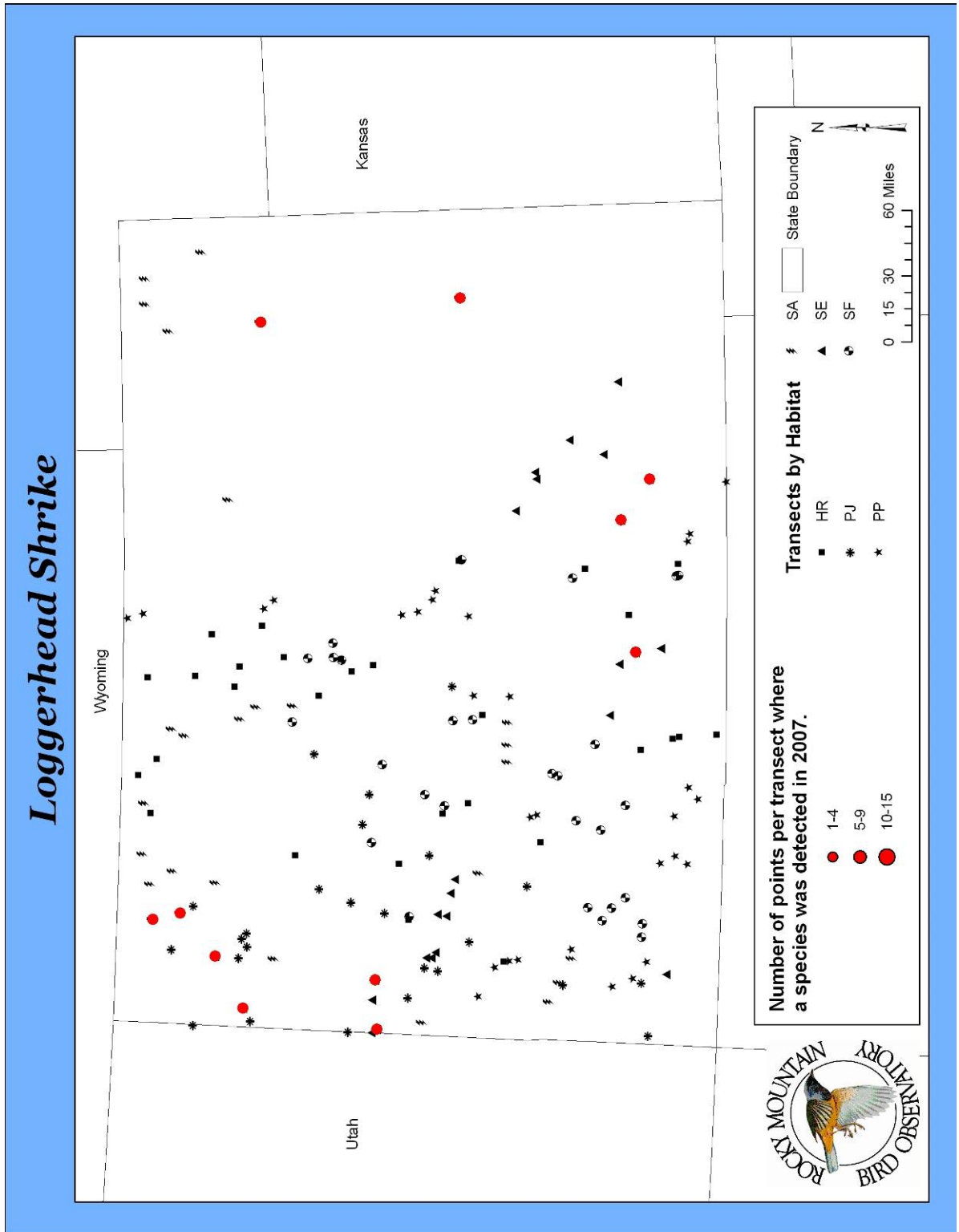
Total number of independent detections, number of individuals, and habitat-specific density estimates for Loggerhead Shrike on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	ID	--	--	--	--	5
SE	0.2	0.1	0.5	73	2	10

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Loggerhead Shrike, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections Loggerhead Shrike on transects in Colorado, 2007.

Gray Vireo

(*Vireo vicinior*)

CDOW - Species of Greatest Conservation Need
 PIF Species of Continental and Regional Concern – BCR 16
 PIF Regional Stewardship Species – BCR 16
 USFWS Bird of Conservation Concern – Nationally

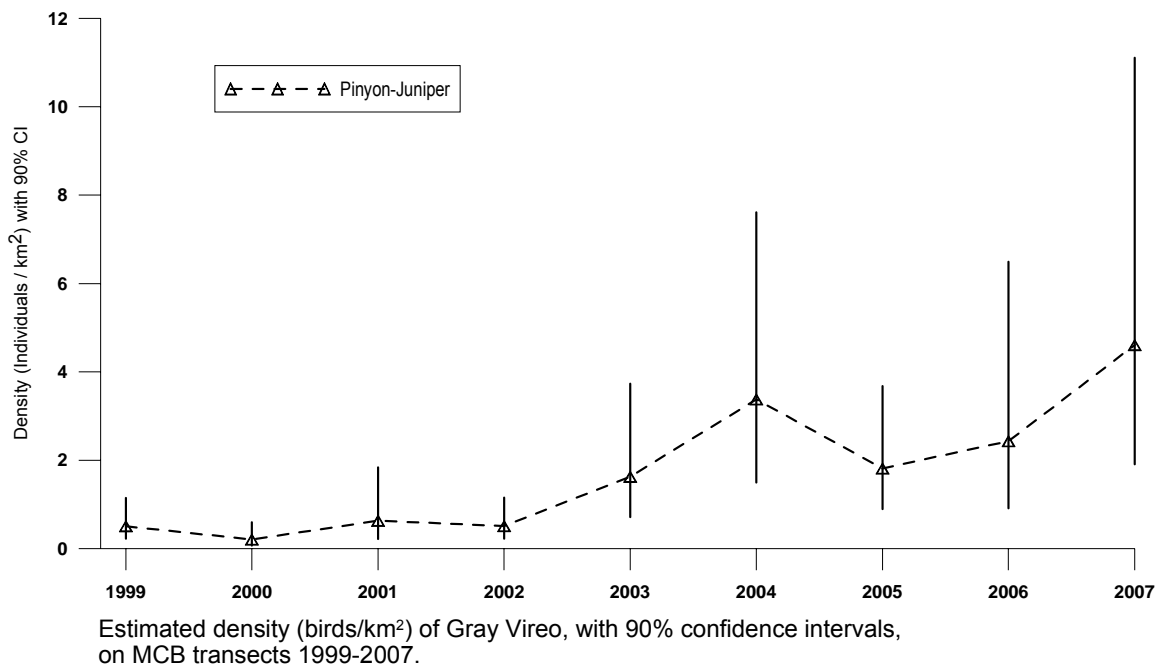
Gray Vireo nests exclusively in pinyon-juniper habitat with abundant shrubs. Possibly it nests only in low-elevation pinyon-juniper, which may explain why it is not encountered more frequently on MCB transects. In 2007, we detected 45 Gray Vireos in three habitats.

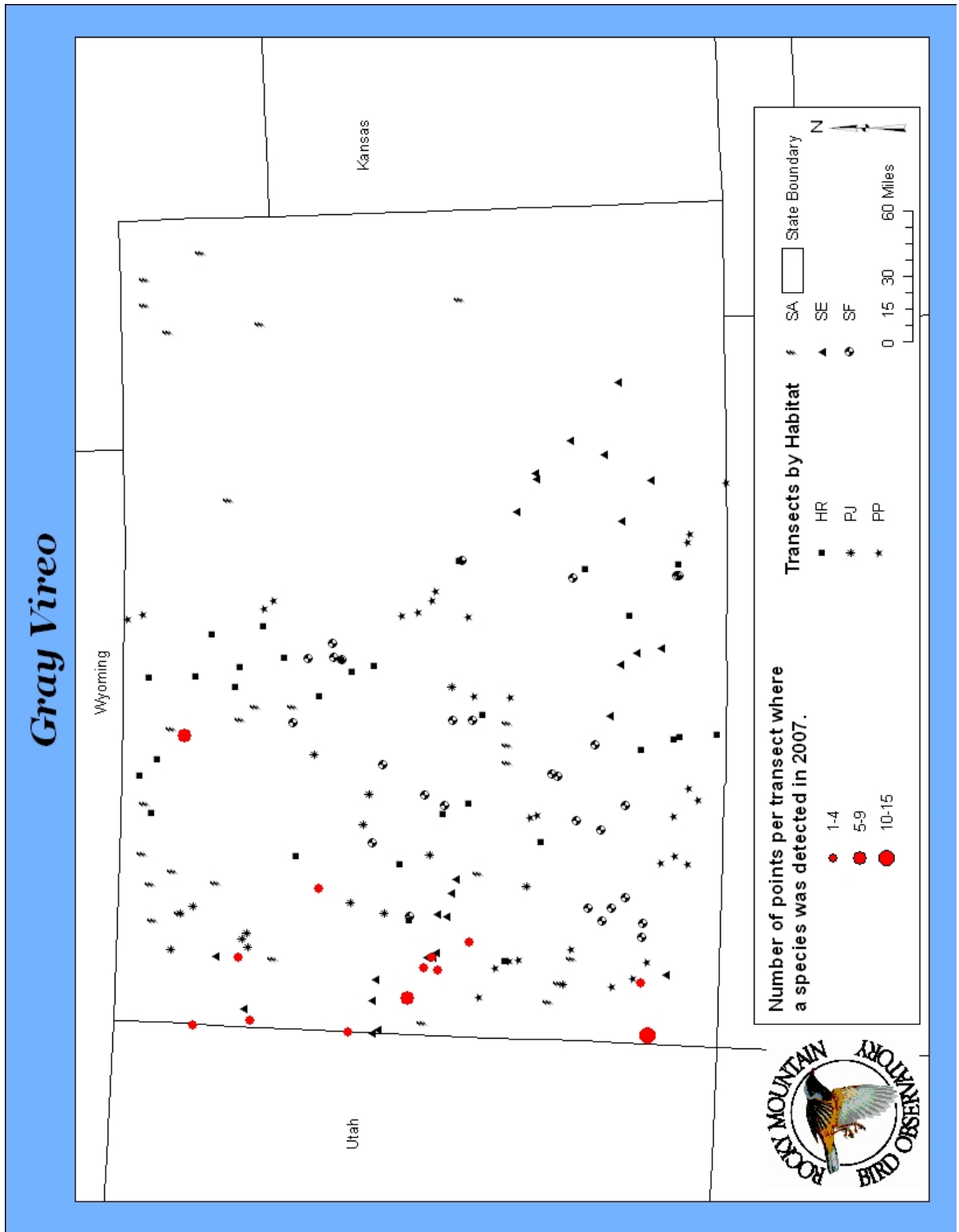
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Gray Vireo within 40 years in pinyon-juniper habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Gray Vireo on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	4.6	1.9	11	55	38	41
SA	ID	--	--	--	--	3
SE	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Gray Vireo on transects in Colorado, 2007.

Plumbeous Vireo
(*Vireo plumbeous*)
PIF Regional Stewardship Species – BCR 16

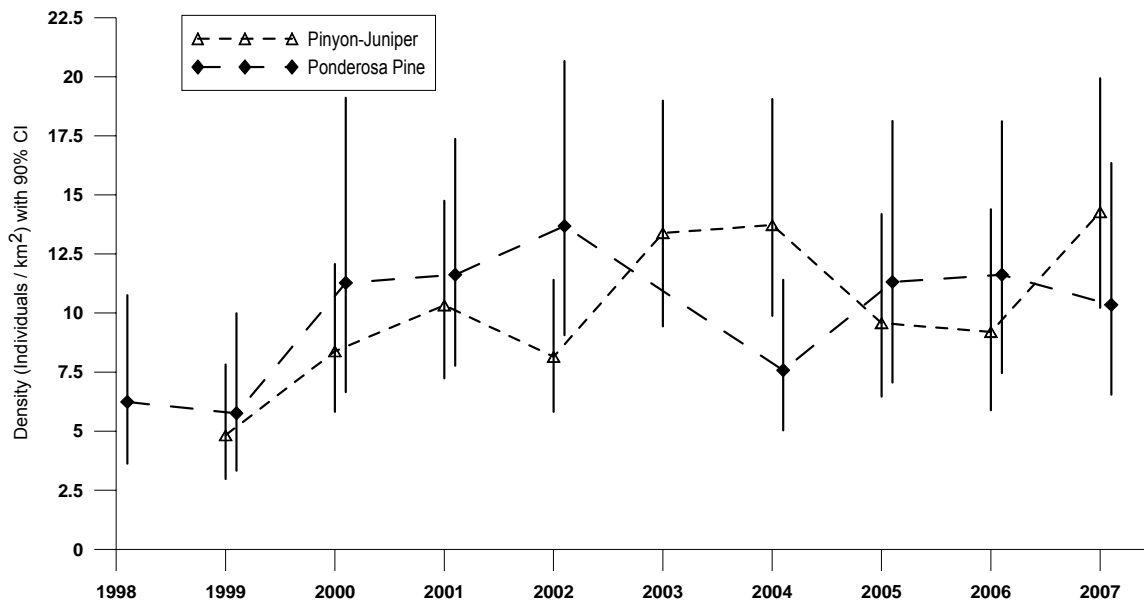
Plumbeous Vireo nests in a variety of habitats, including pinyon-juniper, ponderosa pine, and low-elevation riparian habitat in cottonwood galleries on the west side of the state. Its range rarely overlaps with Gray Vireo, as it prefers higher elevations. In 2007, we detected 213 Plumbeous Vireos in three habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Plumbeous Vireo within 20 years in pinyon-juniper habitat and within 25 years in ponderosa pine habitat.

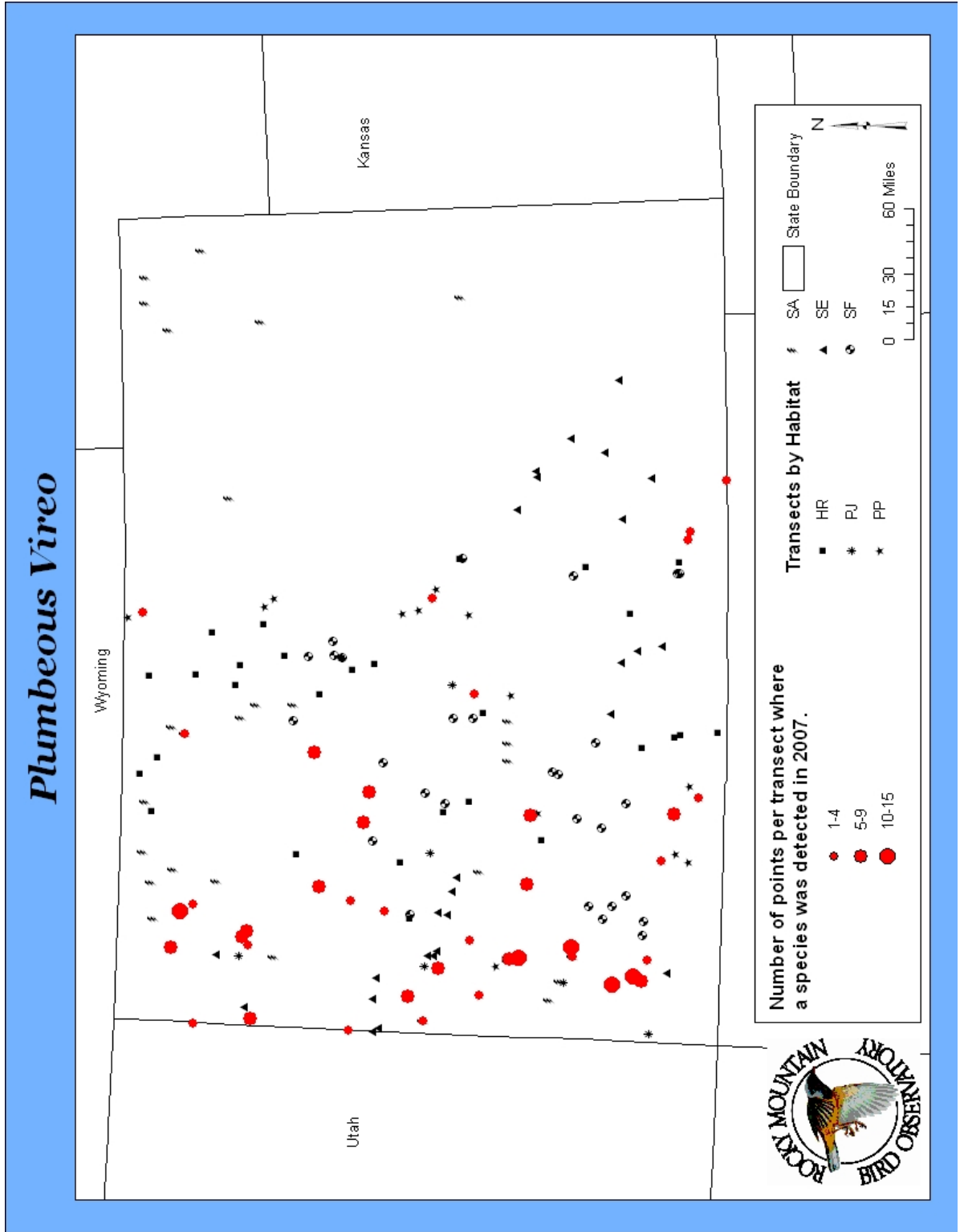
Total number of independent detections, number of individuals, and habitat-specific density estimates for Plumbeous Vireo on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	14	10	20	20	84	129
PP	10	6.5	16	28	66	81
SA	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Plumbeous Vireo, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Plumbeous Vireo on transects in Colorado, 2007.

Warbling Vireo
(*Vireo gilvus*)
PIF Regional Stewardship Species – BCR 16

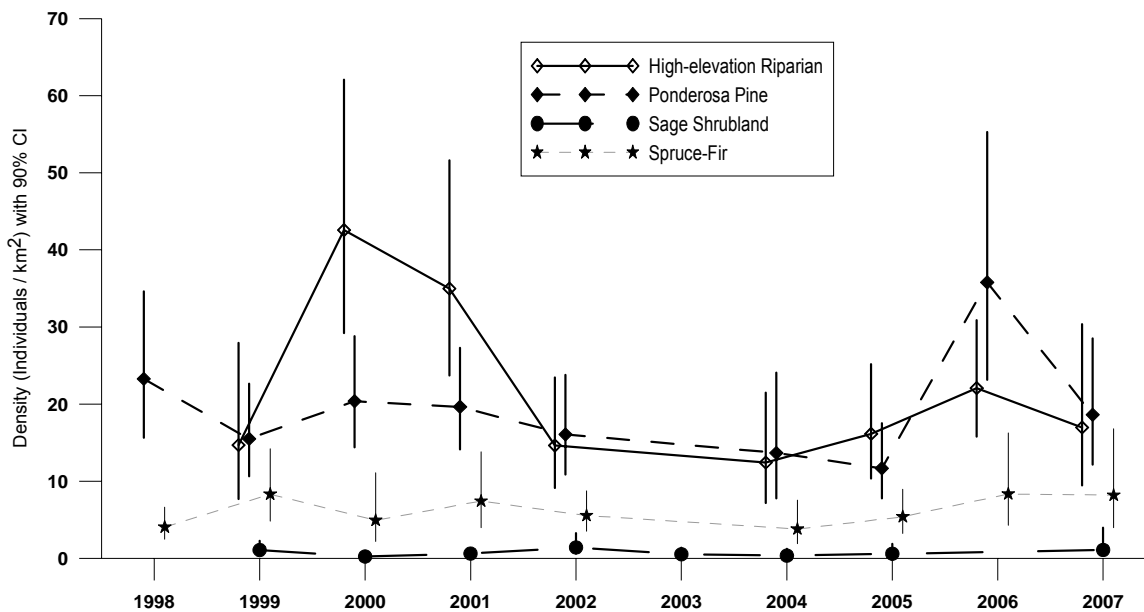
Warbling Vireo nests in habitats with deciduous trees or tall deciduous shrubs. In 2007, we detected 388 Warbling Vireos in five habitats on MCB transects and calculated density estimates in four habitats.

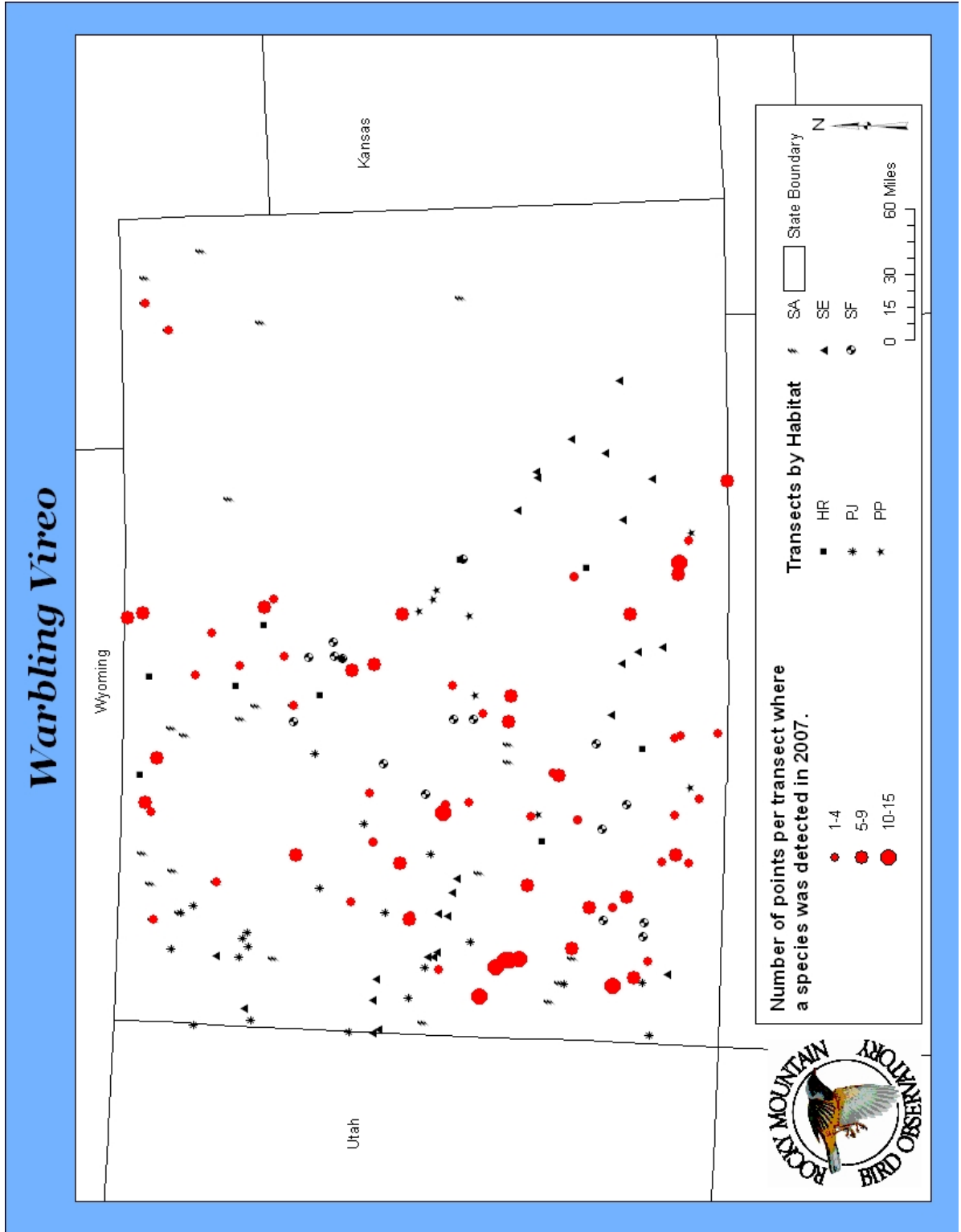
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Warbling Vireo within 25 years in high-elevation riparian and ponderosa pine habitats, within 30 years in spruce-fir habitat using point transect data, and within 40 years in sage shrubland habitat.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Warbling Vireo on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	17	9.5	30	36	116	124
PJ	ID	--	--	--	--	10
PP	19	12	29	26	160	172
SA	1.1	0.3	4.0	88	15	32
SF	8.2	4.0	17	44	45	52

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Warbling Vireo on transects in Colorado, 2007.

Pinyon Jay

(*Gymnorhinus cyanocephalus*)

CDOW - Species of Greatest Conservation Need

PIF Species of Continental and Regional Concern – BCR 16

PIF Continental and Regional Stewardship Species – BCR 16

PIF Species of Continental Concern – BCR 18

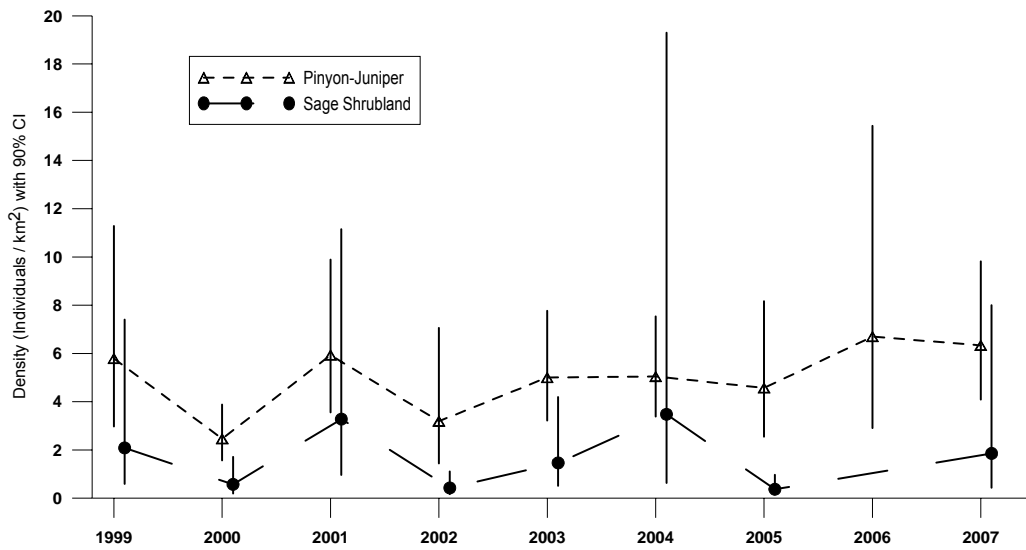
Pinyon Jay breeds almost exclusively in pinyon-juniper habitat, where the species is important to the overall health of pinyon pines because it caches large amounts of seeds. Pinyon Jays frequently travel in large flocks and it is unusual to observe a single individual. In 2007, we detected 180 Pinyon Jays in four habitats and calculated a density estimate for pinyon-juniper and sage shrubland on MCB.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Pinyon Jay within 30 years in pinyon-juniper habitat using point transect data.

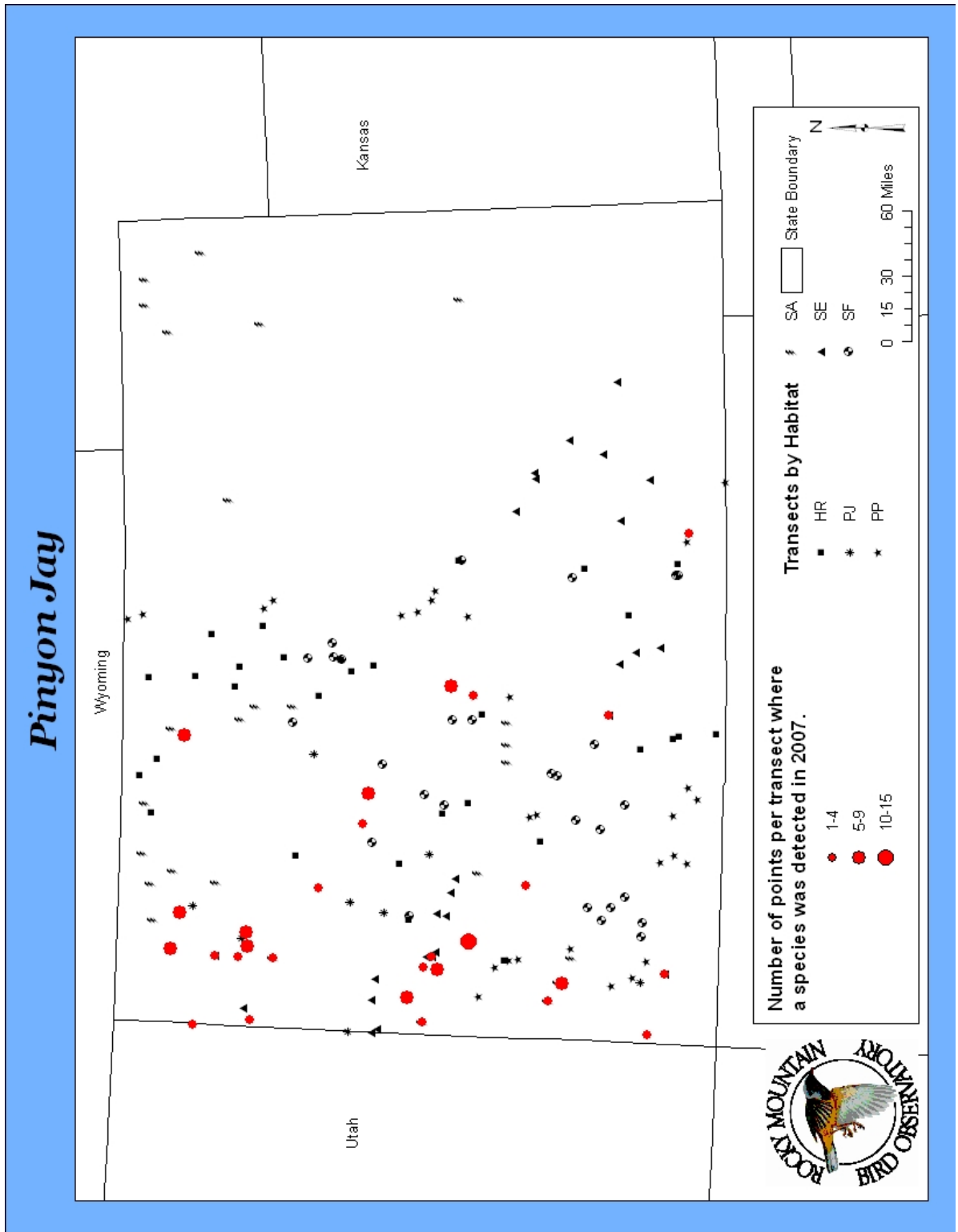
Total number of independent detections, number of individuals, and habitat-specific density estimates for Pinyon Jay on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	6.3	4.1	9.8	27	67	134
PP	ID	--	--	--	--	3
SA	1.8	0.4	8.0	96	5	34
SE	ID	--	--	--	--	9

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Pinyon Jay, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Pinyon Jay on transects in Colorado, 2007.

Clark's Nutcracker

(*Nucifraga Columbiana*)

PIF Continental and Regional Stewardship Species – BCR 16

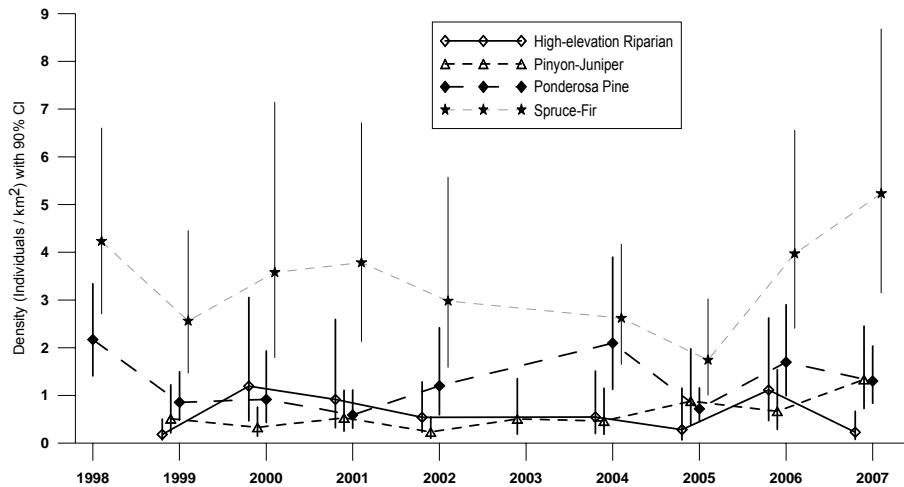
Clark's Nutcracker nests in all coniferous habitats, but outside of the breeding season it travels widely in search of food. In 2007, we detected 154 Clark's Nutcrackers in five habitats and calculated density estimates in high-elevation riparian, pinyon-juniper, ponderosa pine, and spruce-fir habitats on MCB transects.

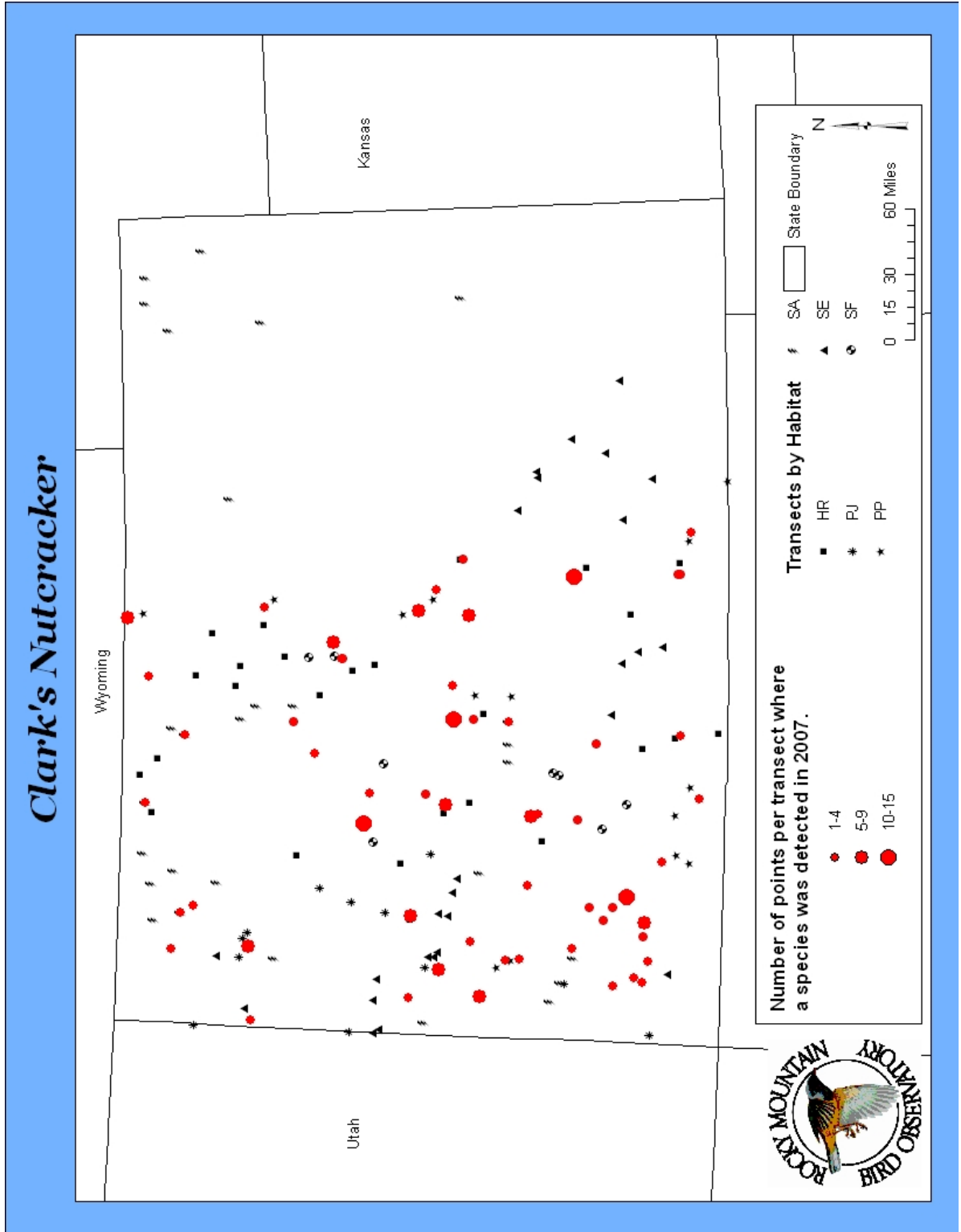
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Clark's Nutcracker within 25 years in ponderosa pine and spruce-fir habitats, within 30 years in pinyon-juniper habitat, and more than 40 years in high-elevation riparian habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Clark's Nutcracker on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	0.2	0.1	0.7	71	4	7
PJ	1.3	0.7	2.5	37	23	35
PP	1.3	0.8	2.0	27	28	31
SA	ID	--	--	--	--	3
SF	5.2	3.2	8.7	31	50	78

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Clark's Nutcracker on transects in Colorado, 2007.

Black-billed Magpie
(*Pica hudsonia*)
PIF Regional Stewardship Species – BCR 16

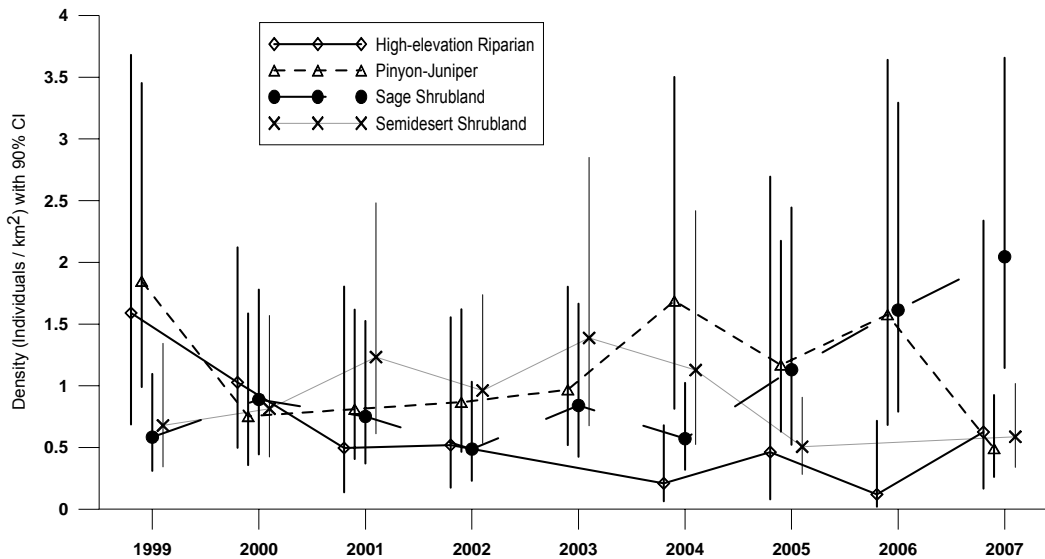
Black-billed Magpie requires a supply of mud, which it uses to construct large nests that will last for years. Abandoned nests are often used by other species, including Great Horned and Long-eared Owls (Righter et al. 2004). In 2007, we detected 129 Black-billed Magpies in six habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Black-billed Magpie within 30 years in pinyon-juniper, sage shrubland, and semidesert shrubland habitats, and more than 40 years in high-elevation riparian using point transect data.

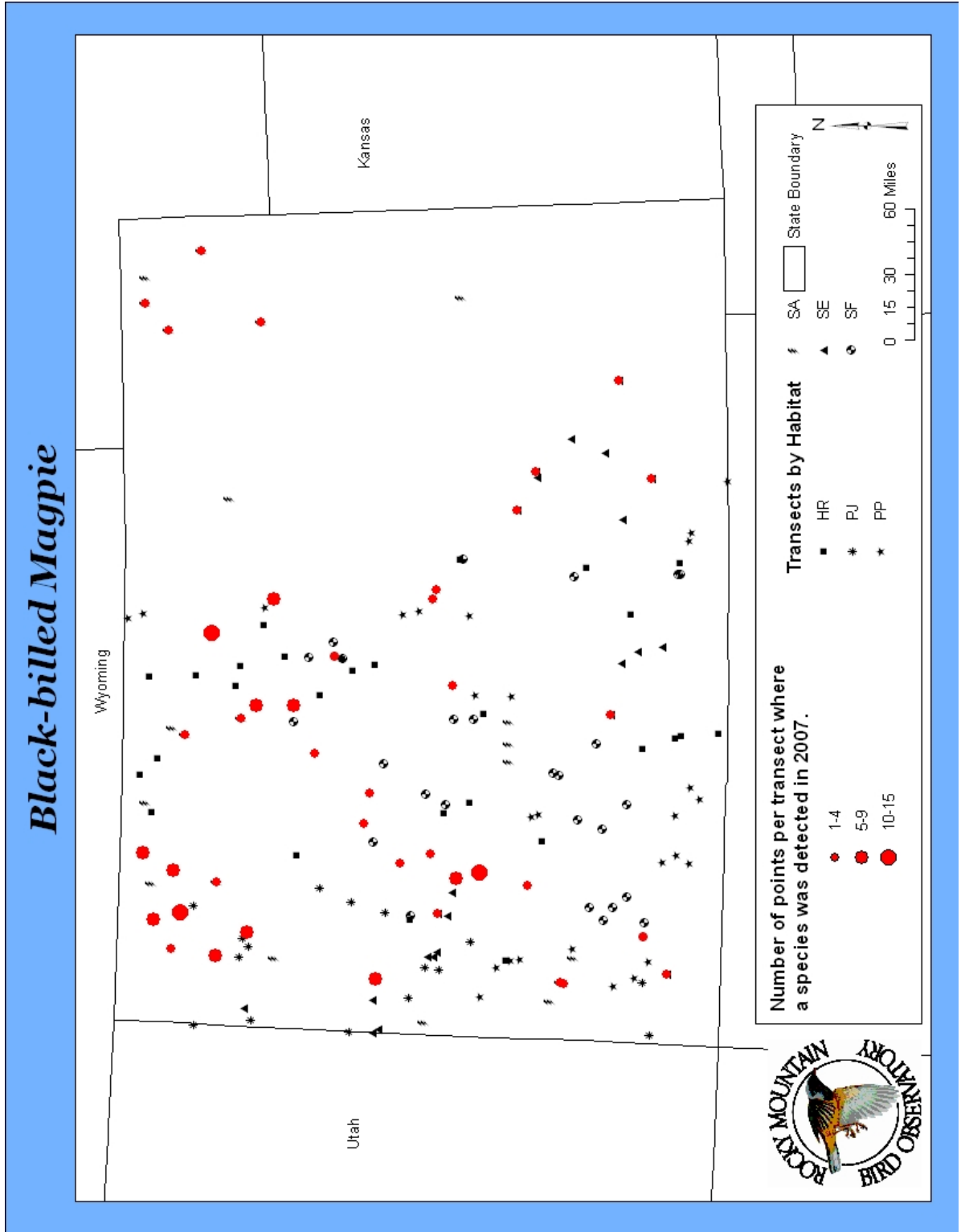
Total number of independent detections, number of individuals, and habitat-specific density estimates for Black-billed Magpie on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	0.6	0.2	2.3	91	10	11
PJ	0.5	0.3	0.9	39	10	17
PP	ID	--	--	--	--	8
SA	2.0	1.1	3.7	36	47	62
SE	0.6	0.3	1.0	34	23	29
SF	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Black-billed Magpie, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Black-billed Magpie on transects in Colorado, 2007.

Chihuahuan Raven
 (Corvus cryptoleucus)
 PIF Regional Stewardship Species – BCR 18

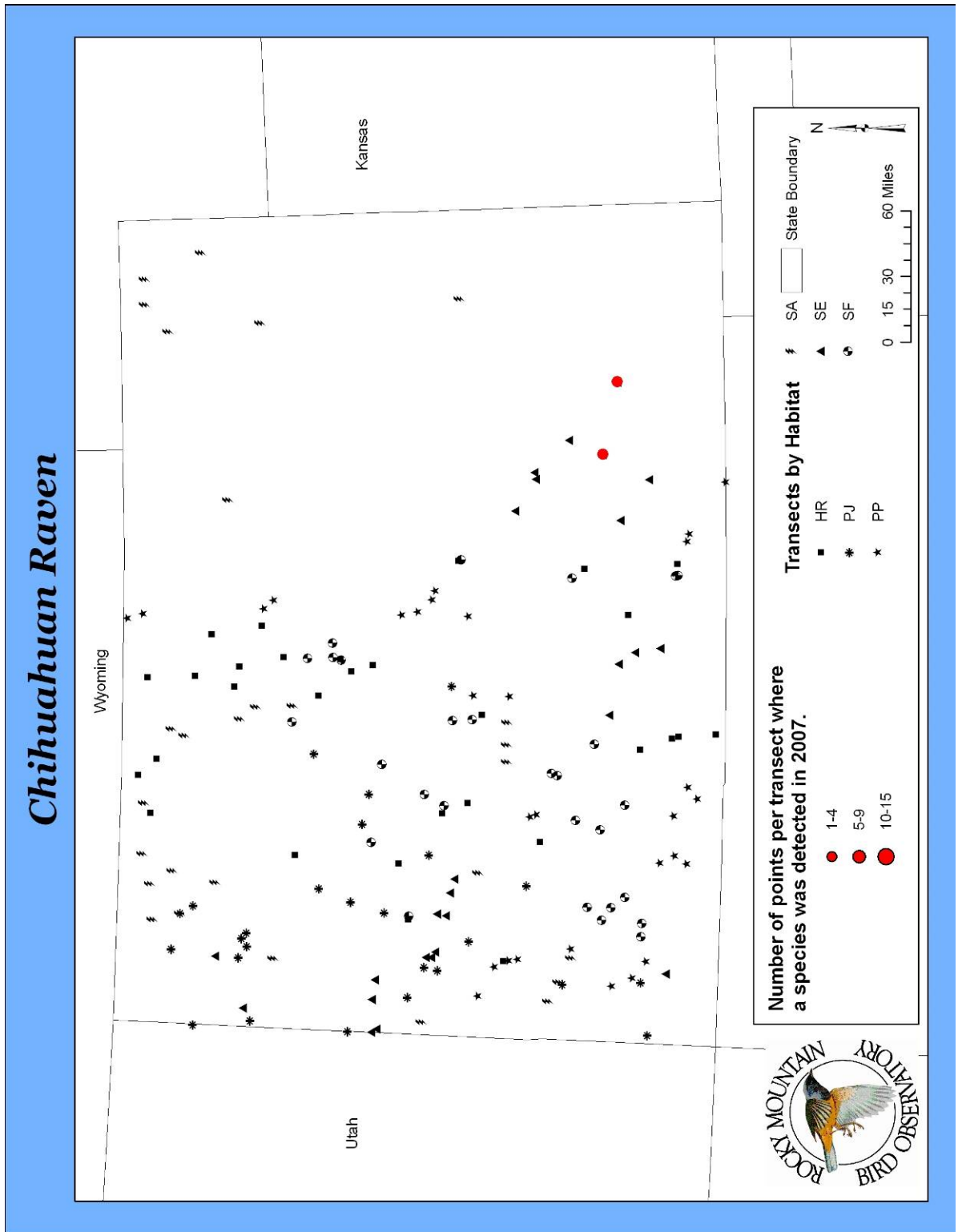
Chihuahuan Raven breeds in southeast Colorado and often nests on windmills or power poles. We detected 3 Chihuahuan Ravens in semidesert shrubland habitat in 2007.

Chihuahuan Raven is difficult to monitor under MCB using the point-transect protocol, because of its low density and large territory size. Alternatively, locating and monitoring Chihuahuan Raven nests could be incorporated into the MCB special species program in a cost-effective manner, especially if combined with similar efforts for prairie-nesting raptor species (e.g., Ferruginous Hawk).

Total number of independent detections, number of individuals, and habitat-specific density estimates for Chihuahuan Raven on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SE	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Chihuahuan Raven on transects in Colorado, 2007.

Purple Martin

(*Progne subis*)

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

*Also see special species section

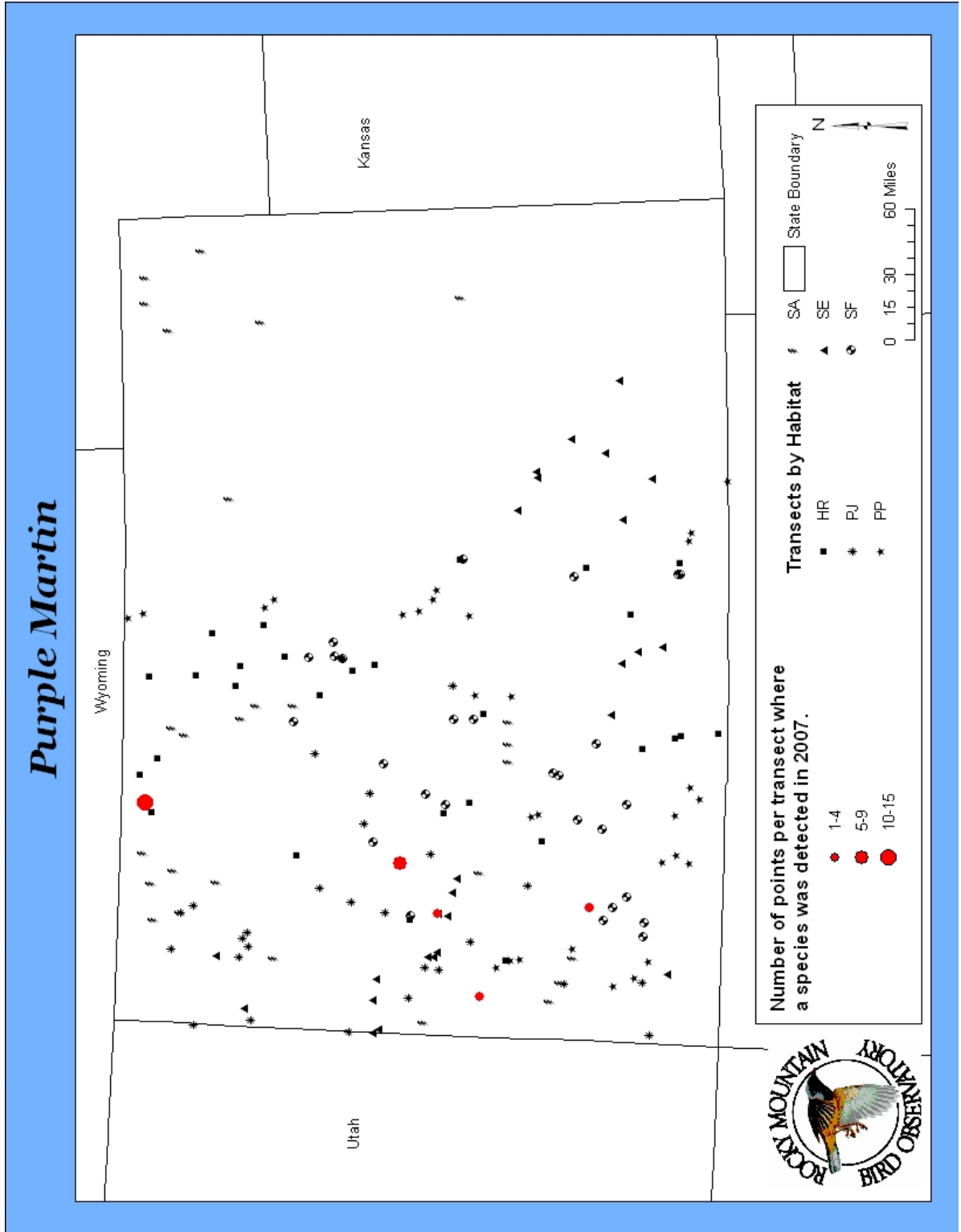
In Colorado, Purple Martin breeds near open meadows in old-growth aspen, usually near water (Righter et al. 2004). We detected 12 Purple Martins in five habitats in 2007. Nine of these detections were from low-elevation habitats where the species does not breed and were, therefore, migrants or birds foraging far from nesting locations.

Purple Martin can not be adequately monitored using the point-transect protocol. The MCB special species program, however, has gathered a large amount of information on this species since 1998. During the first Colorado breeding bird atlas, 24 breeding locations were found for the species and as a result of the MCB special species program, there are 136 known colonies today. This effort, which is the result of collaboration between RMBO staff and volunteers, and agency cooperators, illustrates the effectiveness of the special species program. With adequate funding and a statistically viable monitoring plan, Purple Martins could be monitored in Colorado under the MCB special species program.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Purple Martin on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	2
PP	ID	--	--	--	--	1
SA	ID	--	--	--	--	3
SE	ID	--	--	--	--	3
SF	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Purple Martin on transects in Colorado, 2007.

Violet-green Swallow
(*Tachycineta thalassina*)
PIF Regional Stewardship Species – BCR 16

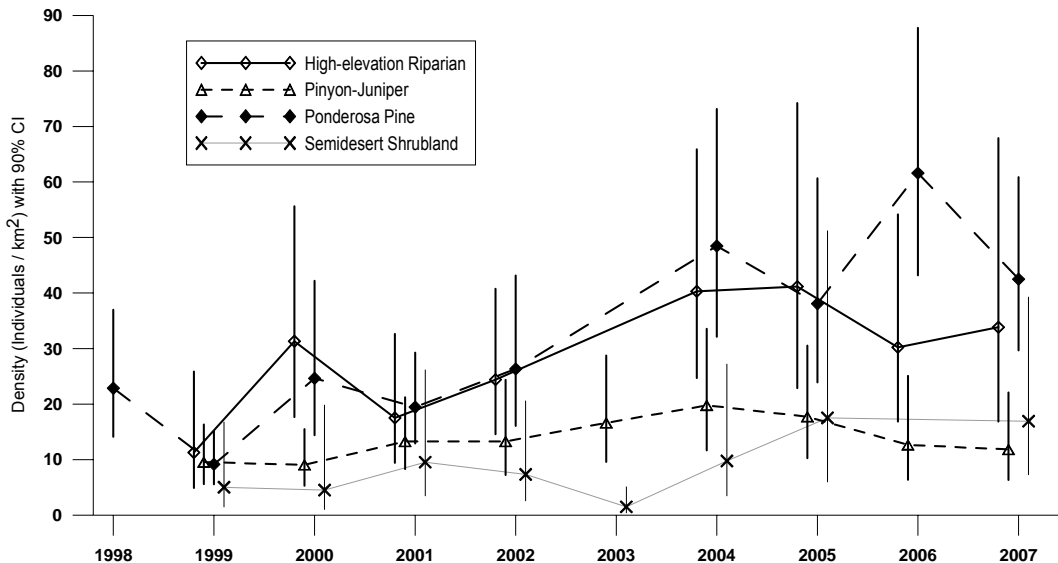
Violet-green Swallow often nests on cliffs, sometimes near White-throated Swifts. It also will nest in aspen stands, often with Tree Swallows, or in ponderosa pine snags. We detected 353 Violet-green Swallows in six habitats on MCB transects and calculated density estimates for four habitats in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Violet-green Swallow within 20 years in ponderosa pine habitat and within 30 years in high-elevation riparian and pinyon-juniper habitats using point transect data.

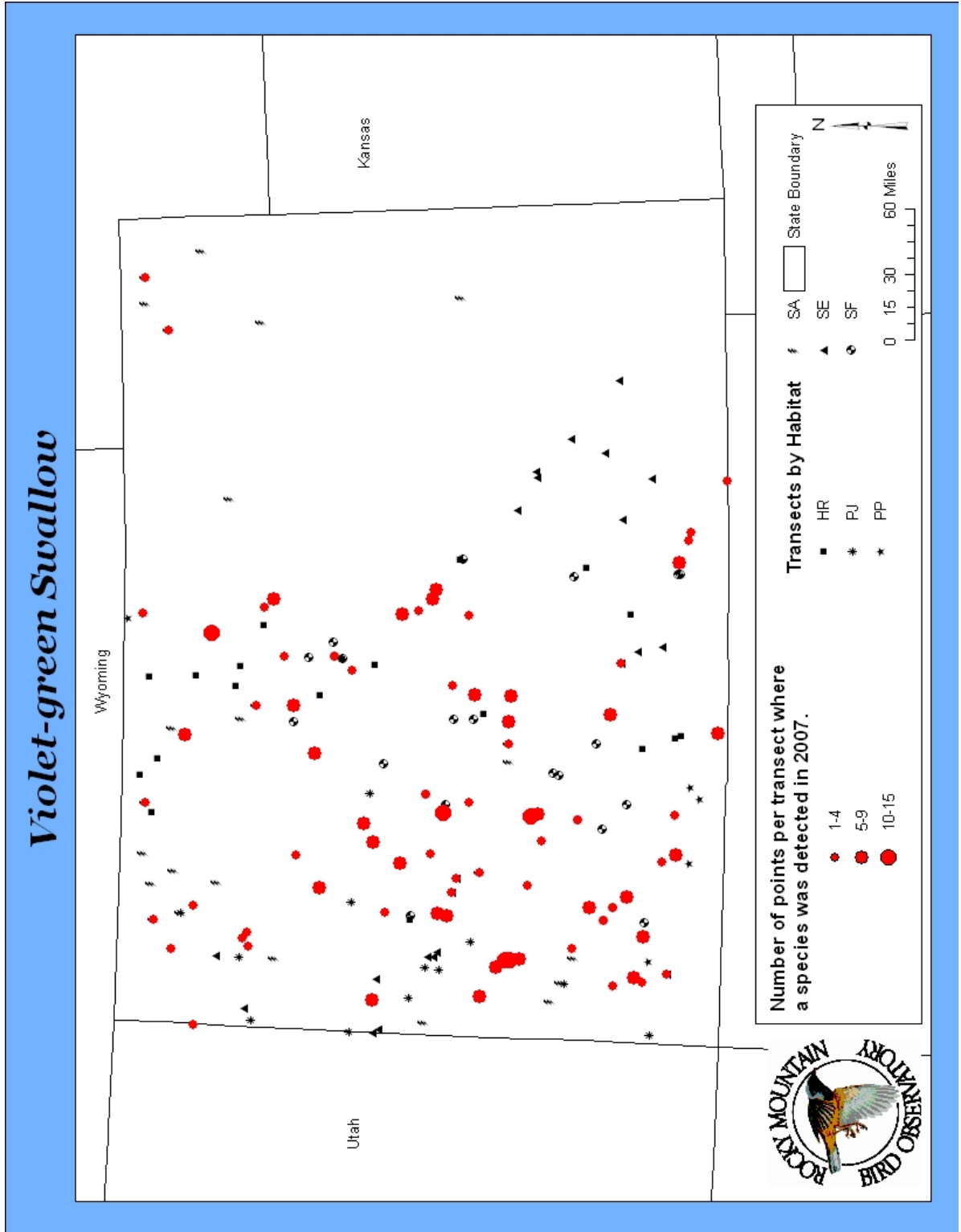
Total number of independent detections, number of individuals, and habitat-specific density estimates for Violet-green Swallow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	34	17	68	43	49	81
PJ	12	6.3	22	38	22	47
PP	43	30	61	22	103	142
SA	ID	--	--	--	--	19
SE	17	7.3	39	54	22	39
SF	ID	--	--	--	--	25

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Violet-green Swallow, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Violet-green Swallow on transects in Colorado, 2007.

Juniper Titmouse
 (Baeolophus ridgwayi)
 CDOW - Species of Greatest Conservation Need
 PIF Species of Regional Concern – BCR 16
 PIF Regional Stewardship Species – BCR16

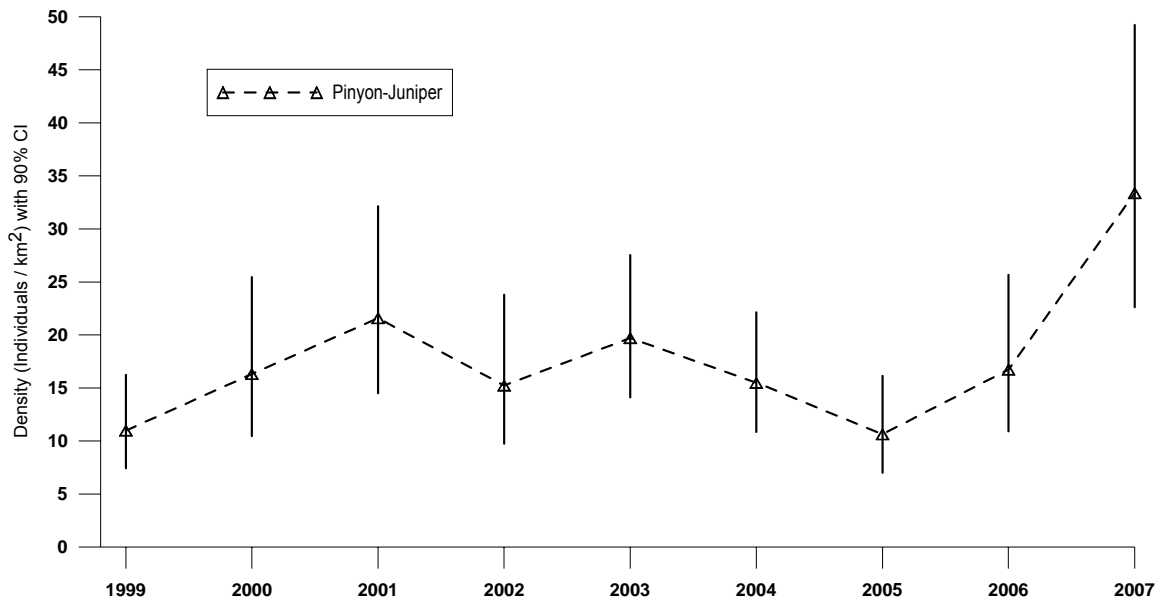
Juniper Titmouse is a pinyon-juniper specialist, rarely found in other habitats. The species nests in natural cavities or cavities excavated by other species. We detected 105 Juniper Titmice in two habitats on MCB transects in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Juniper Titmouse within 25 years in pinyon-juniper habitat using point transect data.

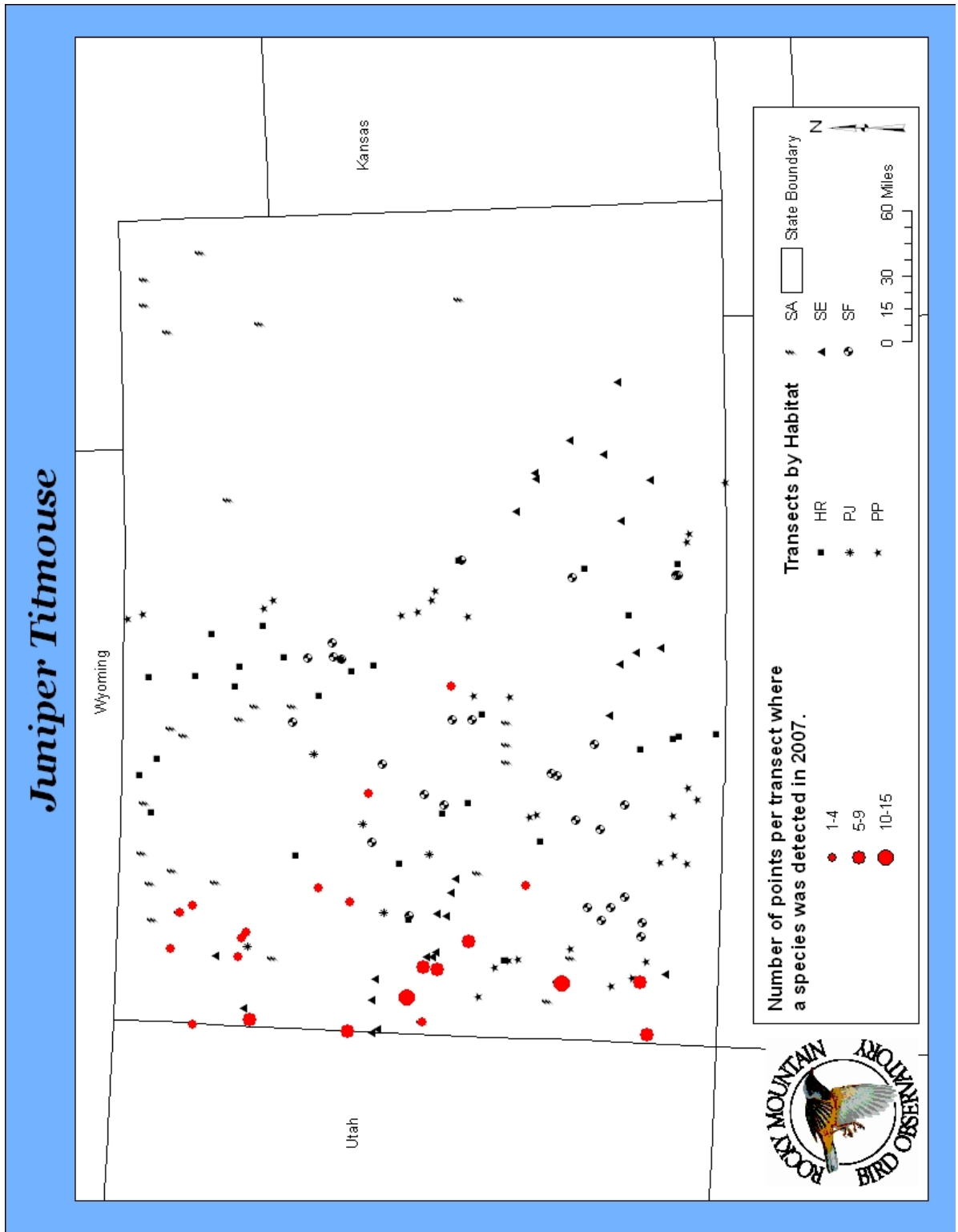
Total number of independent detections, number of individuals, and habitat-specific density estimates for Juniper Titmouse on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	33	23	49	23	88	104
SA	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Juniper Titmouse, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Juniper Titmouse on transects in Colorado, 2007.

Pygmy Nuthatch

(*Sitta pygmaea*)

CDOW – Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 16

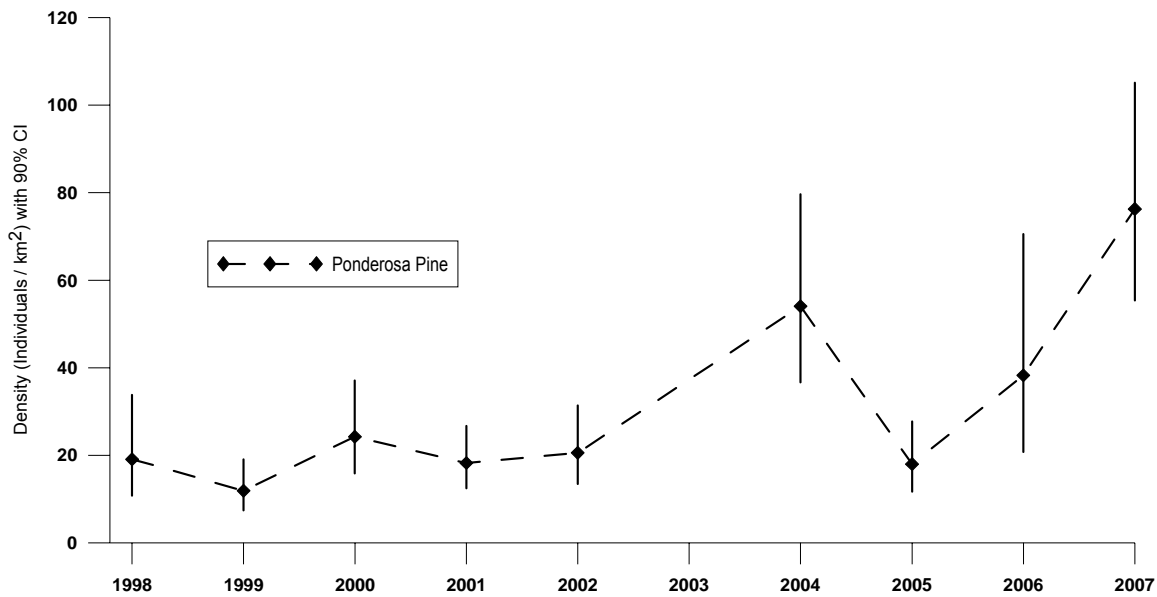
Pygmy Nuthatch is found primarily in ponderosa pine habitat, where it commonly nests in ponderosa pine snags. In 2007, we detected 411 Pygmy Nuthatches in two habitats and were able to calculate a density estimate in ponderosa pine habitat on MCB.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Pygmy Nuthatch within 30 years in ponderosa pine habitat using point transect data.

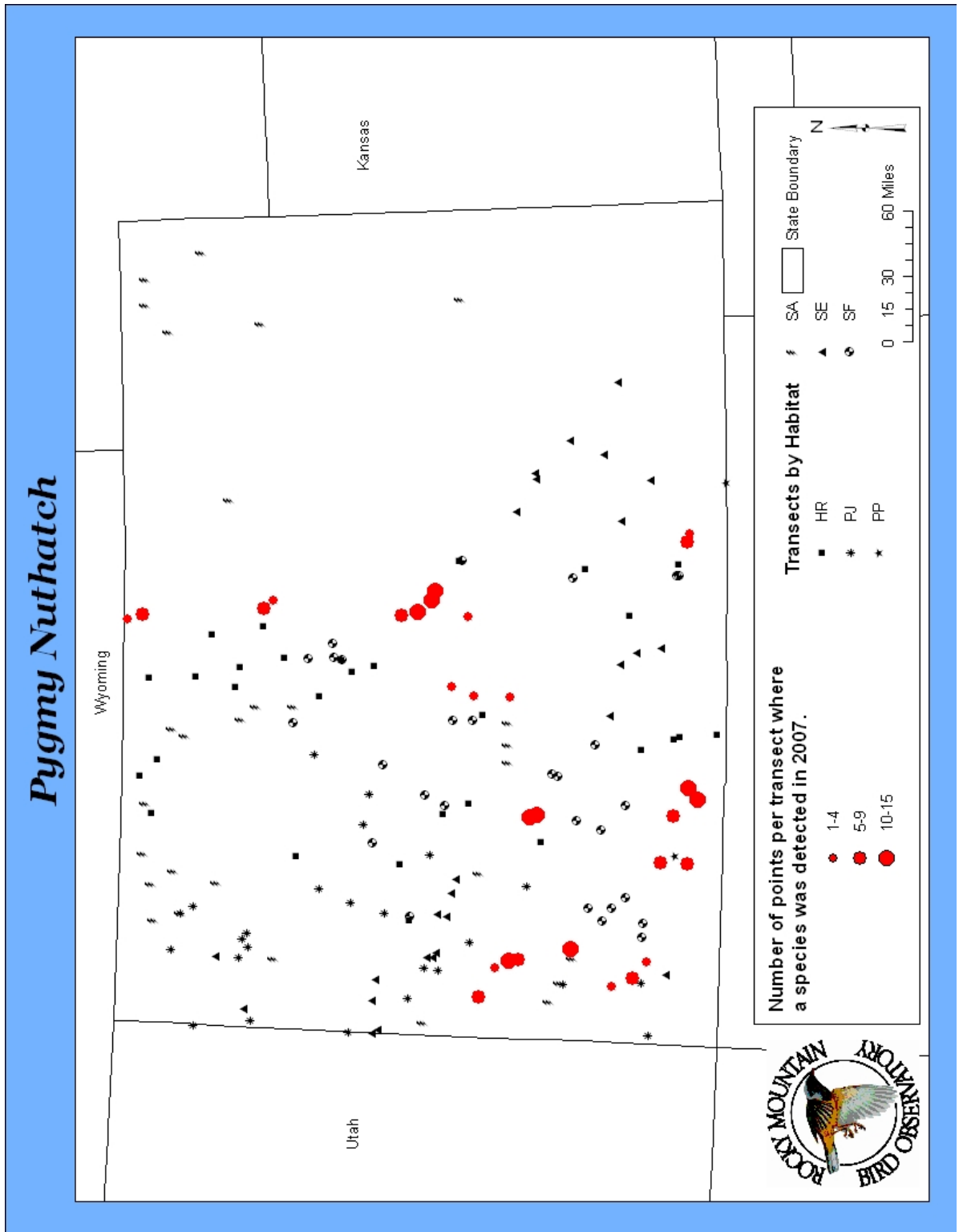
Total number of independent detections, number of individuals, and habitat-specific density estimates for Pygmy Nuthatch on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	1
PP	76	55	105	19	223	422

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Pygmy Nuthatch, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Pygmy Nuthatch on transects in Colorado, 2007.

Rock Wren
(*Salpinctes obsoletus*)
PIF Regional Stewardship Species – BCR 16

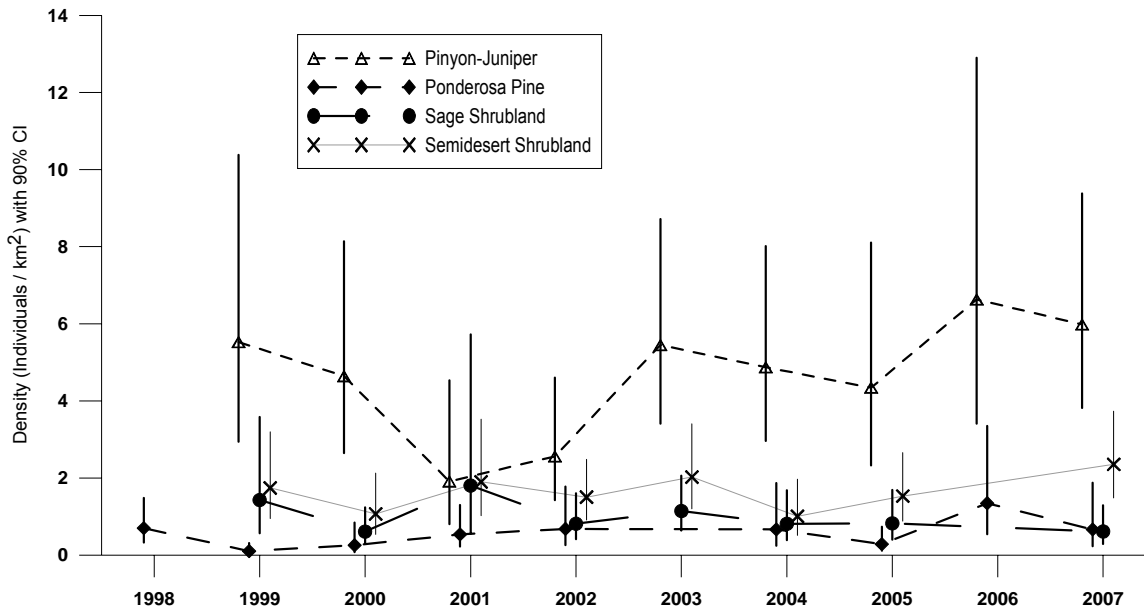
Rock Wren is found in arid or semi-arid habitat, in rocky canyons, on rock slides and boulder-strewn slopes, and in arroyos with sparse vegetation. In 2007, we detected 171 Rock Wrens in five habitats on MCB transects and were able to calculate a density estimate in pinyon-juniper, ponderosa pine, sage shrubland, and semidesert shrubland habitats.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Rock Wren within 25 years in Semidesert Shrubland habitat, within 30 years in pinyon-juniper and sage shrubland habitats, and within 40 years in ponderosa pine habitat.

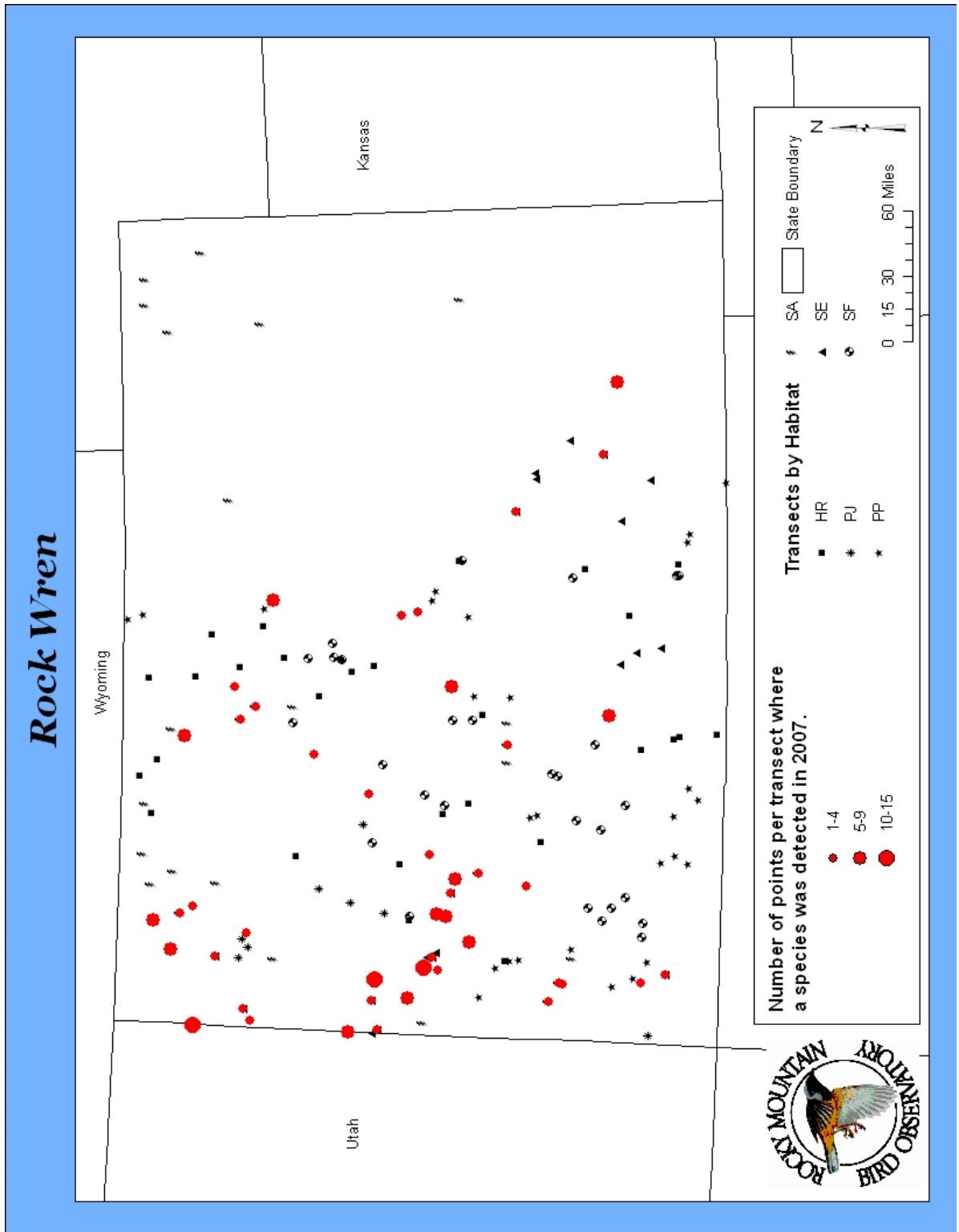
Total number of independent detections, number of individuals, and habitat-specific density estimates for Rock Wren on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	3
PJ	6.0	3.8	9.4	27	54	76
PP	0.7	0.2	1.9	67	12	13
SA	0.6	0.3	1.3	46	11	20
SE	2.4	1.5	3.7	28	52	59

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Rock Wren, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Rock Wren on transects in Colorado, 2007.

Canyon Wren
 (Catherpes mexicanus)
 PIF Species of Regional Concern – BCR 16

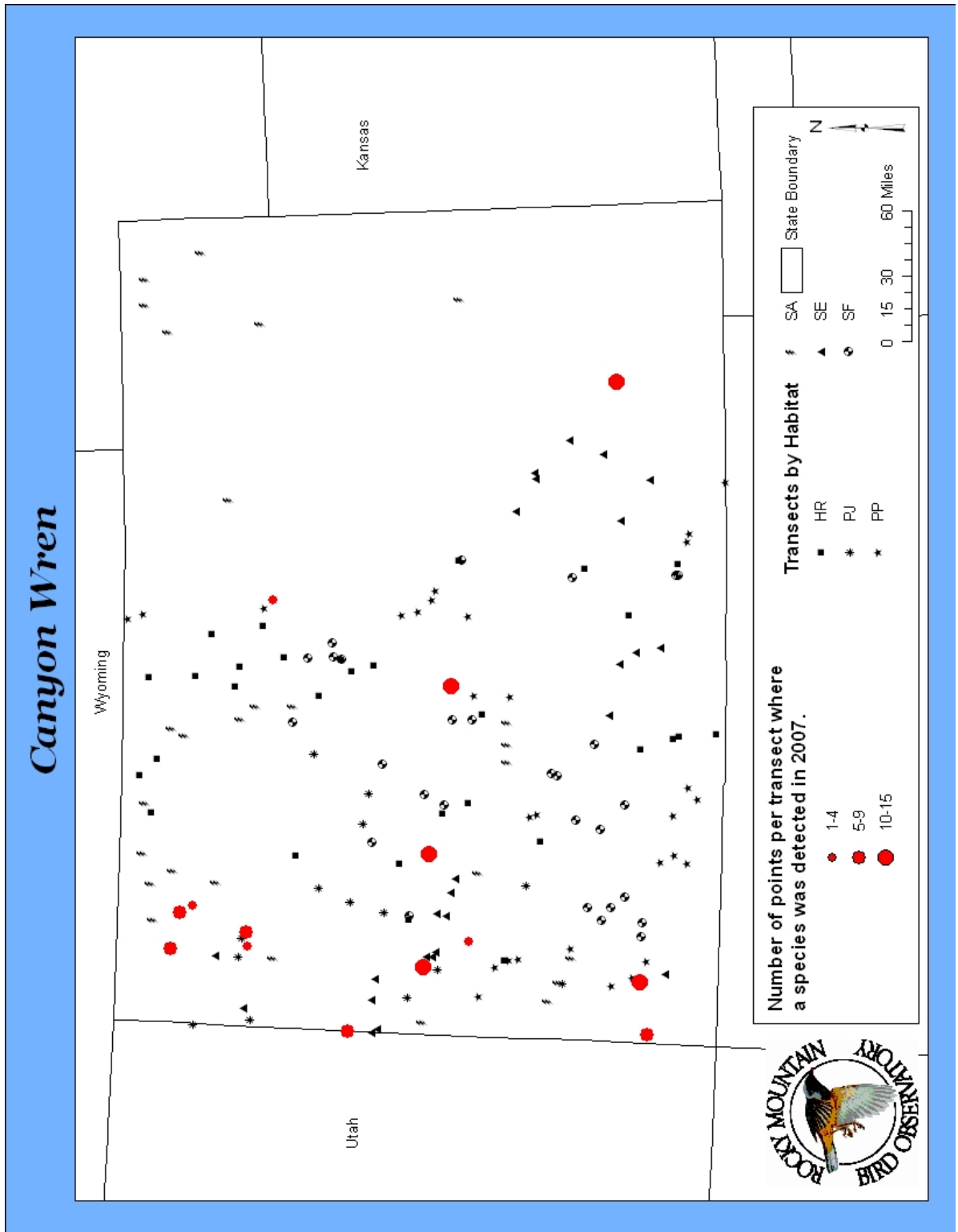
Canyon Wren breeds in rocky areas with plenty of vertical surfaces with crevices in which to nest and search for prey. In 2007, we detected 31 Canyon Wrens in three habitats on MCB transects.

We detect the species every year in low numbers in several habitats on the MCB project. Canyon Wren is too rare and localized in Colorado to be adequately monitored by point transects in any habitat. However, in a few more seasons, using data from all years, we may be able to calculate a global detection function for this species and thereby generate annual density estimates in at least pinyon-juniper habitat that can be used for population-trend monitoring. Adding transects, especially in pinyon-juniper habitat, may improve our ability to monitor Canyon Wren.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Canyon Wren on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	27
PP	ID	--	--	--	--	1
SE	ID	--	--	--	--	3

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Canyon Wren on transects in Colorado, 2007.

Bewick's Wren

(*Thryomanes bewickii*)

USFWS Bird of Conservation Concern – BCR 16

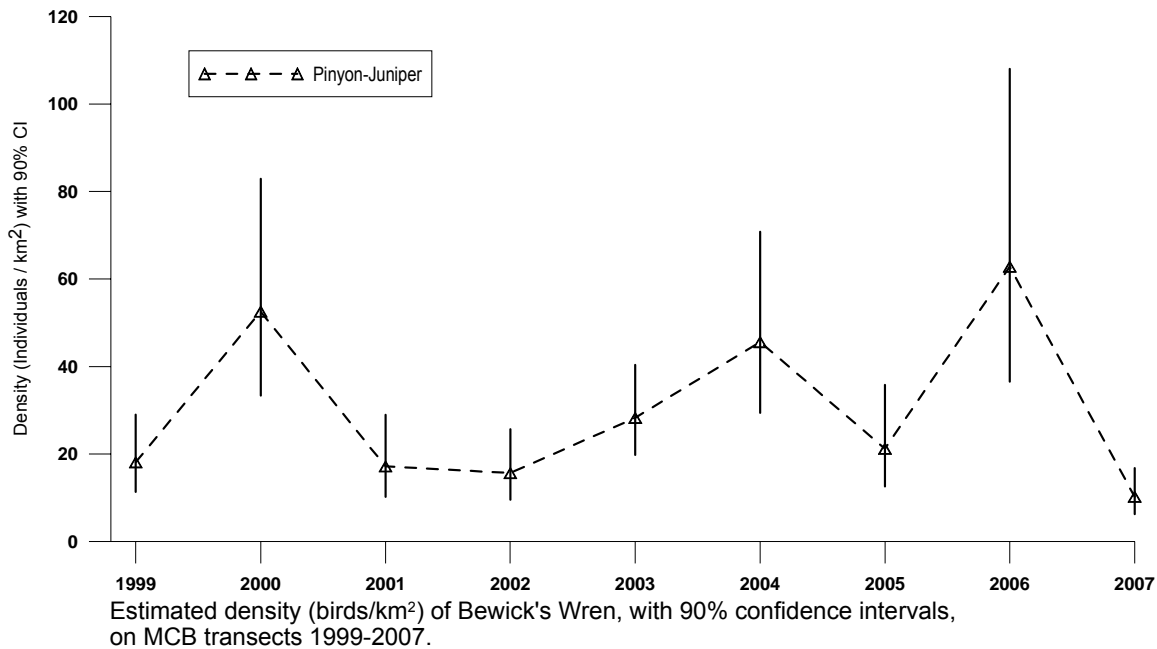
Bewick's Wren is one of the more common birds in pinyon-juniper habitat in western Colorado and may also be found in low-elevation riparian habitat on the west side of the state. In 2007, we detected 144 Bewick's Wrens in pinyon-juniper habitat on MCB transects.

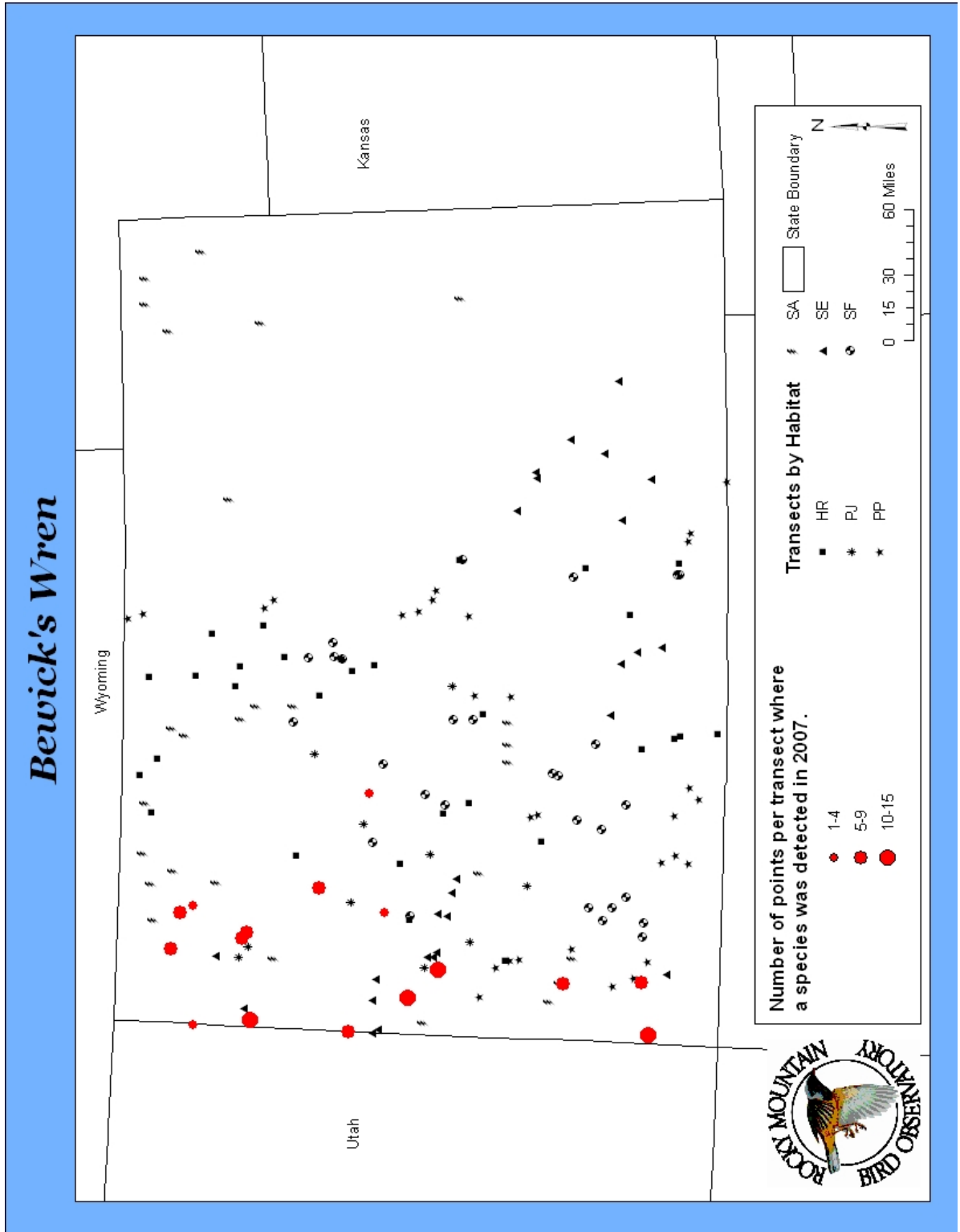
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Bewick's Wren within 25 years in pinyon-juniper habitat.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Bewick's Wren on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	10	6.3	17	30	108	144

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Bewick's Wren on transects in Colorado, 2007.

American Dipper

(*Cinclus mexicanus*)

CDOW – Species of Greatest Conservation Need

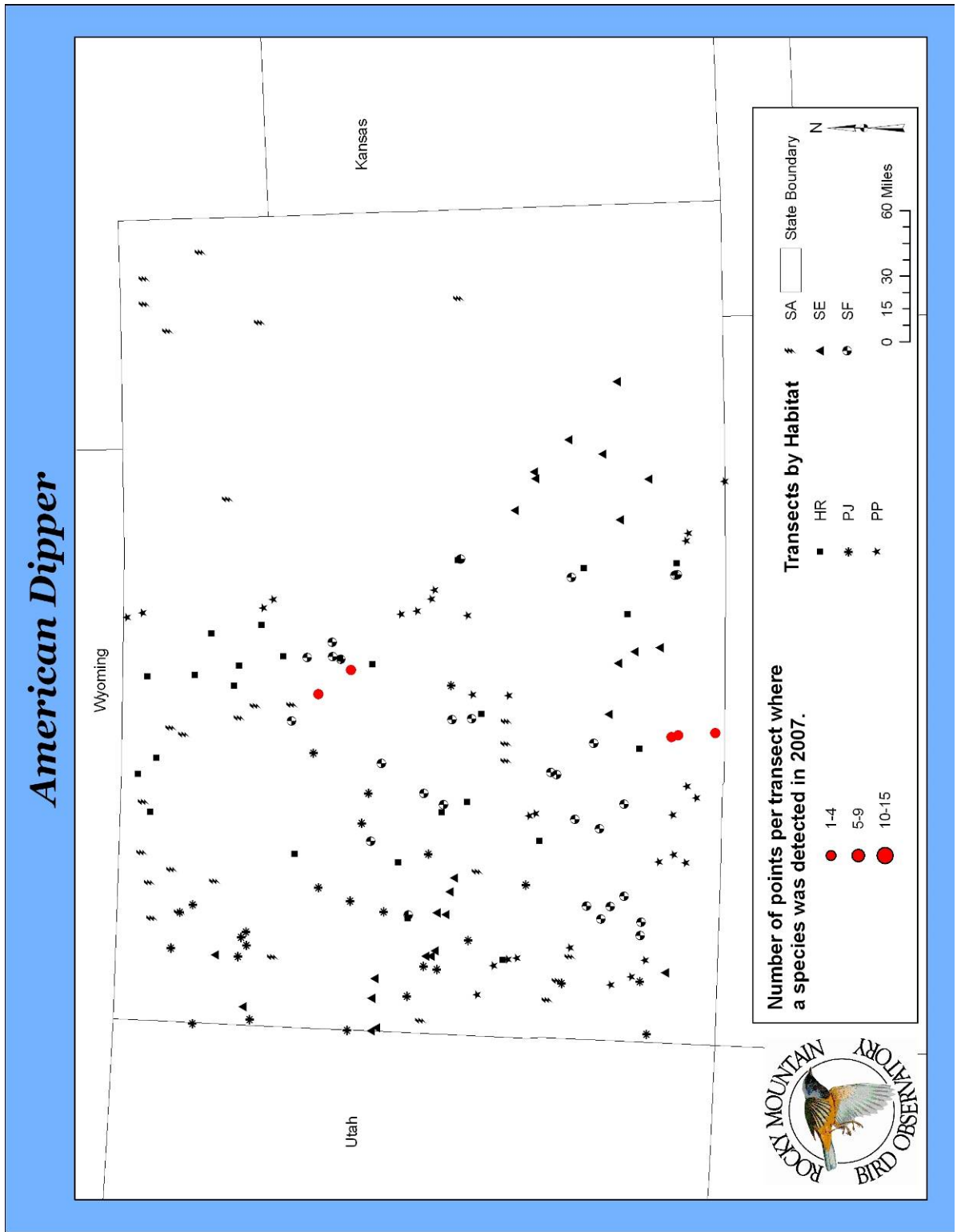
American Dipper occurs along fast-flowing, rocky streams in Colorado, where it relies on aquatic insects (particularly larvae) that are sensitive to water quality. American Dipper is thus an excellent indicator of stream quality. We detected the species eight times on high-elevation riparian surveys in 2007.

American Dipper is not detected in sufficient numbers to be adequately monitored by point transects. One potential method for monitoring this species is by incorporating a technique developed by RMBO: bridge surveys. In 2005, the last year significant effort was put into this survey technique, we found 24 nests on 206 bridges.

Total number of independent detections, number of individuals, and habitat-specific density estimates for American Dipper on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	8

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of American Dipper on transects in Colorado, 2007.

Western Bluebird
(*Sialia mexicana*)
PIF Regional Stewardship Species – BCR 16

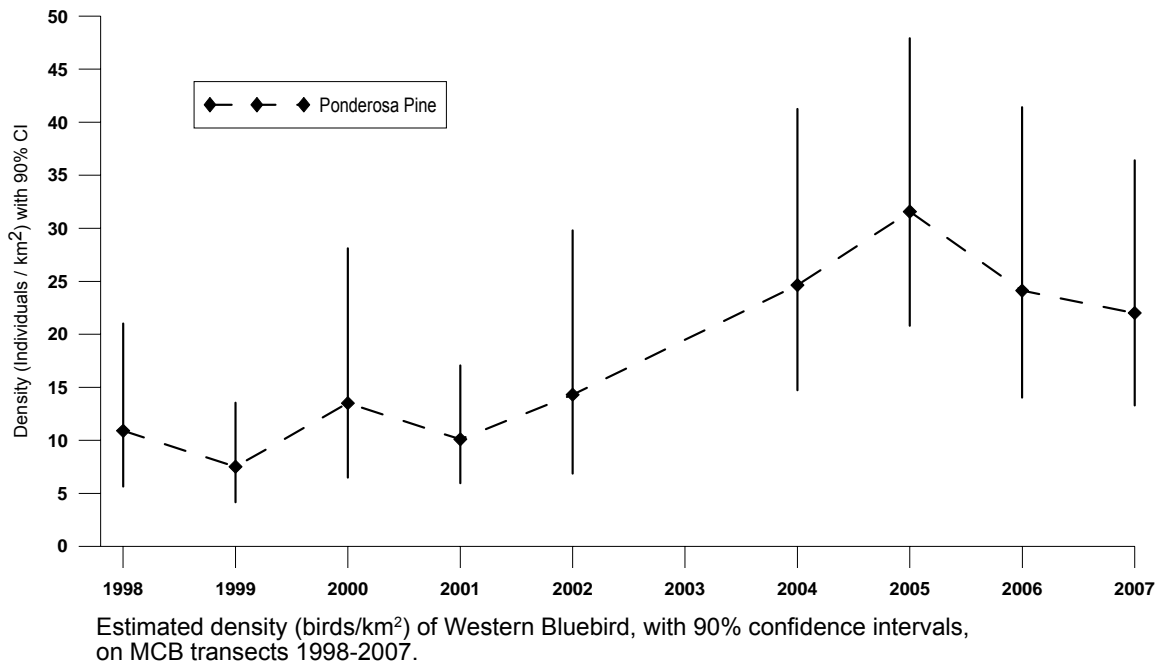
Western Bluebird is a cavity-nester that prefers ponderosa pine, but will also nest in pinyon-juniper habitat. In 2007, we detected 73 Western Bluebirds in two habitats on MCB transects. We were able to calculate a density for ponderosa pine habitat.

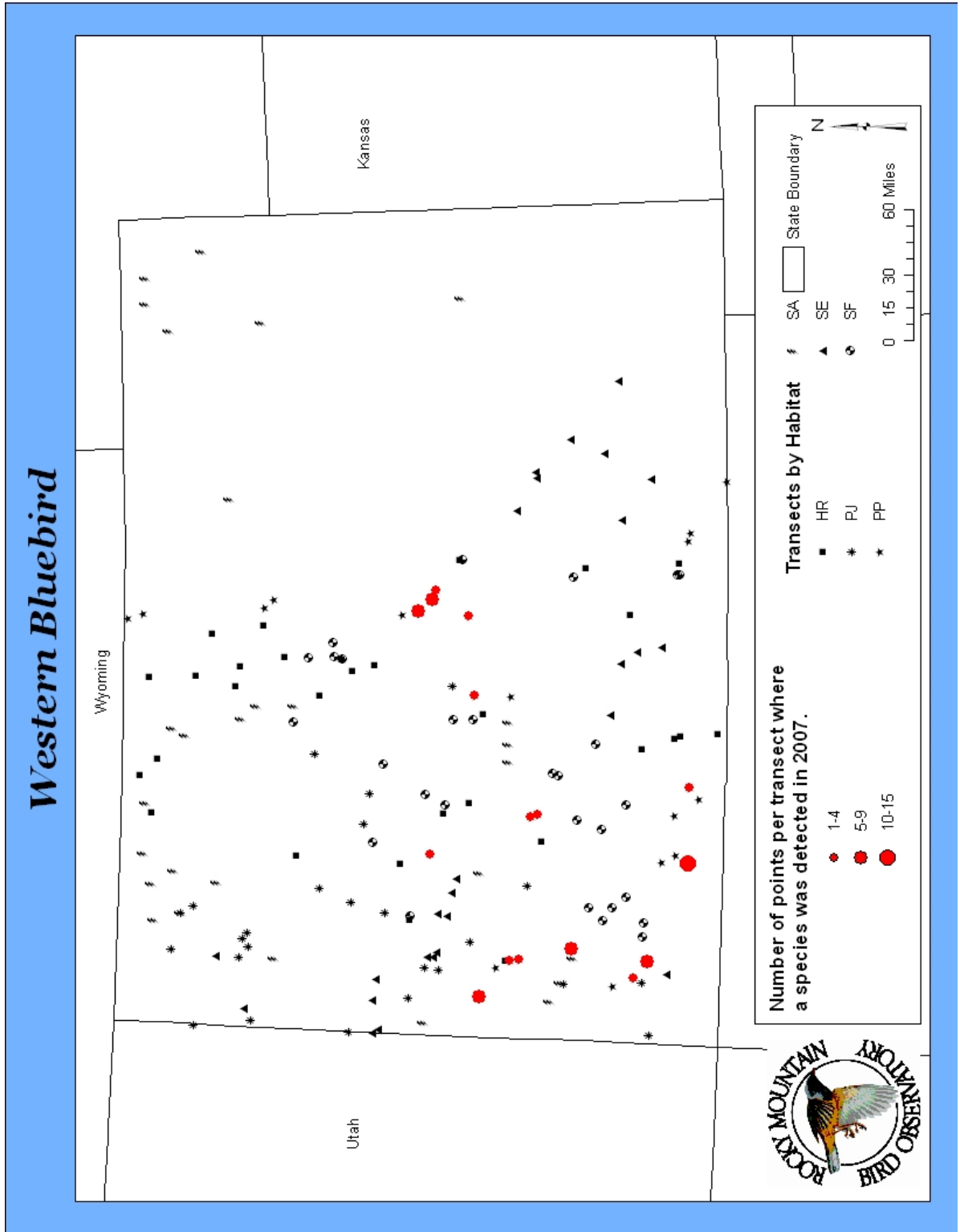
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Western Bluebird within 30 years in ponderosa pine habitat.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Western Bluebird on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	2
PP	22	13	36	31	44	71

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Western Bluebird on transects in Colorado, 2007.

Mountain Bluebird

(*Sialia currocoides*)

PIF Species of Regional Concern – BCR 16

PIF Continental and Regional Stewardship Species – BCR 16

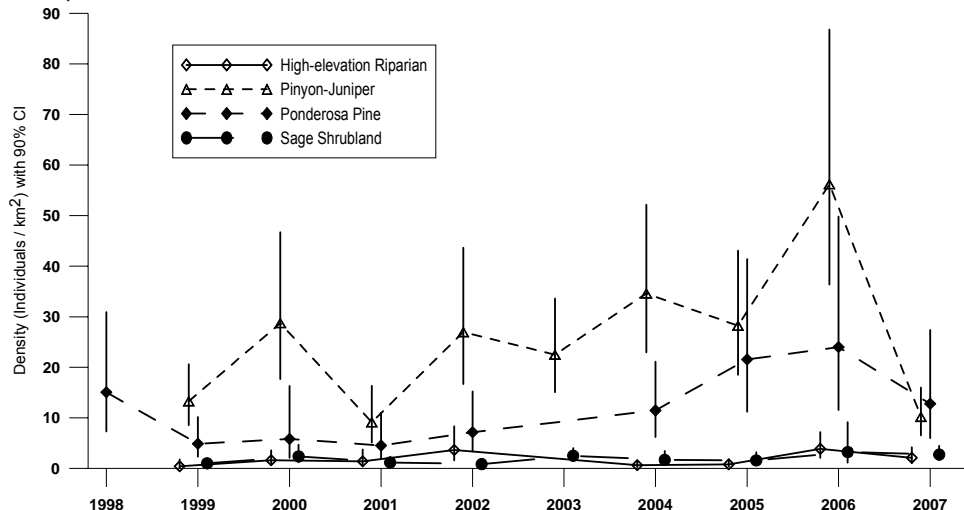
Mountain Bluebird relies on cavities excavated by woodpeckers for nest sites. We detected 234 Mountain Bluebirds in six habitats and calculated density estimates in four habitats on the MCB monitoring project in 2007.

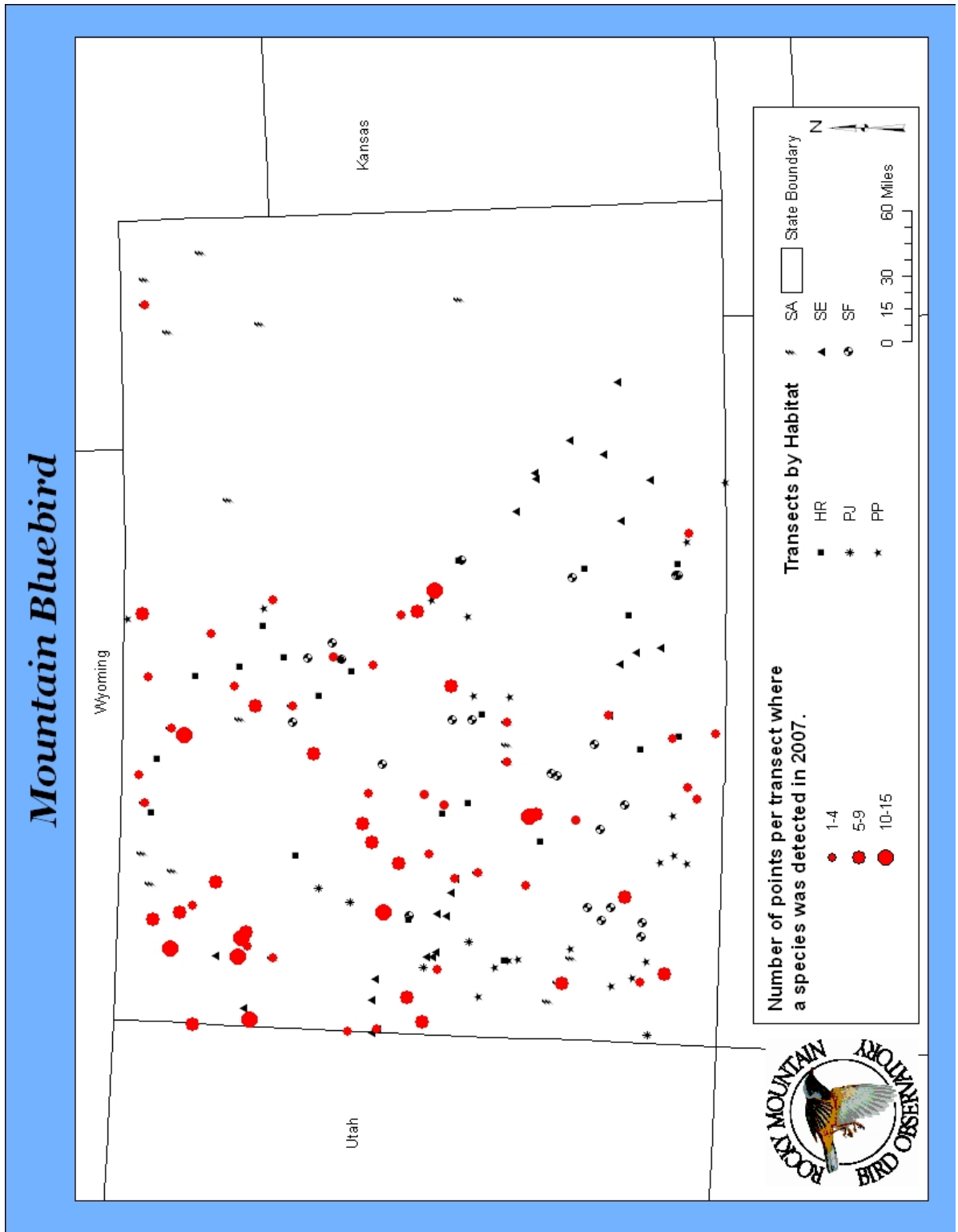
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Mountain Bluebird within 25 years in pinyon-juniper habitat, within 30 years in sage shrubland habitat, within 35 years in ponderosa pine habitat, and within 40 years in high-elevation riparian habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Mountain Bluebird on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	2.1	1.0	4.2	43	11	14
PJ	10	6.5	16	27	72	102
PP	13	6.0	27	48	29	43
SA	2.7	1.7	4.5	30	30	53
SE	ID	--	--	--	--	11
SF	ID	--	--	--	--	11

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Mountain Bluebird on transects in Colorado, 2007.

Veery

(*Catharus fuscescens*)

CDOW – Species of Greatest Conservation Need

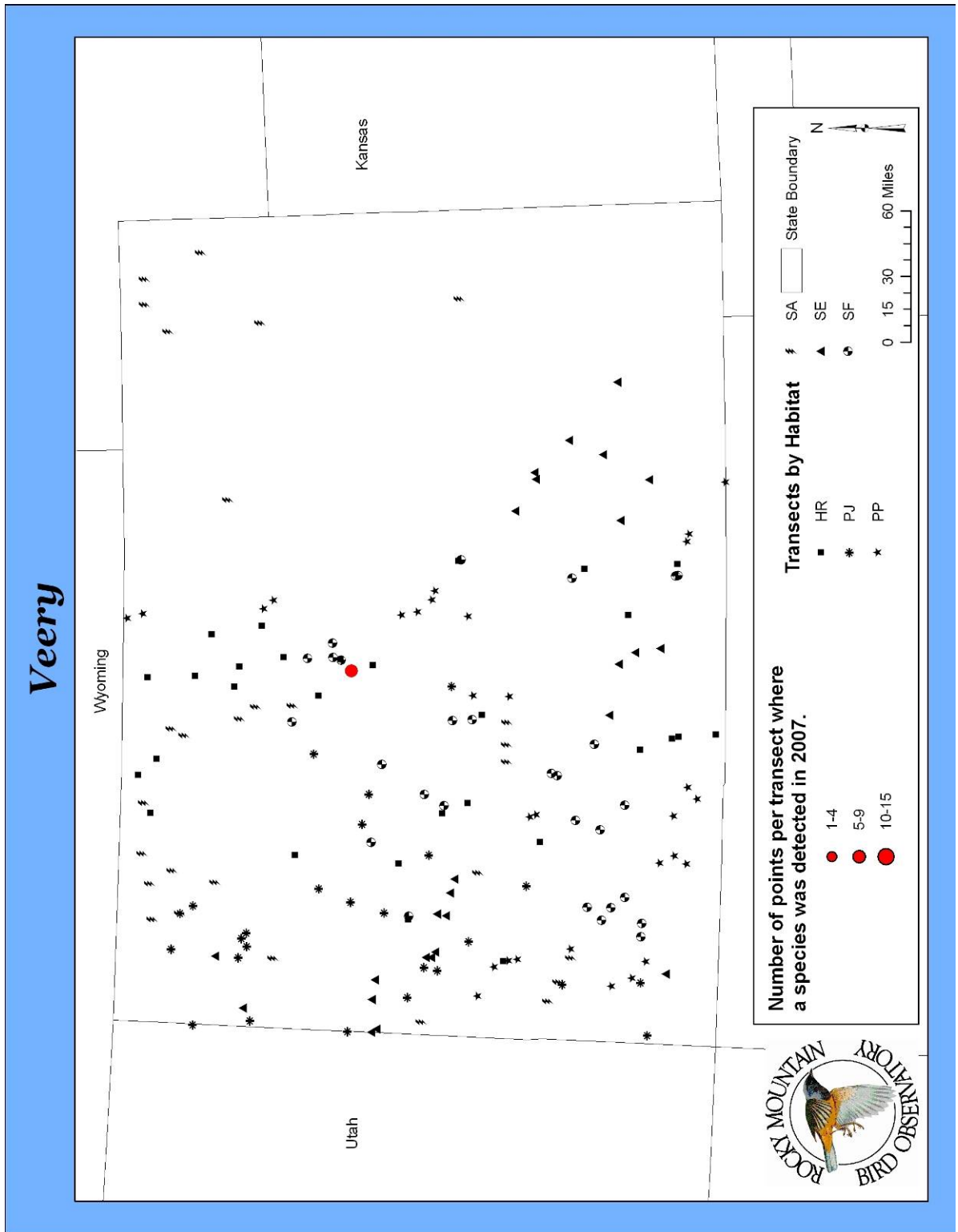
Veery requires expansive stands of dense willows and was once known as the “Willow Thrush” (Richter et al. 2004). We detected two Veery in high-elevation riparian habitat transects in 2007.

With the current level of effort, we will not be able to monitor this species through point transects. Monitoring this species will require additional effort through the MCB’s special species program. A dual frame sampling approach could be a good method to use for this species (Haines and Pollack 1998). Using this technique, one frame is all known breeding locations, in which a census would be conducted. The second sampling frame would be a random sample of all potential habitat. If any new breeding locations were found, they would be censused, and moved to the first sampling frame in subsequent years.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Veery on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Veery on transects in Colorado, 2007.

Curve-billed Thrasher

(*Toxostoma curvirostre*)

CDOW – Species of Greatest Conservation Need

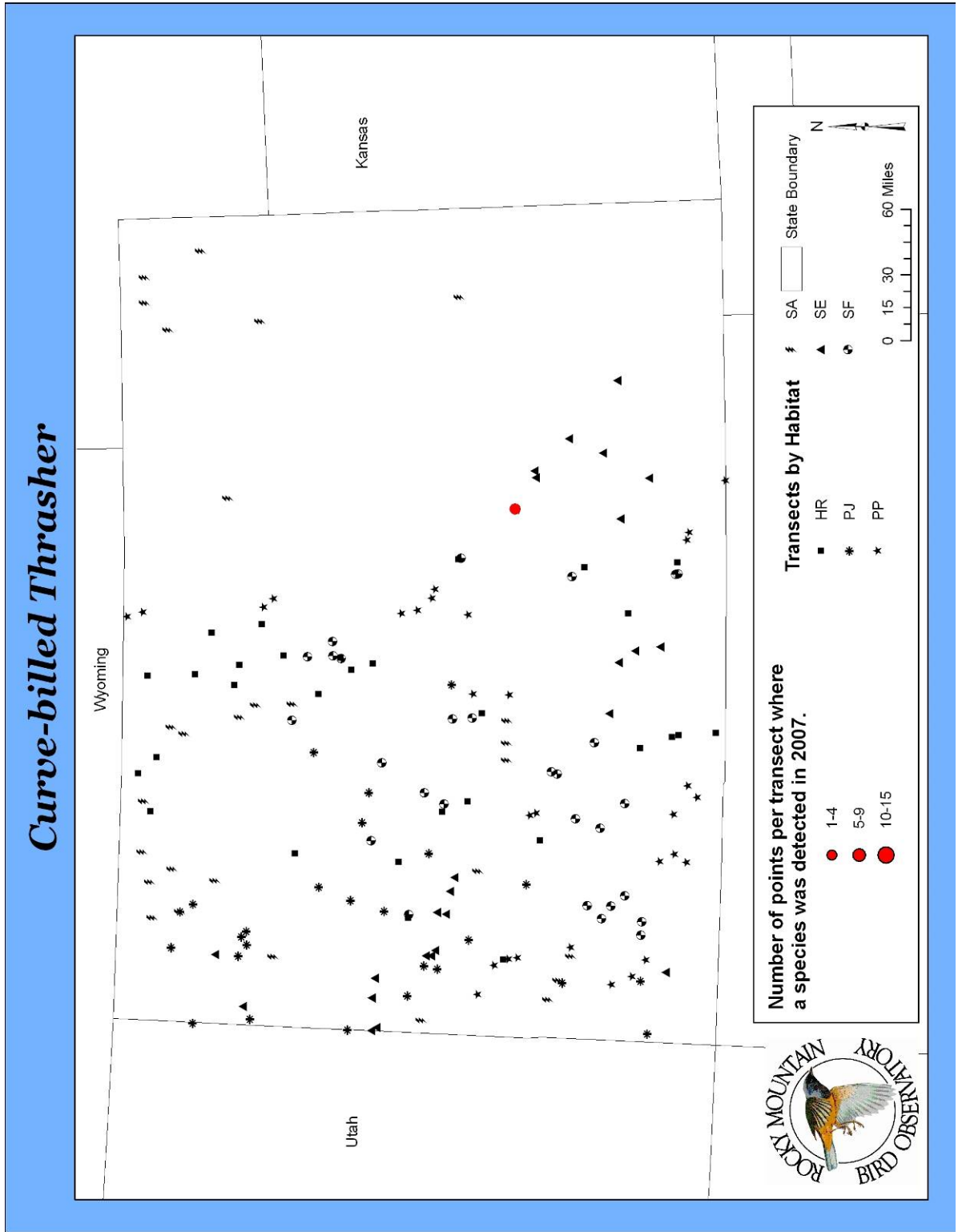
Curve-billed Thrasher breeds exclusively in southeast Colorado in areas with an abundance of tall cacti or other thorny plants (Kingery 1998). We detected two Curve-billed Thrashers in semidesert shrubland habitat in 2007.

With the current level of effort, we will not be able to monitor this species through point transects under MCB. Monitoring this species in Colorado will require additional effort through the special species program. The dual frame approach, previously mentioned, could be a potential monitoring technique for this species also.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Curve-billed Thrasher on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SE	ID	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Curve-billed Thrasher on transects in Colorado, 2007.

Virginia's Warbler

(*Vermivora virginiae*)

CDOW – Species of Greatest Conservation Need
 PIF Species of Continental and Regional Concern – BCR 16
 PIF Regional Stewardship Species – BCR 16
 USFWS Bird of Conservation Concern – BCR 16

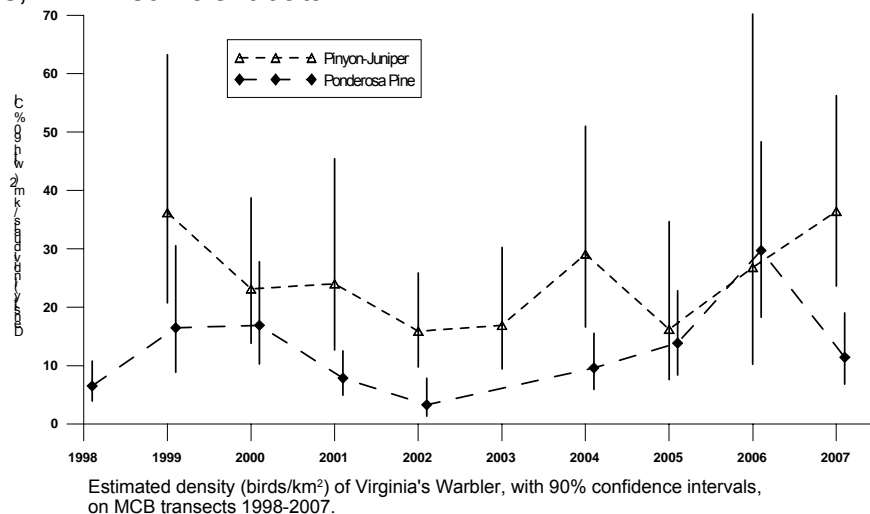
Virginia's Warbler is most often found in habitats with a Gambel's oak component, from ponderosa pine forests to pinyon-juniper woodlands. In 2007, we detected 198 Virginia's Warblers in four habitats on MCB transects. We were able to calculate a density estimate for this species in pinyon-juniper and ponderosa pine habitats.

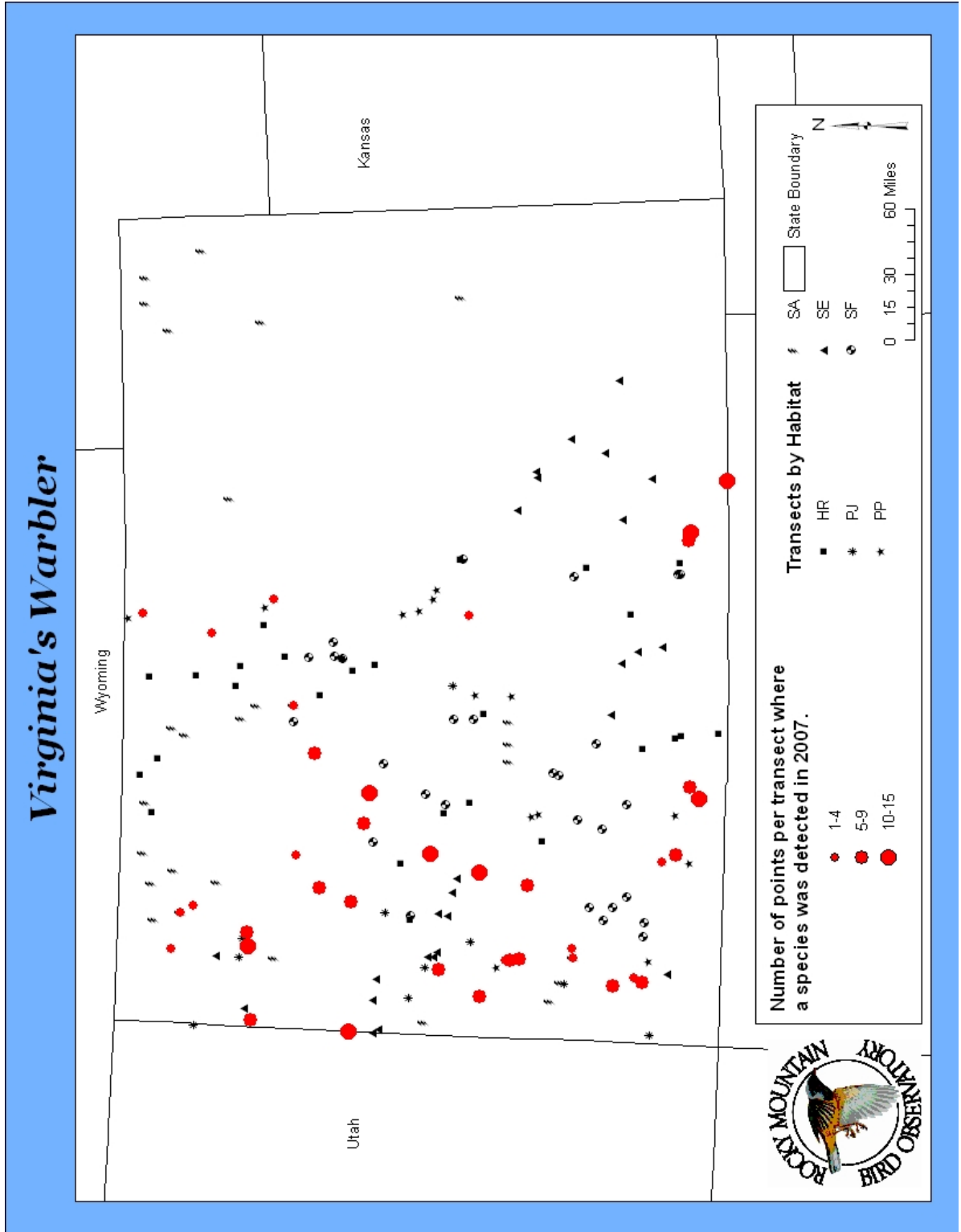
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Virginia's Warbler within 35 years in pinyon-juniper habitat and within 30 years in ponderosa pine habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Virginia's Warbler on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	3
PJ	36	24	56	26	79	107
PP	11	6.9	19	31	51	74
SA	ID	--	--	--	--	14

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Virginia's Warbler on transects in Colorado, 2007.

Yellow Warbler
(*Dendroica petechia*)
PIF Species of Regional Concern – BCR 18

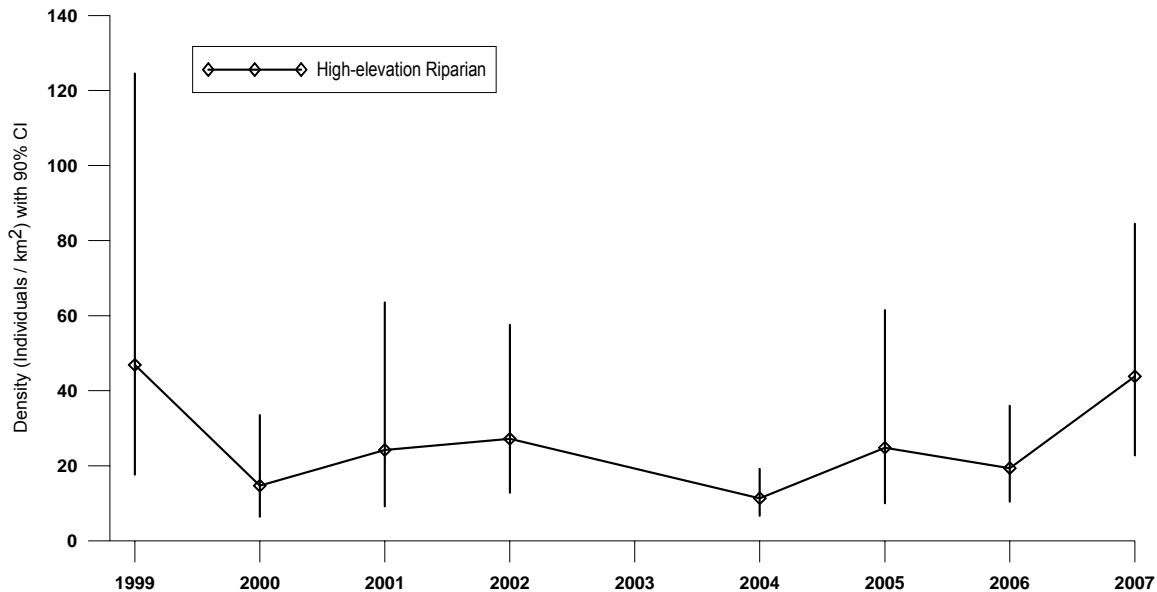
Yellow Warbler breeds in areas where deciduous shrubs and trees are dominant and where there is a high insect abundance. This species will also nest in aspen stands with a multi-layered understory. In 2007, we detected 102 Yellow Warblers in three habitats on MCB transects and were able to calculate a density estimate in high-elevation riparian habitat.

Power simulation indicates that it would take more than 40 years to detect a 3% average annual population change with 80% power for Yellow Warbler within high-elevation riparian habitat using point transect data.

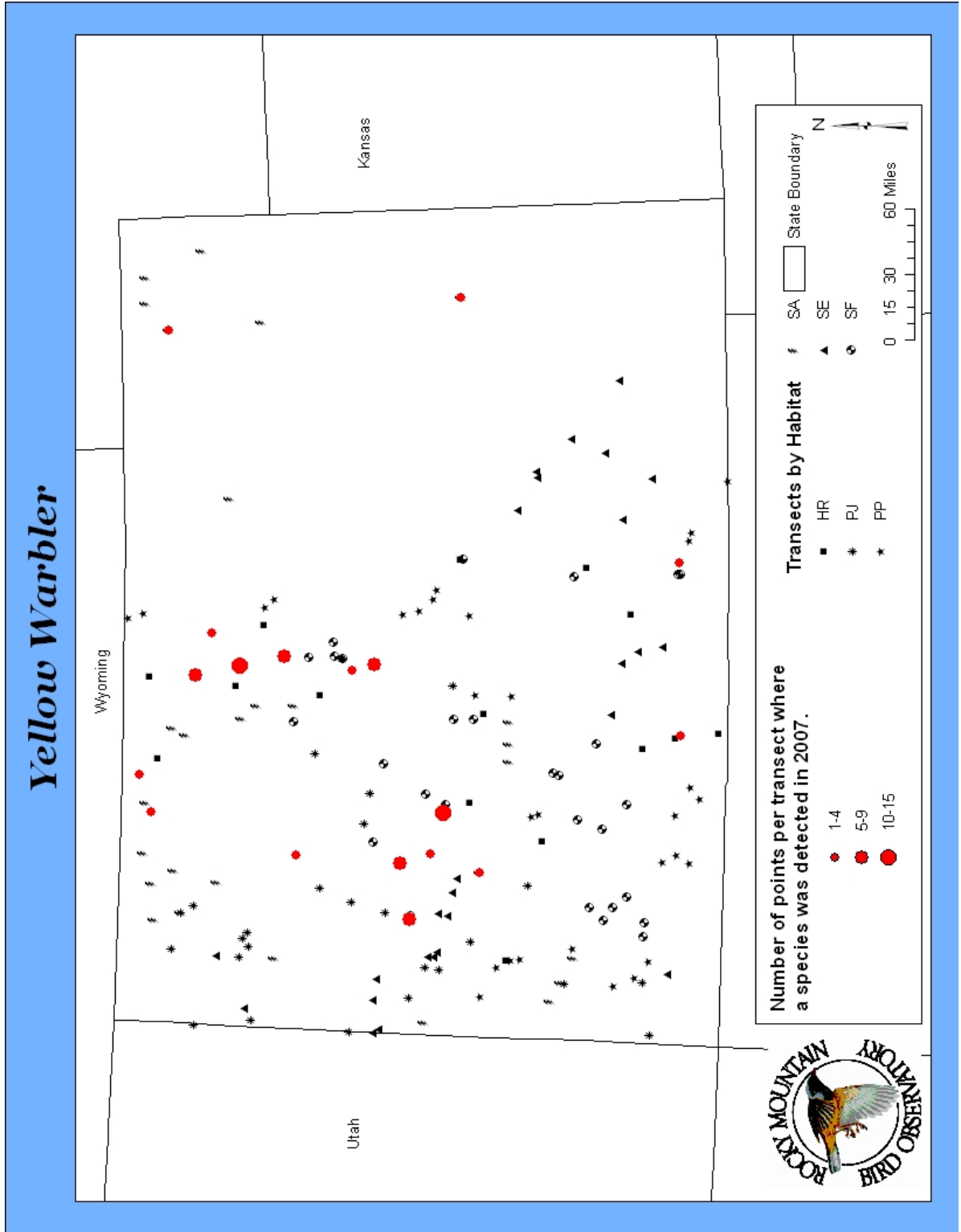
Total number of independent detections, number of individuals, and habitat-specific density estimates for Yellow Warbler on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	44	23	85	40	81	96
PJ	ID	--	--	--	--	1
SA	ID	--	--	--	--	5

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Yellow Warbler, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Yellow Warbler on transects in Colorado, 2007.

Black-throated Gray Warbler

(*Dendroica nigrescens*)

CDOW - Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 16

USFWS Bird of Conservation Concern – BCR 16

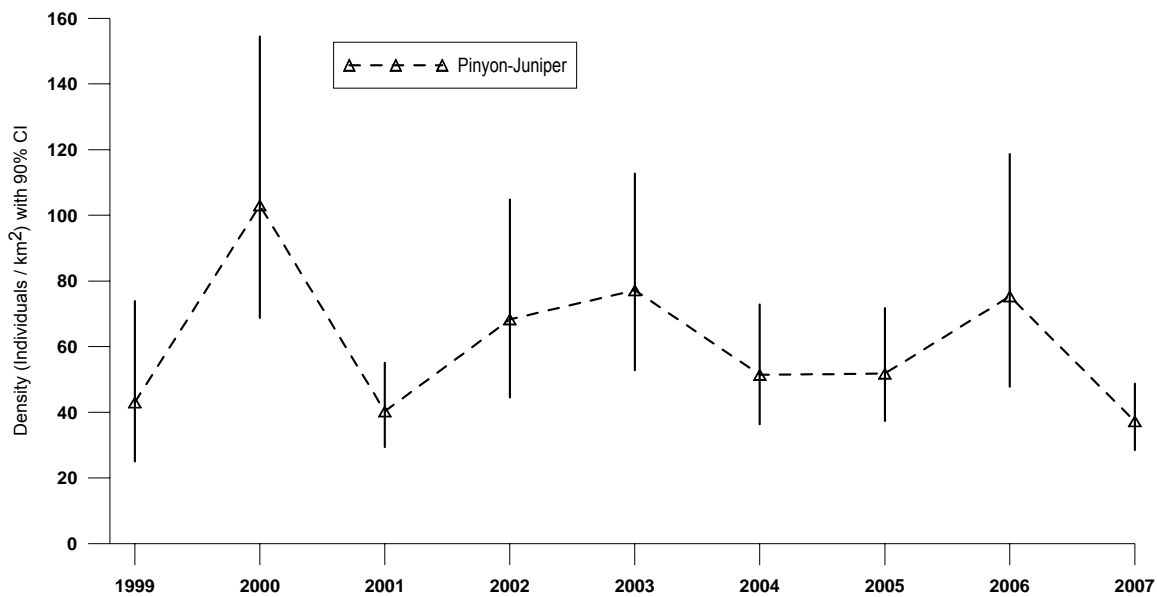
Black-throated Gray Warbler prefers large stands of pinyon-dominated woodland. In 2007, we detected 386 Black-throated Gray Warblers in two habitats on MCB transects and were able to calculate a density estimate in pinyon-juniper habitat. As in previous years, Black-throated Gray Warbler was one of the most abundant species in pinyon-juniper habitat.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Black-throated Gray Warbler within 20 years in pinyon-juniper habitat using point transect data.

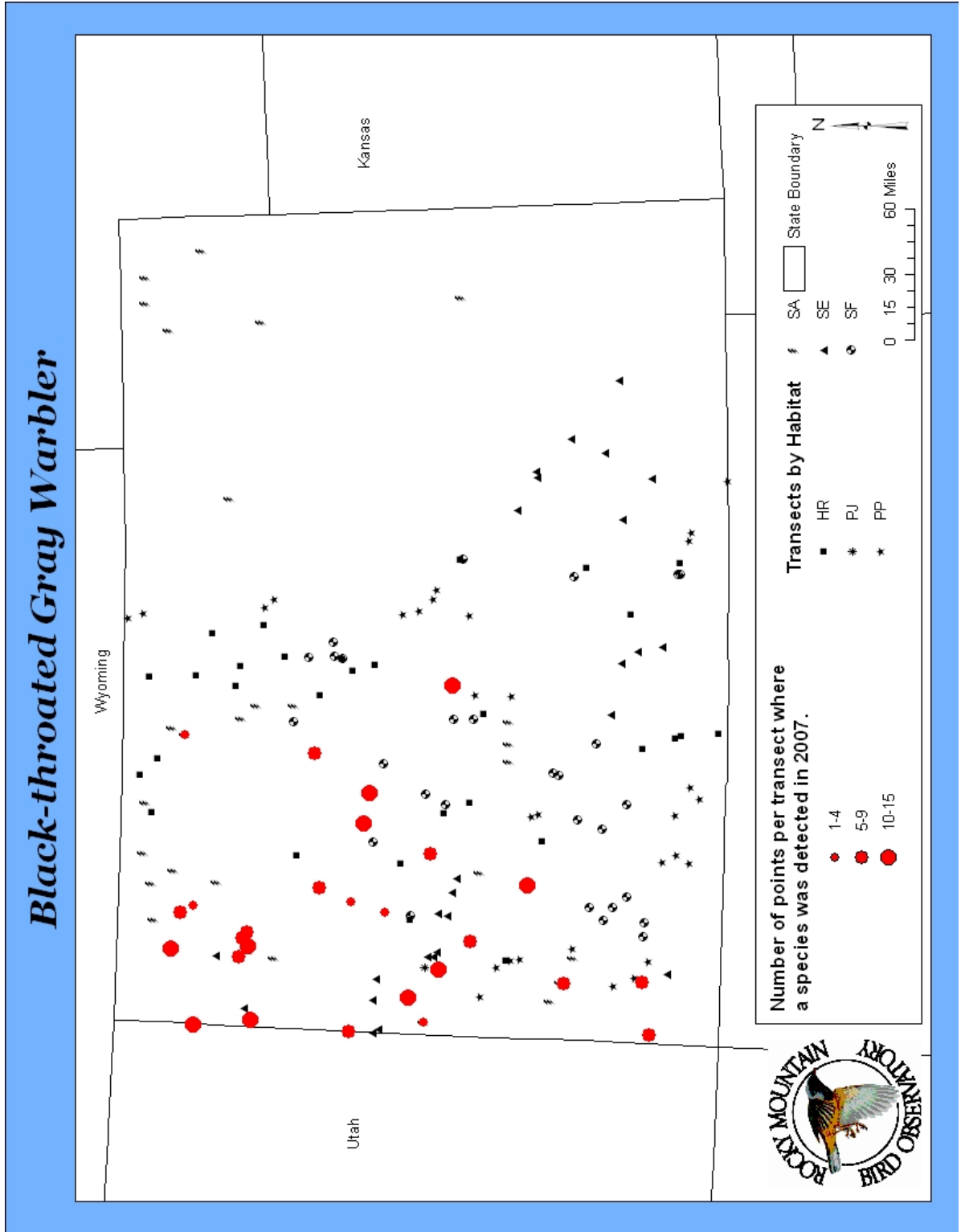
Total number of independent detections, number of individuals, and habitat-specific density estimates for Black-throated Gray Warbler on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	37	29	49	16	321	384
SA	--	--	--	--	--	2

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Black-throated Gray Warbler, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Black-throated Gray Warbler on transects in Colorado, 2007.

Grace's Warbler

(*Dendroica graciae*)

CDOW – Species of Greatest Conservation Need

PIF Species of Continental and Regional Concern – BCR 16

USFWS Bird of Conservation Concern – BCR 16

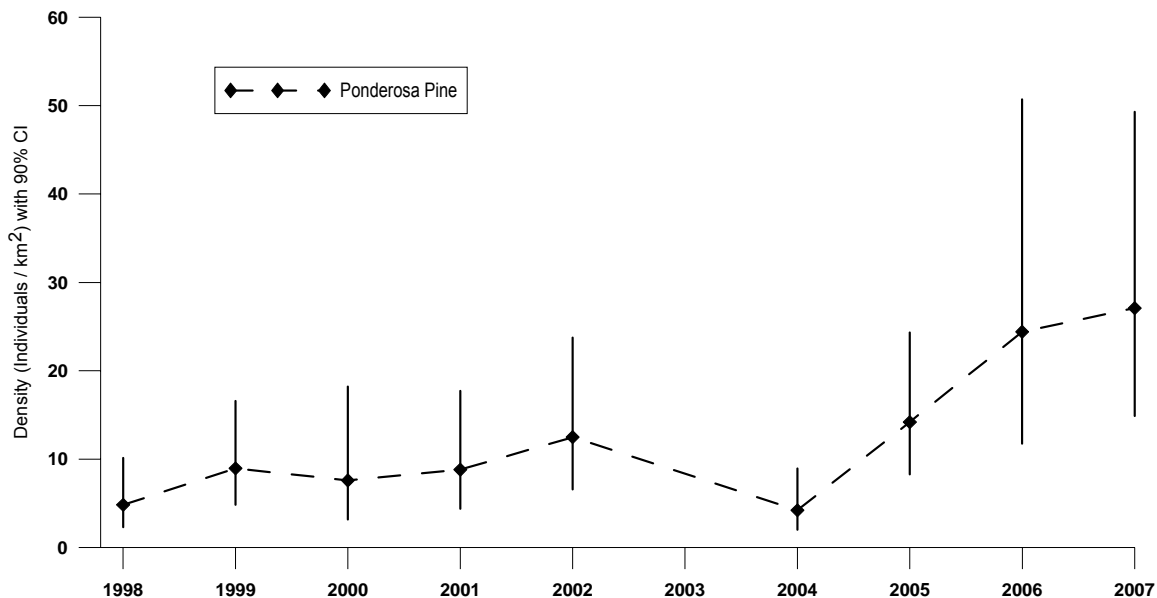
Grace's Warbler breeds in older, mature ponderosa pine stands often with an understory of Gambel's oak. In 2007, we detected 134 Grace's Warblers in ponderosa pine habitat on MCB transects. We were able to calculate a density estimate for this habitat.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Grace's Warbler within 35 years in ponderosa pine habitat using point transect data.

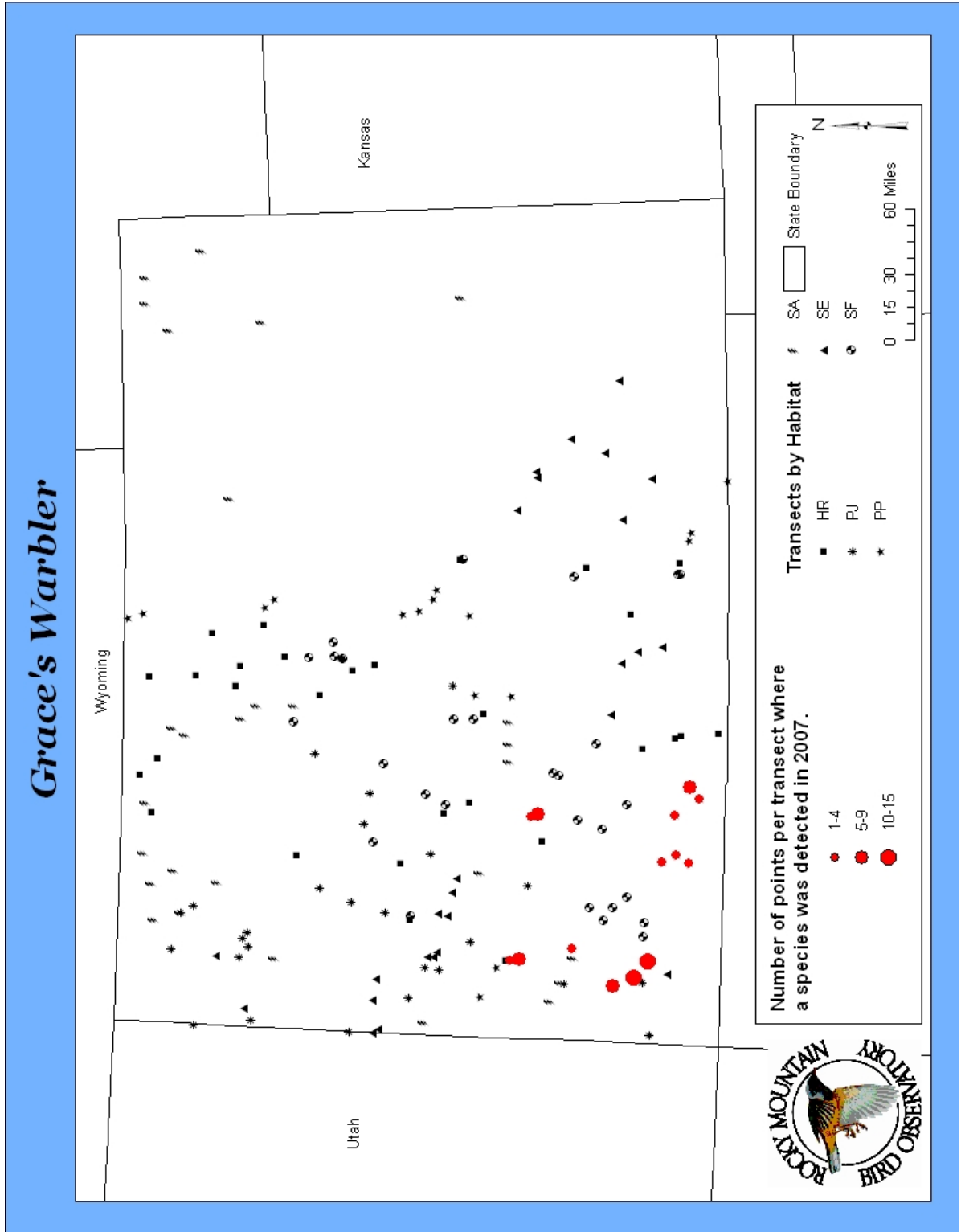
Total number of independent detections, number of individuals, and habitat-specific density estimates for Grace's Warbler on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PP	27	15	49	36	120	134

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Grace's Warbler, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Grace's Warbler on transects in Colorado, 2007.

Green-tailed Towhee

(*Pipilo chlorurus*)

PIF Continental and Regional Stewardship Species – BCR 16

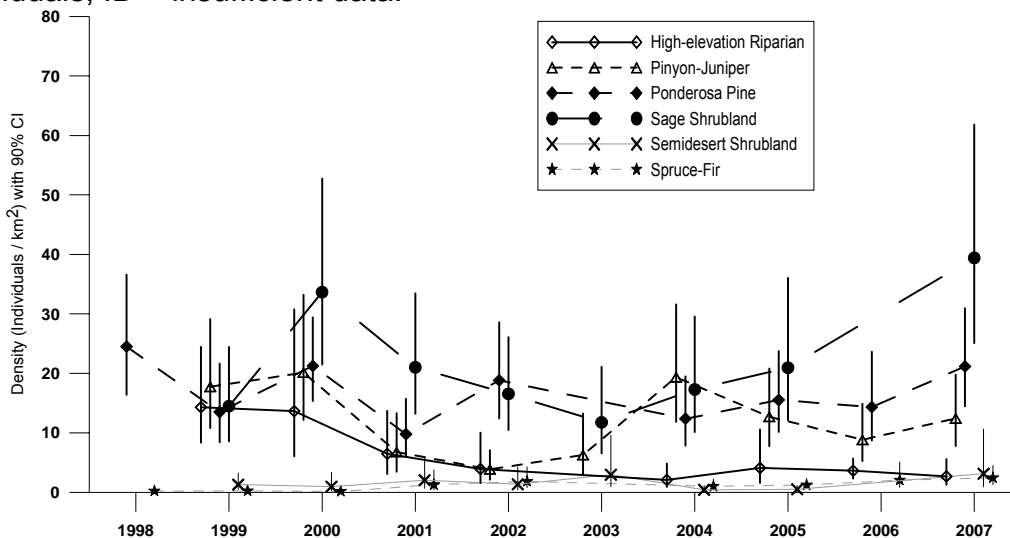
At lower elevations, Green-tailed Towhee nests in mesic areas with a high diversity of shrub species, including sagebrush and pinyon-juniper. At higher elevations it uses more xeric shrub areas. In 2007, we detected 649 Green-tailed Towhees in six habitats on MCB transects, and we were able to calculate a density estimate for this species in all habitats surveyed.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Green-tailed Towhee within 25 years in ponderosa pine and sage shrubland habitats, within 30 years in pinyon-juniper habitat, within 40 years in semidesert shrubland and spruce-fir habitat, and more than 40 years in high-elevation riparian habitat using point transect data.

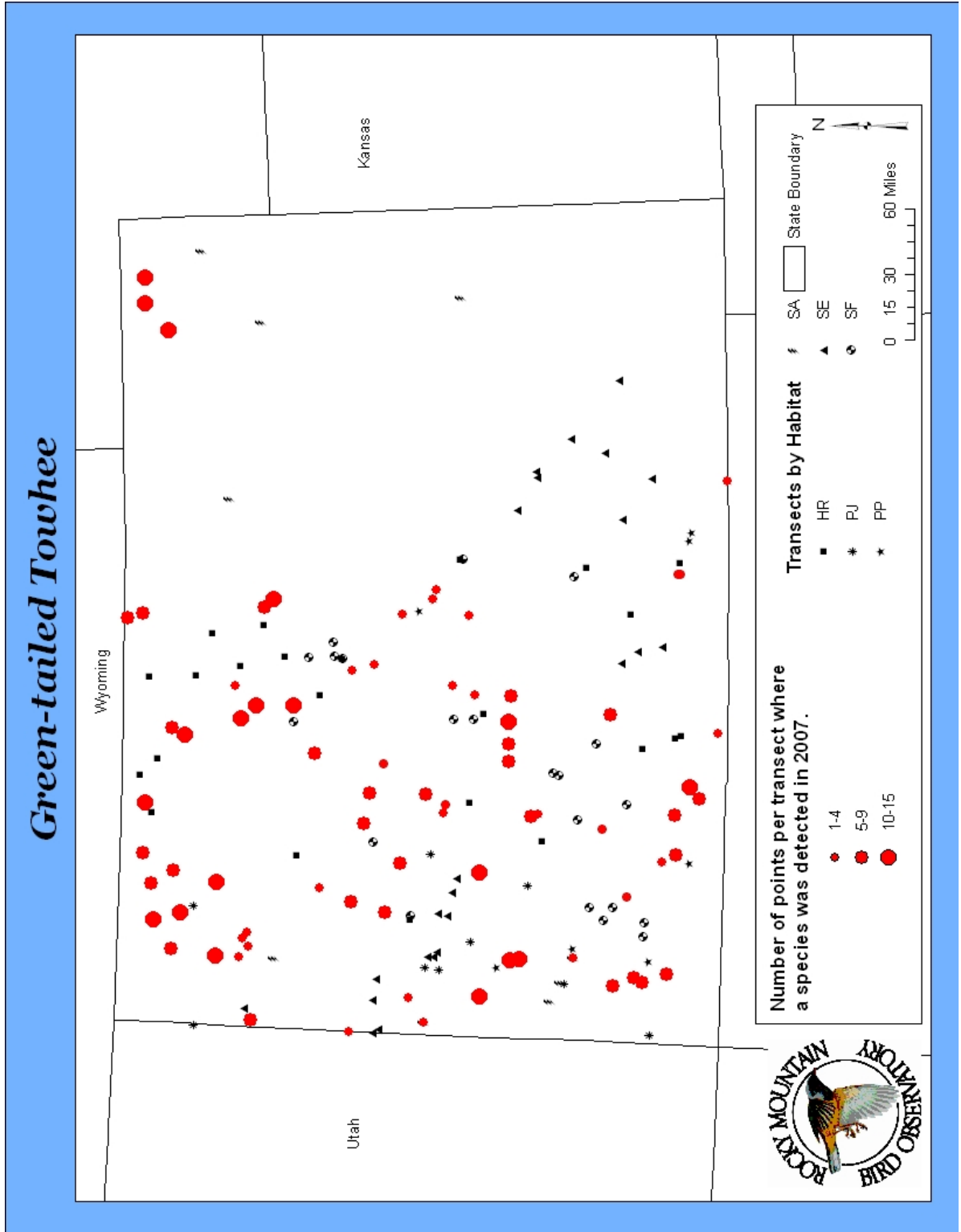
Total number of independent detections, number of individuals, and habitat-specific density estimates for Green-tailed Towhee on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	2.7	1.3	5.6	45	14	15
PJ	12	7.8	20	28	62	79
PP	21	14	31	23	156	168
SA	39	25	62	27	286	330
SE	3.1	0.9	11	82	32	38
SF	2.4	1.3	4.5	38	19	19

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Green-tailed Towhee, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Green-tailed Towhee on transects in Colorado, 2007.

Cassin's Sparrow

(*Aimophila cassinii*)

CDOW - Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 18

PIF Regional Stewardship Species – BCR 18

USFS Region 2 Sensitive Species

USFWS Bird of Conservation Concern – Nationally

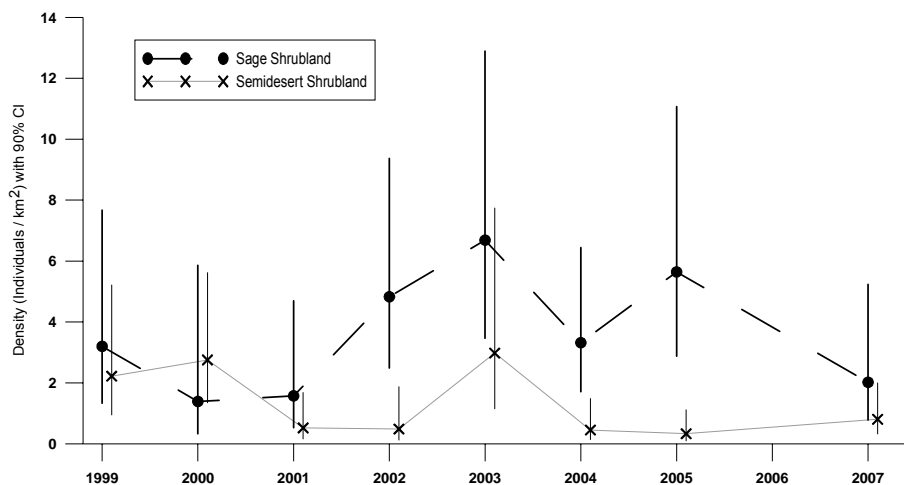
In Colorado, Cassin's Sparrow is found exclusively in the eastern prairie regions of the state. In the areas where the species breeds, there is typically some type of shrub or taller vegetation; it does not breed in pure open grassy areas. The semi-nomadic nature of this species makes it common in some years and difficult to find in others. In 2007, we detected 88 Cassin's Sparrows in three habitats on MCB transects.

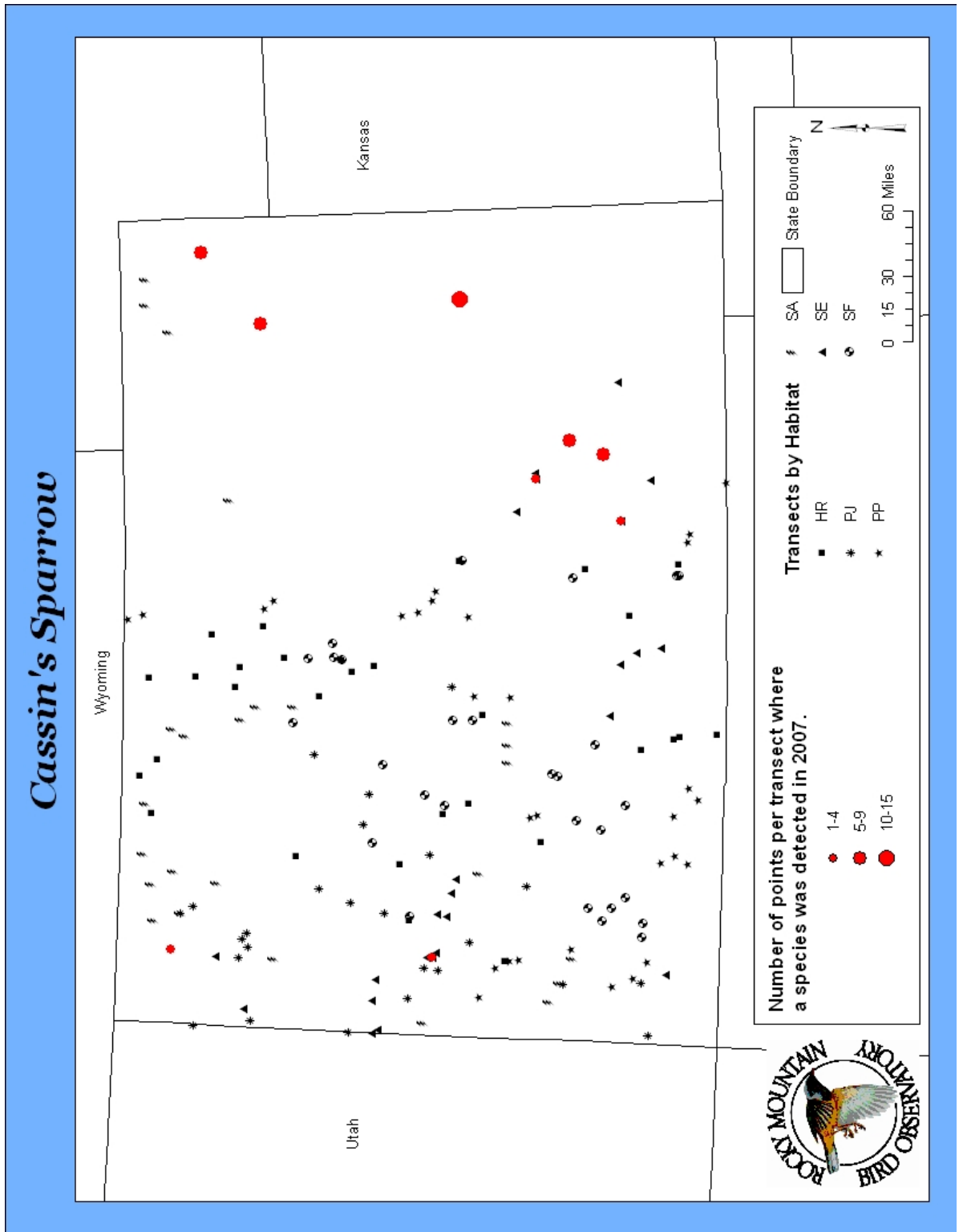
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Cassin's Sparrow within 35 years in sage shrubland habitat and within 40 years in semidesert shrubland habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Cassin's Sparrow for the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	1
SA	2.0	0.8	5.2	60	35	60
SE	0.8	0.3	2.0	57	23	27

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Cassin's Sparrow on transects in Colorado, 2007.

Brewer's Sparrow
(*Spizella breweri*)

CROW - Species of Greatest Conservation Need
 PIF Species of Continental and Regional Concern – BCR 16 & 18
 USFS Region 2 Sensitive Species
 USFWS – Bird of Conservation Concern - Nationally

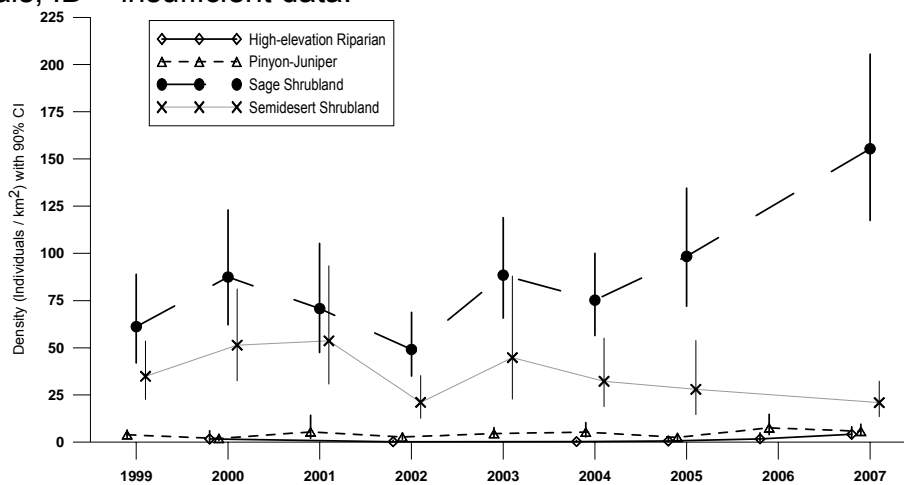
Brewer's Sparrow prefers sagebrush habitat but may also breed in areas dominated by mountain mahogany or other shrubs. Interestingly, this species is occasionally detected above timberline in shrubby areas and it is possible that the high-altitude individuals constitute a different subspecies. In 2007, we detected 1048 Brewer's Sparrows in five habitats on MCB transects and were able to calculate a density estimate in pinyon-juniper habitat.

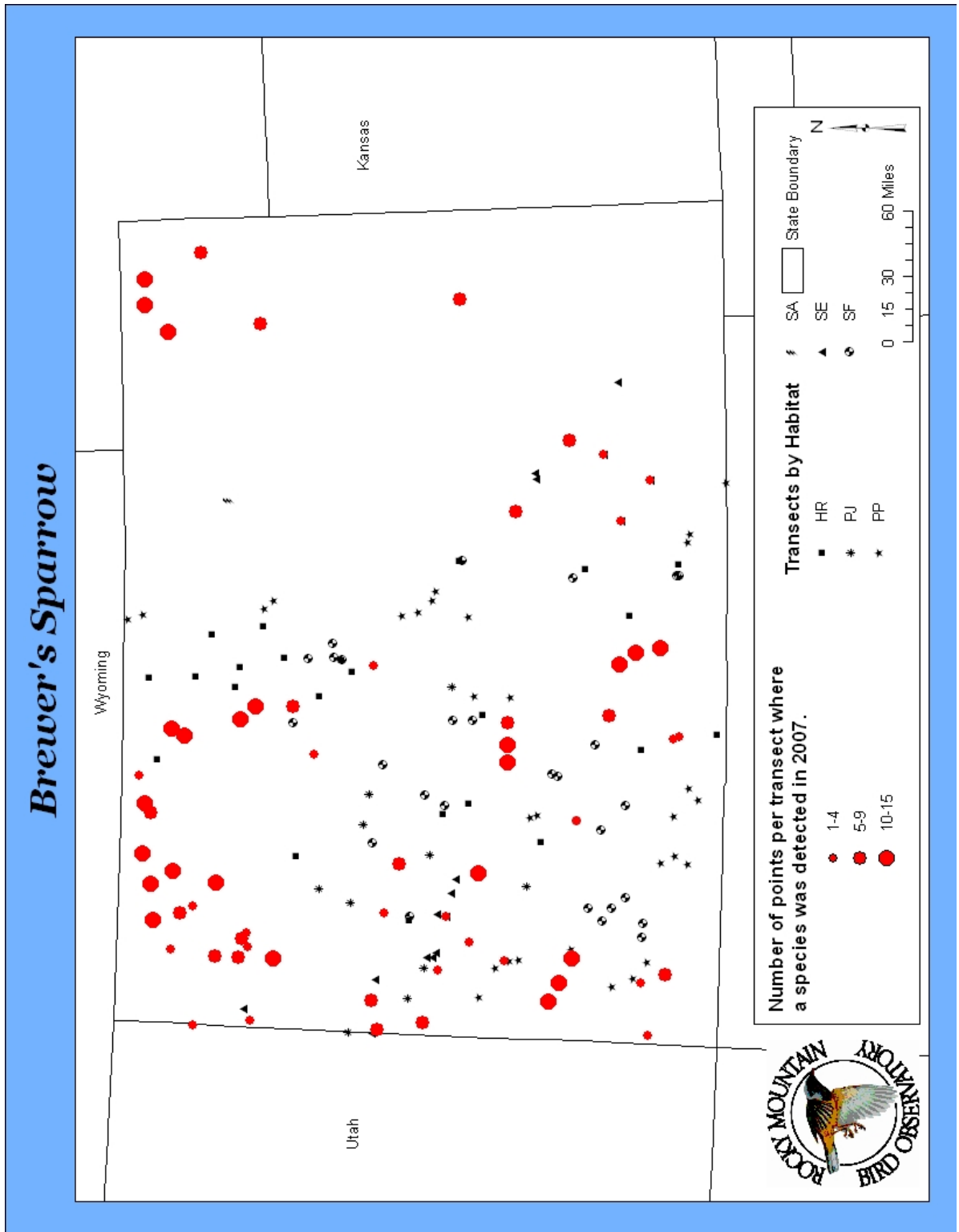
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Brewer's Sparrow within 20 years in sage shrubland habitat and within 30 years in pinyon-juniper habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Brewer's Sparrow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	4.1	2.0	8.2	43	39	39
PJ	5.8	3.5	9.5	30	48	56
SA	155	117	205	17	667	782
SE	21	14	32	26	134	170
SF	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Brewer's Sparrow on transects in Colorado, 2007.

Vesper Sparrow
(*Pooecetes gramineus*)
CDOW - Species of Greatest Conservation Need

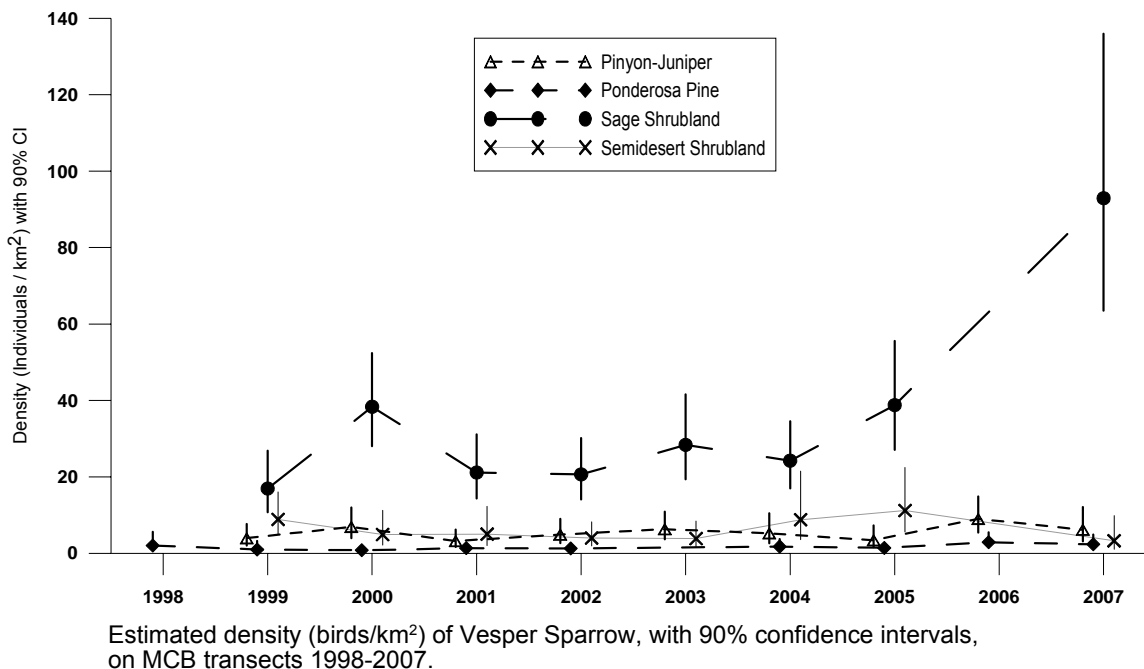
In Colorado, Vesper Sparrow prefers sage shrubland and montane grassland, but will occasionally nest in other habitats with patchily distributed shrubs and grass cover. In 2007, we detected 561 Vesper Sparrows in five habitats on MCB transects and were able to calculate a density estimate in two habitats.

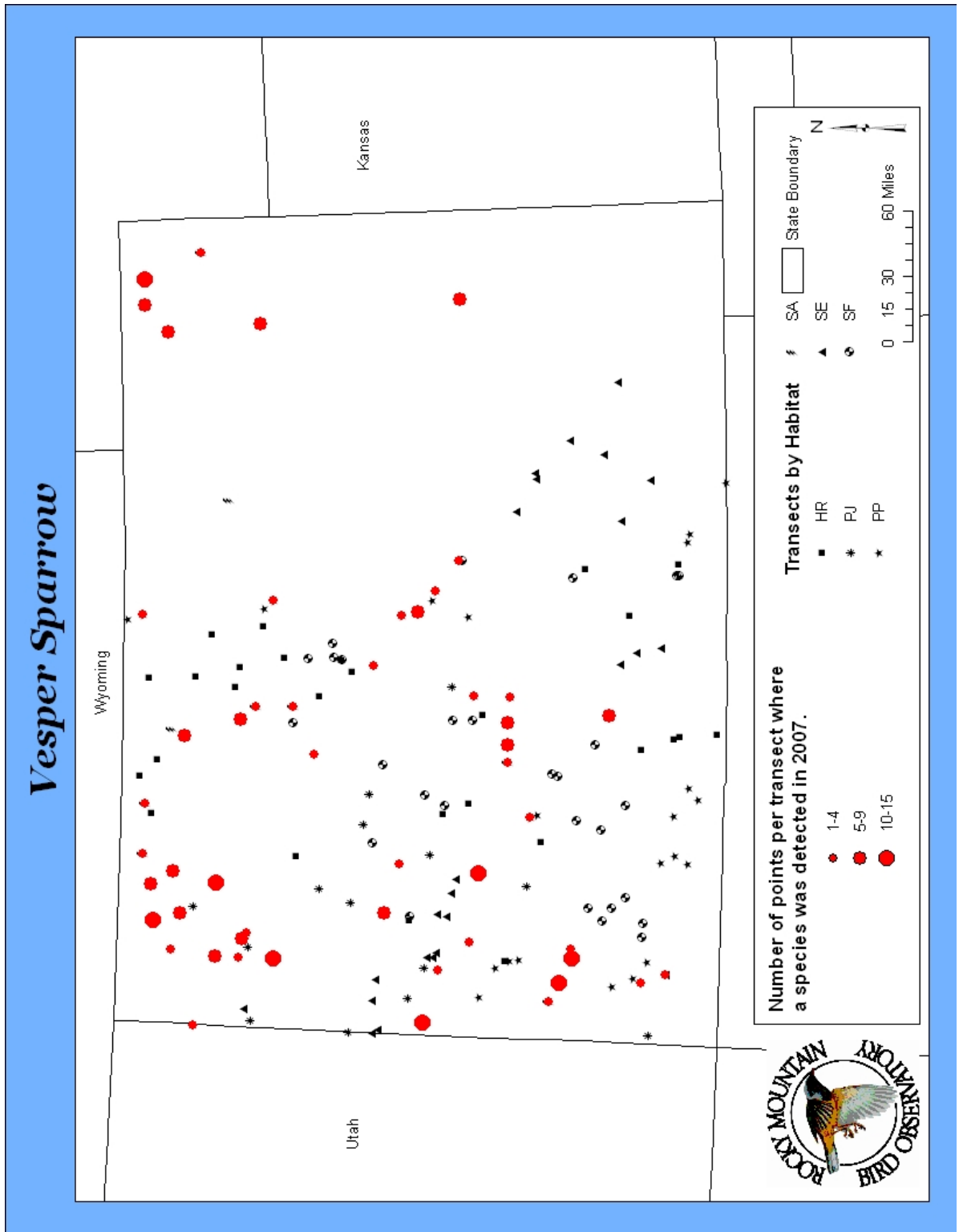
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Vesper Sparrow within 20 years in sage shrubland habitat, within 30 years in pinyon-juniper habitat and within 35 years in ponderosa pine and semidesert shrubland habitats using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Vesper Sparrow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	9
PJ	6.2	3.2	12	41	35	46
PP	2.4	1.2	4.9	45	34	36
SA	93	63	136	23	369	436
SE	3.3	1.1	9.9	73	33	34

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Vesper Sparrow on transects in Colorado, 2007.

Lark Sparrow
(*Chondestes grammacus*)
PIF Species of Regional Concern – BCR 18

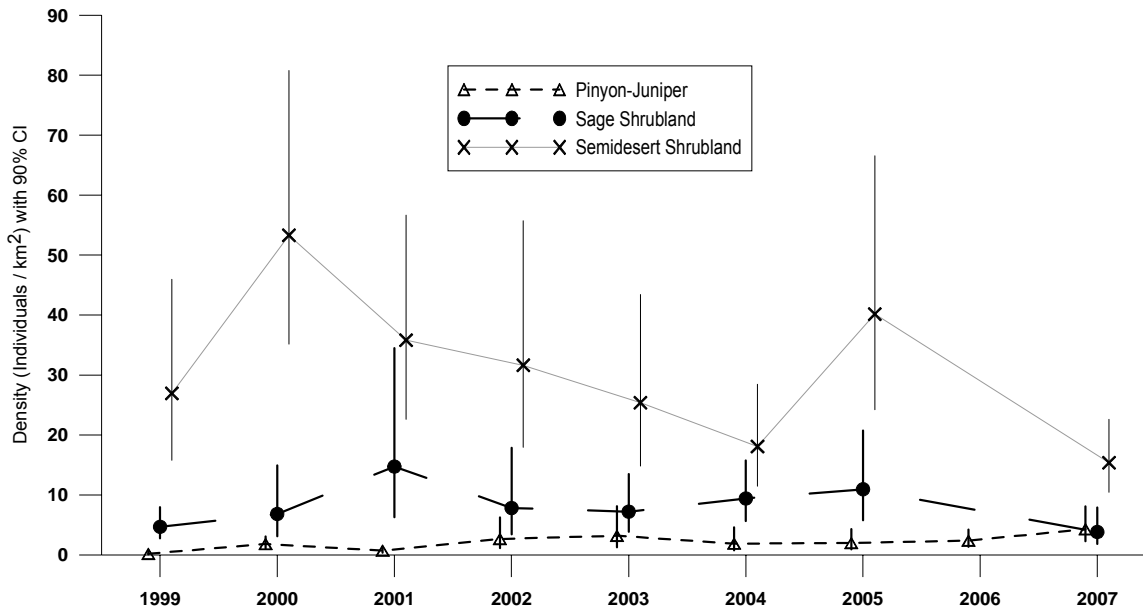
Lark Sparrow prefers arid, open areas with some shrub component and breeds in a variety of locations including prairies, roadsides, farms, and open woodlands. In 2007, we detected 252 Lark Sparrows in three habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Lark Sparrow within 30 years in sage shrubland habitat and within 35 years in pinyon-juniper habitat using point transect data.

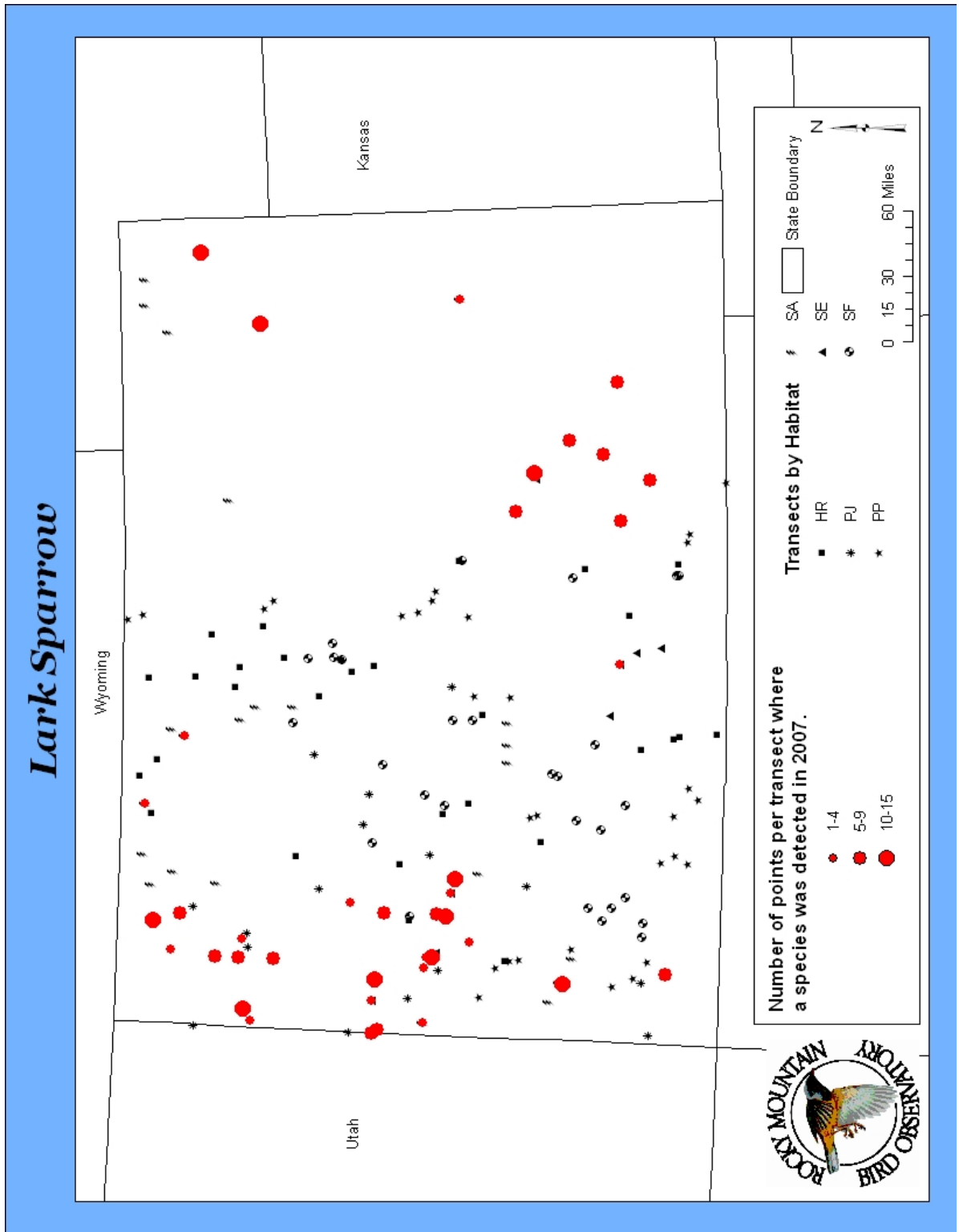
Total number of independent detections, number of individuals, and habitat-specific density estimates for Lark Sparrow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	4.3	2.3	8.1	38	29	41
PP	3.8	1.9	7.9	44	27	41
SA	15	10	23	23	130	170

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Lark Sparrow, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Lark Sparrow on transects in Colorado, 2007.

Black-throated Sparrow
 (Amphispiza bilineata)
 PIF Species of Regional Concern – BCR 16

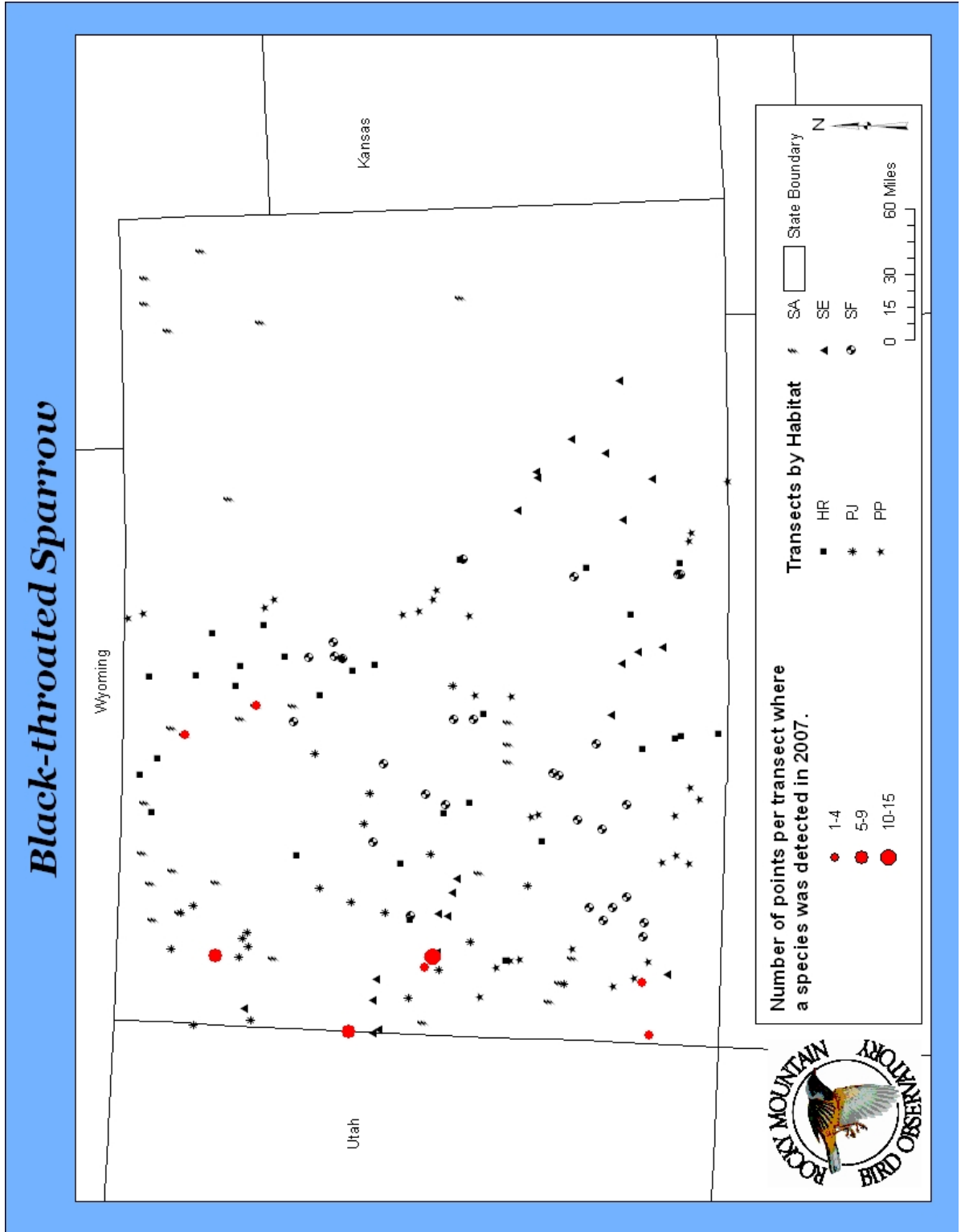
Black-throated Sparrow nests in low-elevation arid areas with little or no ground cover and scattered shrubs. In 2007, we detected 14 Black-throated Sparrows in three habitats on MCB transects.

Black-throated Sparrows are uncommon in Colorado and it is unlikely that we will be able to monitor the species with point-count transects without adding additional transects in its range.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Black-throated Sparrow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	6
SA	ID	--	--	--	--	2
SE	ID	--	--	--	--	6

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Black-throated Sparrow on transects in Colorado, 2007.

Sage Sparrow
(*Amphispiza belli*)

CDOW - Species of Greatest Conservation Need
PIF Species of Regional Concern – BCR 16
USFS Region 2 Sensitive Species
USFWS Bird of Conservation Concern – BCR 16

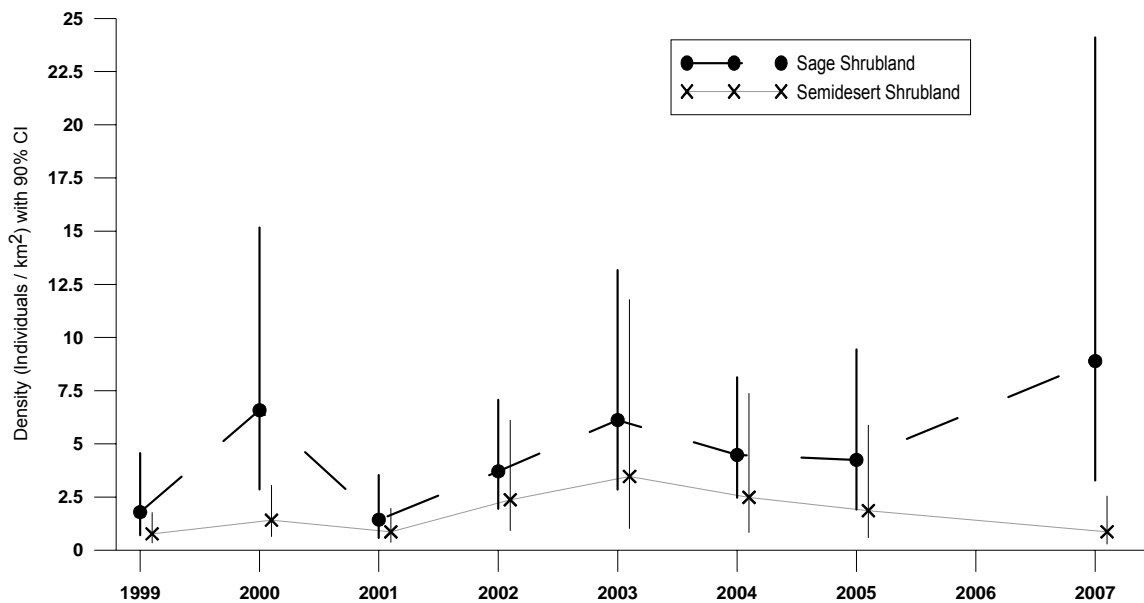
Sage Sparrow prefers open habitats with evenly spaced shrubs, and is closely tied to big sagebrush, where it nests almost exclusively. In Colorado, we have found that some Sage Sparrows also breed in pure stands of greasewood. In 2007, we detected 86 Sage Sparrows in two habitats on MCB transects.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Sage Sparrow within 35 years in sage shrubland and semidesert shrubland habitats using point transect data.

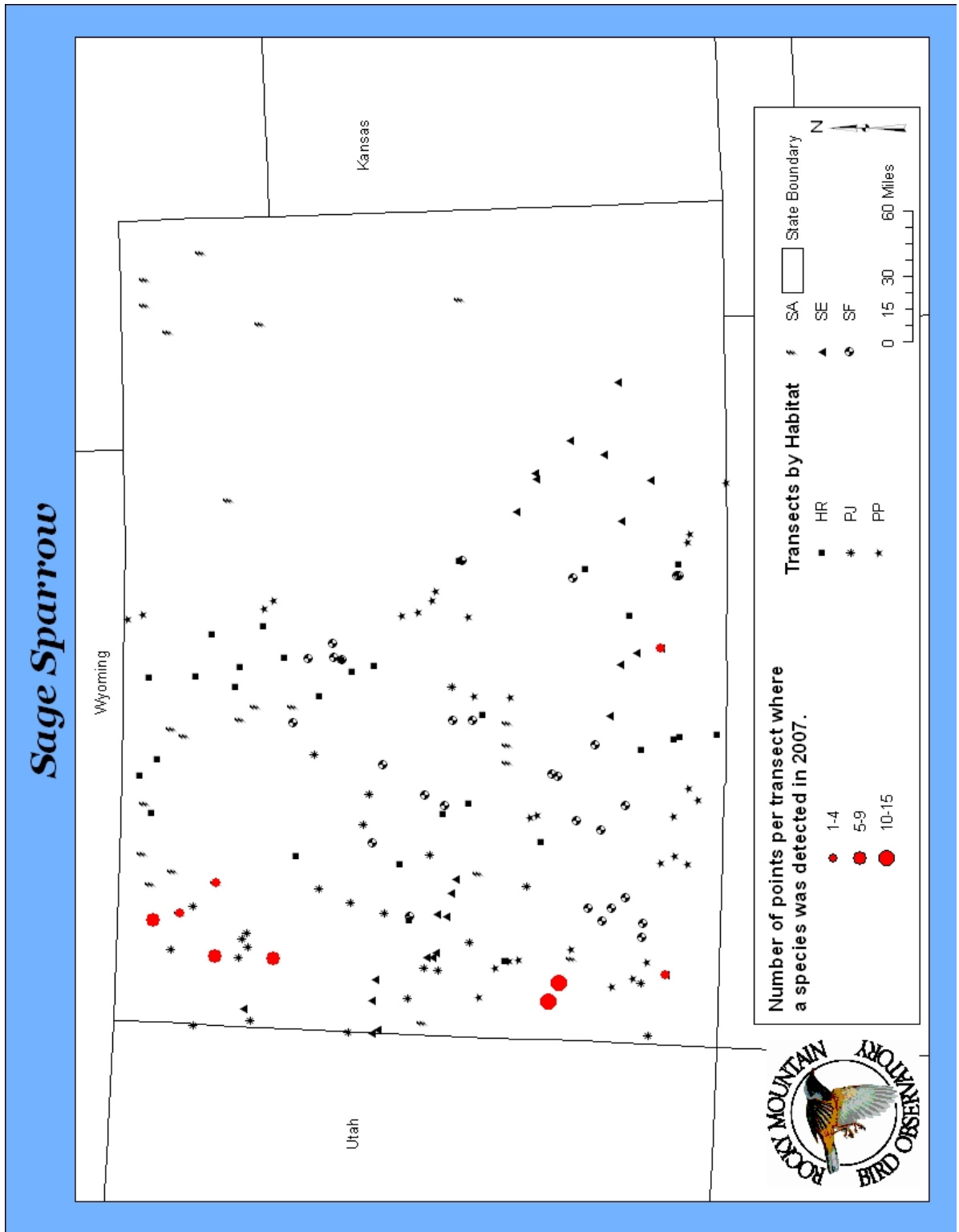
Total number of independent detections, number of individuals, and habitat-specific density estimates for Sage Sparrow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	8.9	3.3	24	63	70	80
SE	0.9	0.3	2.5	70	6	6

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Sage Sparrow, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Sage Sparrow on transects in Colorado, 2007.

Lark Bunting

(*Calamospiza melanocorys*)

CDOW - Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 18

PIF Continental and Regional Stewardship Species – BCR 18

USFWS Bird of Conservation Concern – BCR 18

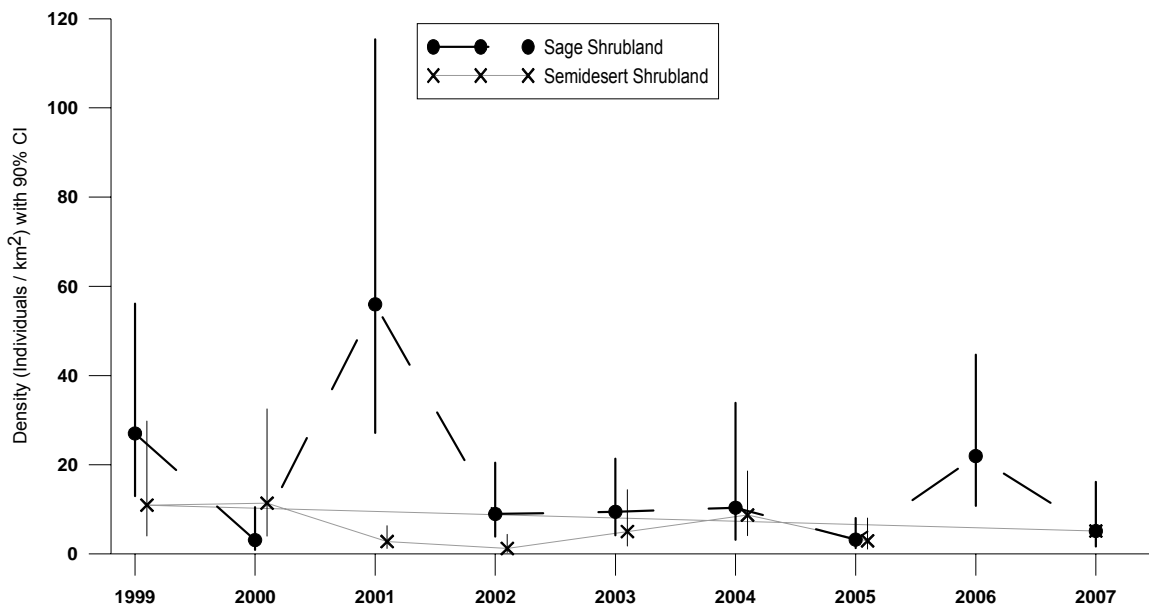
Lark Bunting is found primarily in native grassland habitat. It is very nomadic and more common in some years than others. We detected 498 Lark Buntings in three habitats on MCB transects in 2007. We were able to calculate density estimates in sage shrubland and semidesert shrubland habitats in 2007.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Lark Bunting within 40 years in sage shrubland habitat using point transect data.

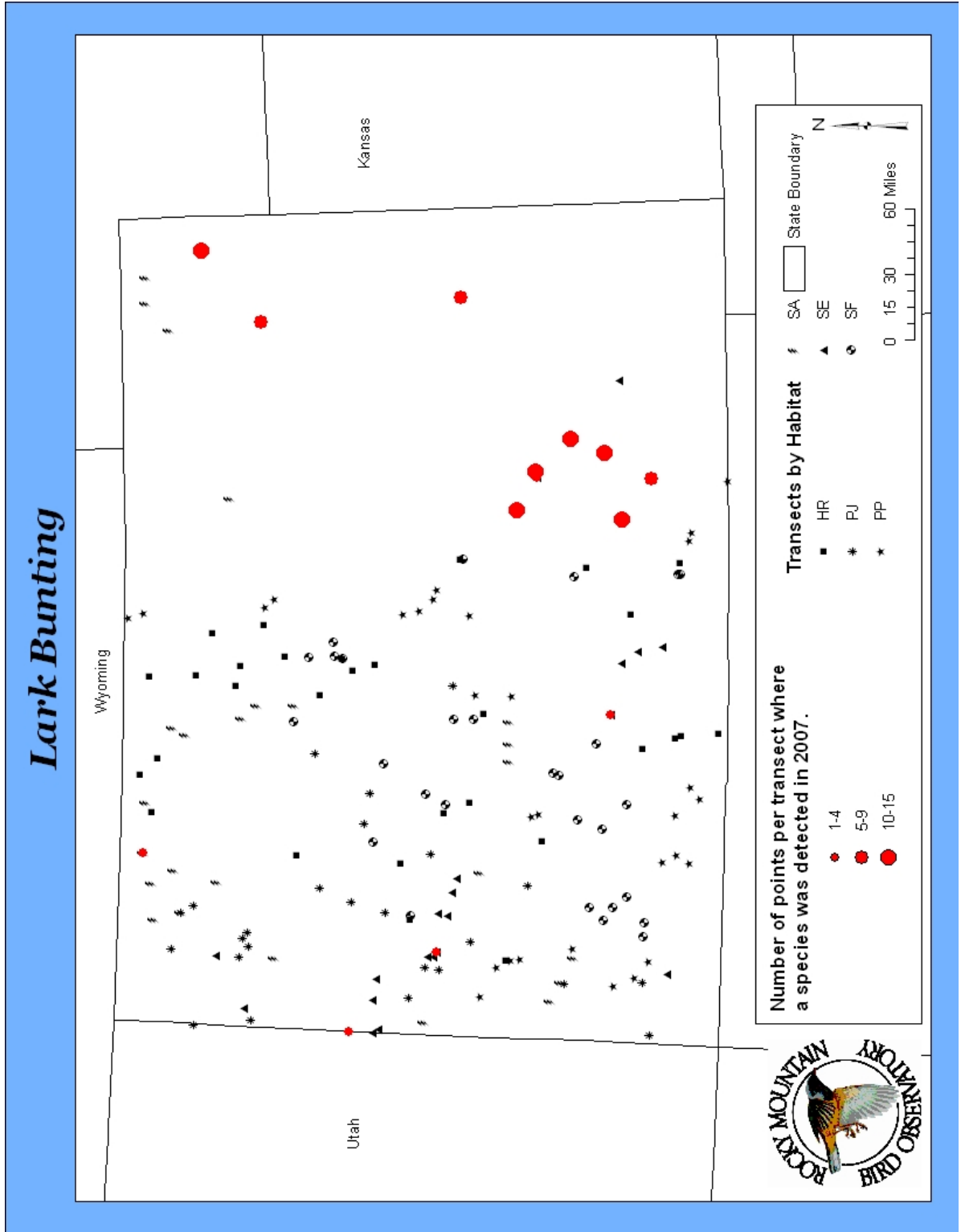
Total number of independent detections, number of individuals, and habitat-specific density estimates for Lark Bunting on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
PJ	ID	--	--	--	--	2
SA	5.1	1.6	16	77	33	73
SE	27	14	53	40	292	423

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Lark Bunting, with 90% confidence intervals, on MCB transects 1999-2007.



RMBO point-transect locations and detections of Lark Bunting on transects in Colorado, 2007.

Grasshopper Sparrow

(*Ammodramus savannarum*)

PIF Species of Regional Concern – BCR 18

PIF Continental and Regional Stewardship Species – BCR 18

USFS Region 2 Sensitive Species

USFWS Bird of Conservation Concern – BCR 18

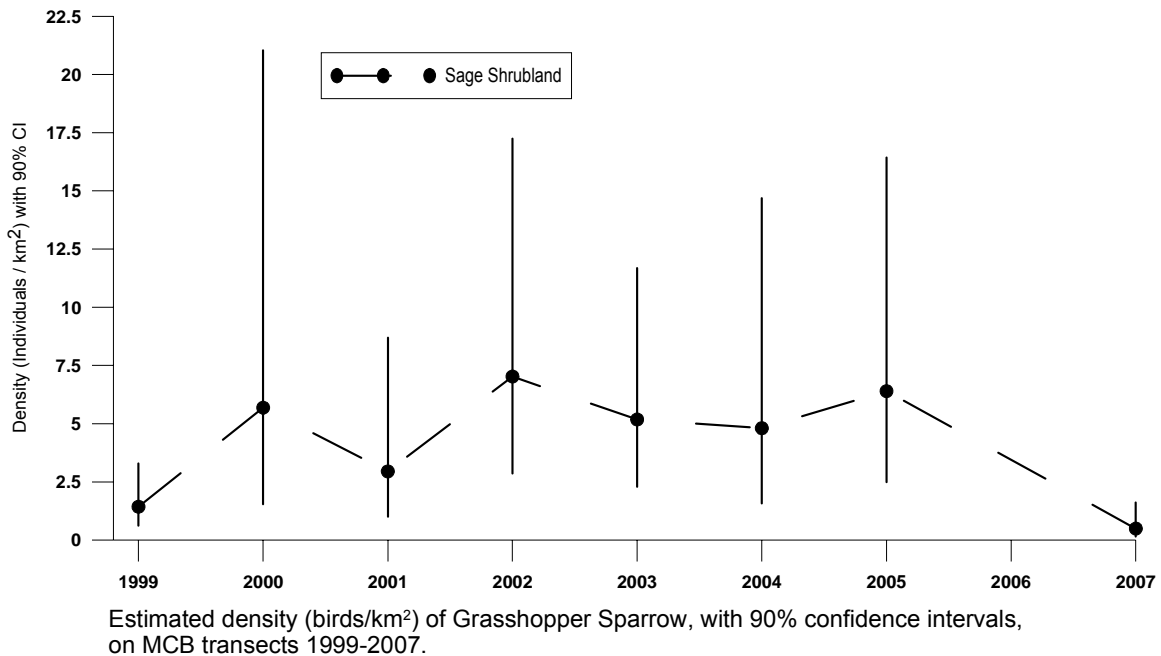
In the prairies of eastern Colorado, Grasshopper Sparrow seeks out the tallest grass available in areas with or without shrubs. We detected Grasshopper Sparrow in two habitats on MCB transects in 2007. We were able to calculate a density estimate in sage shrubland habitat in 2007.

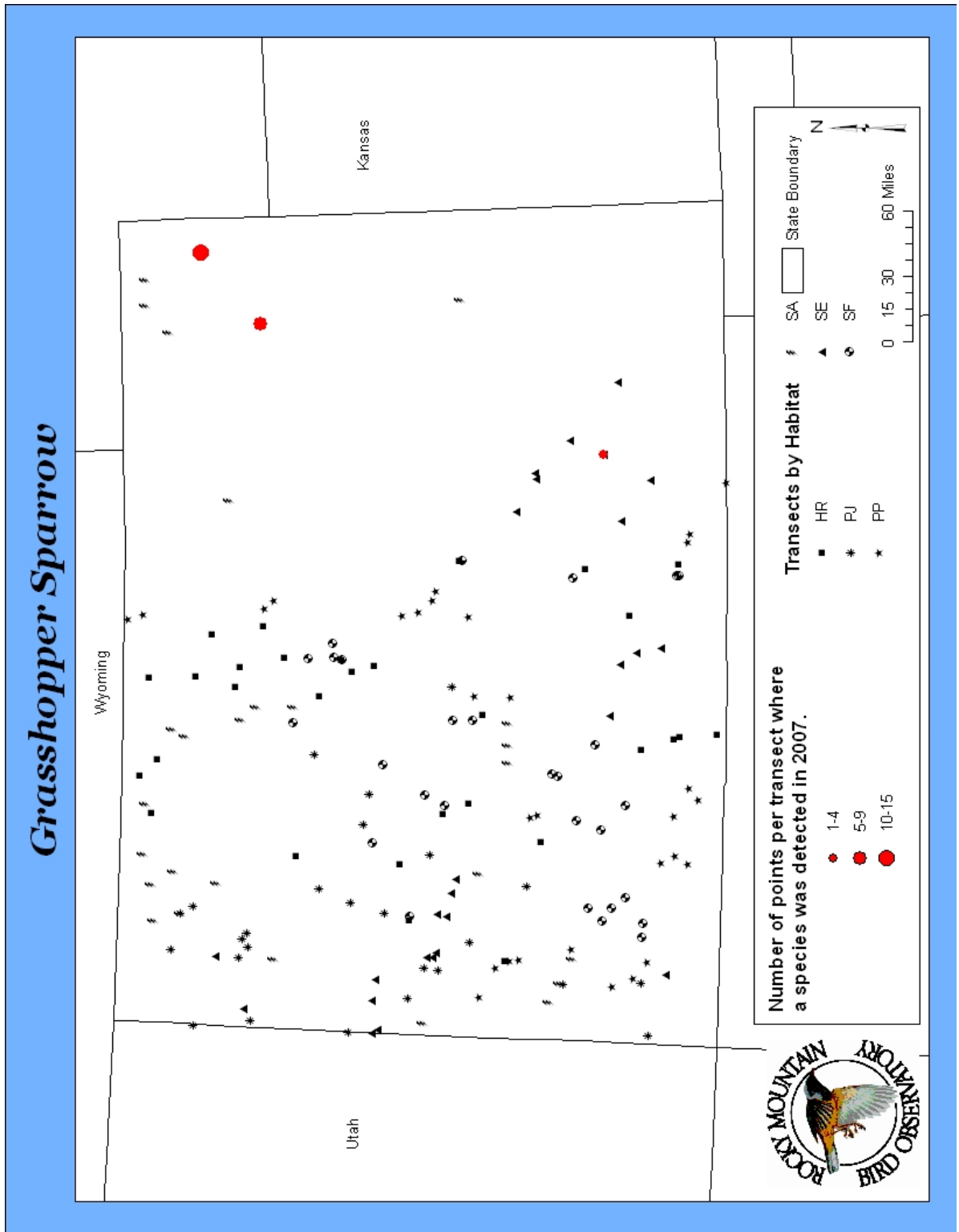
Power simulation indicates that it will take over 40 years to detect a 3% average annual population change with 80% power for Grasshopper Sparrow in sage shrubland habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Grasshopper Sparrow on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
SA	0.5	0.2	1.6	78	4	16
SE	ID	--	--	--	--	1

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Grasshopper Sparrow on transects in Colorado, 2007.

Lazuli Bunting
(*Passerina amoena*)
CDOW - Species of Greatest Conservation Need

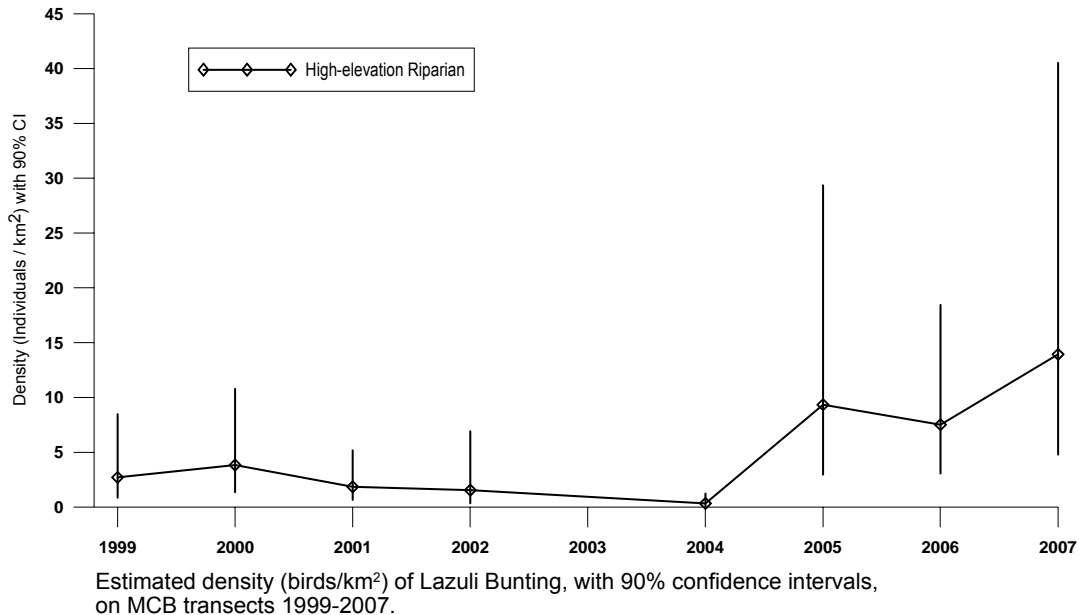
Lazuli Buntings nest most frequently in riparian areas with a rich mix of shrubs. They can also be found in other areas with a diversity of dense shrubs. In 2007, we detected 76 Lazuli Buntings in six habitats on MCB transects, and we were able to calculate a density estimate for high-elevation riparian habitat.

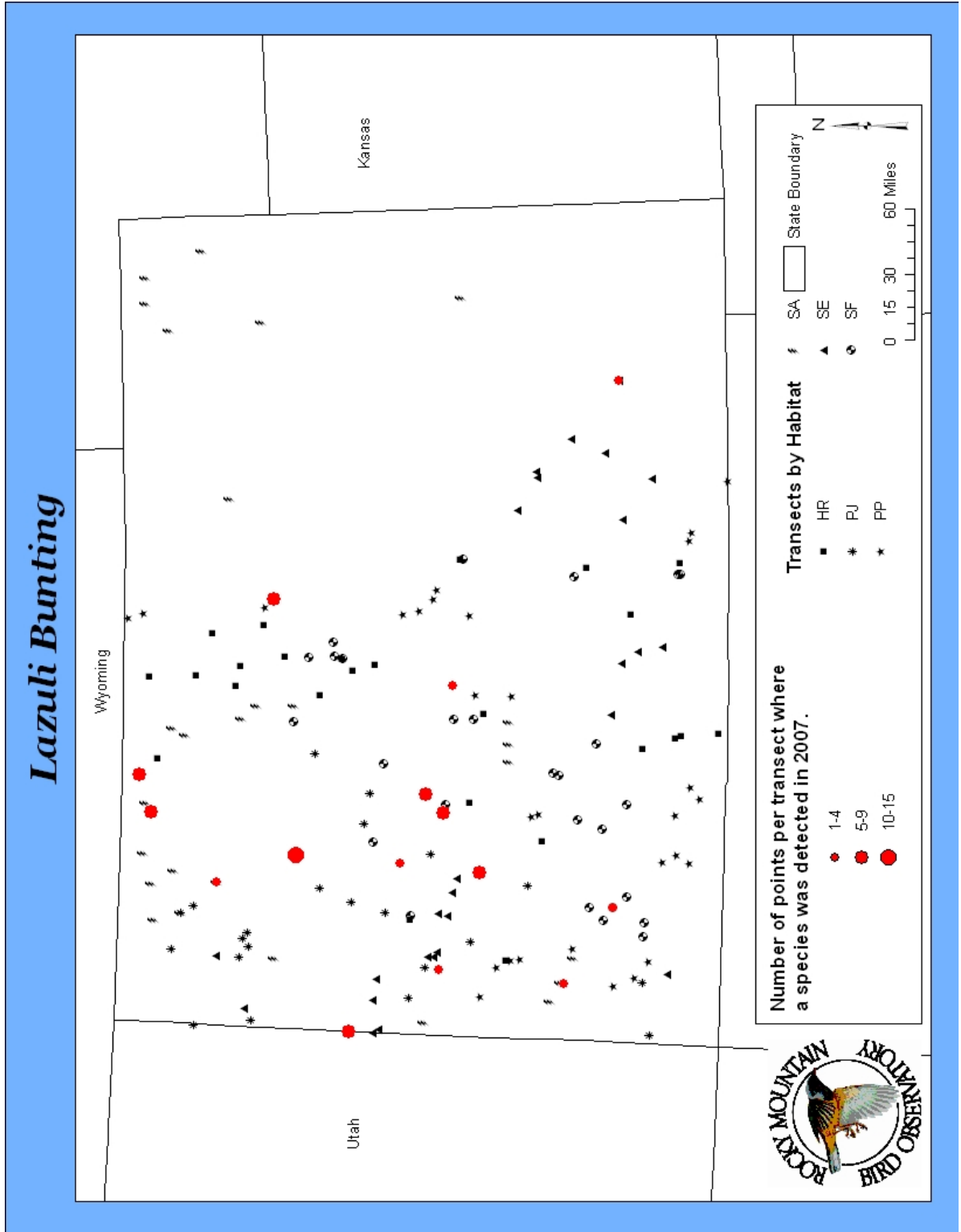
Power simulation indicates that it will take more than 40 years to detect a 3% average annual population change with 80% power for Lazuli Bunting in high-elevation riparian habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Lazuli Bunting on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	14	4.8	41	70	39	45
PJ	ID	--	--	--	--	13
PP	ID	--	--	--	--	4
SA	ID	--	--	--	--	5
SE	ID	--	--	--	--	1
SF	ID	--	--	--	--	8

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Lazuli Bunting on transects in Colorado, 2007.

Western Meadowlark

(*Sturnella neglecta*)

PIF Regional Stewardship Species – BCR 18

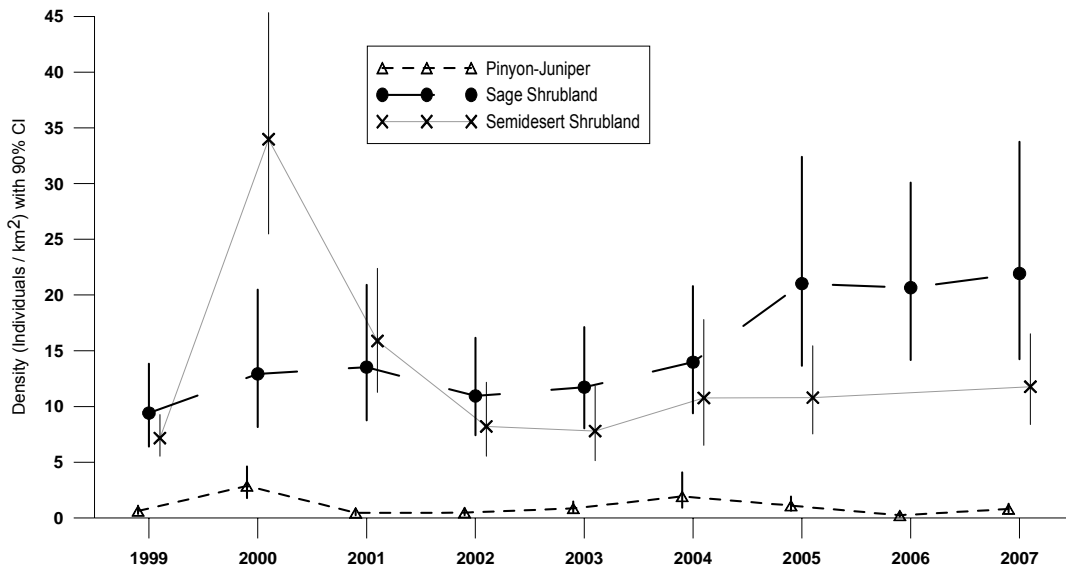
Western Meadowlark nests primarily in native grasslands, semi-desert shrublands, and sagebrush shrublands. In 2007, we detected 855 Western Meadowlarks in five habitats on MCB transects and were able to calculate a density estimate for pinyon-juniper, sage shrubland, and semidesert shrubland habitats.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Western Meadowlark within 20 years in sage shrubland and semidesert shrubland habitats and 35 years in pinyon-juniper habitat using point transect data.

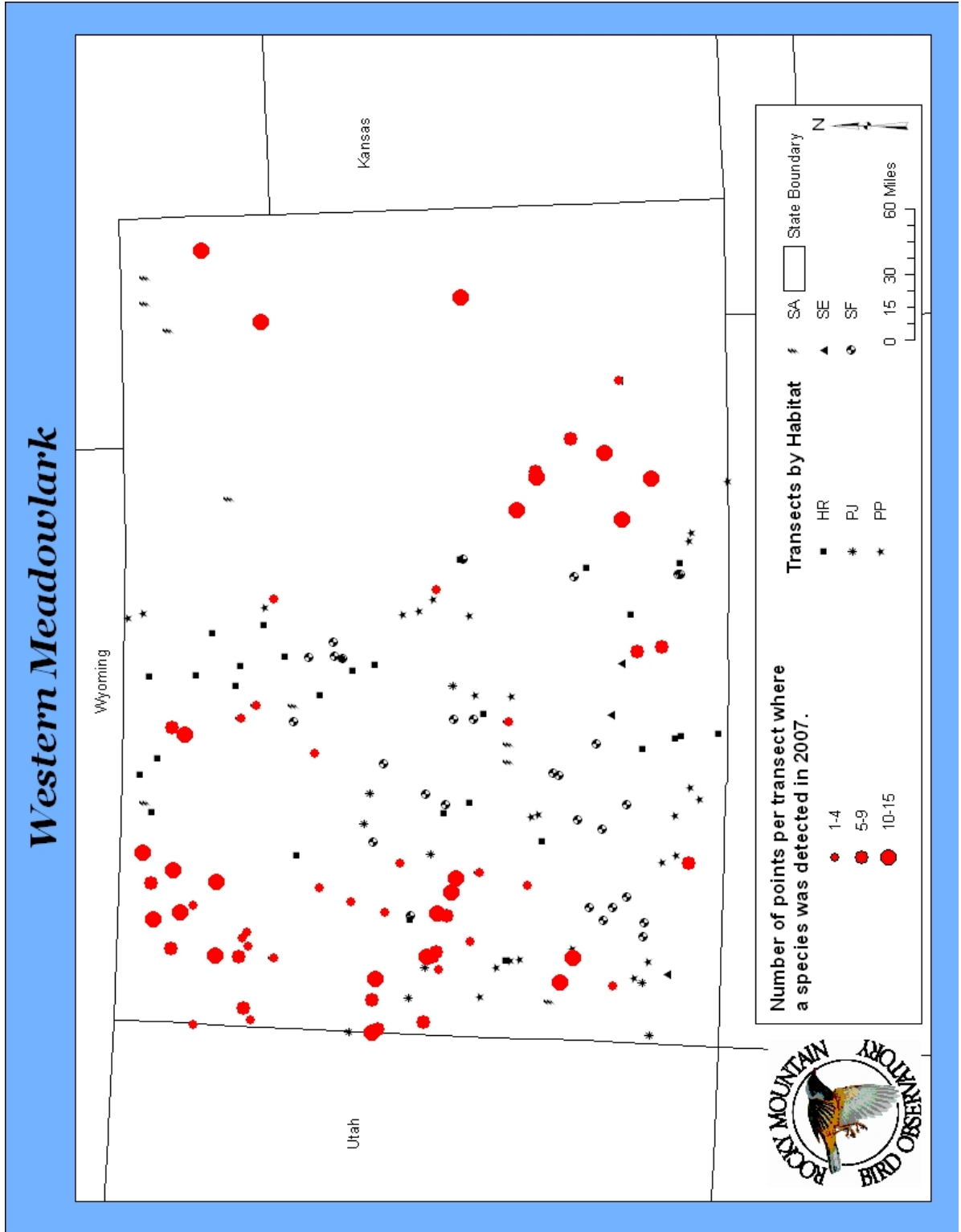
Total number of independent detections, number of individuals, and habitat-specific density estimates for Western Meadowlark on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	3
PJ	0.8	0.5	1.3	28	43	48
PP	ID	--	--	--	--	14
SA	22	14	34	26	276	358
SE	12	8.4	17	21	364	432

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Western Meadowlark, with 90% confidence intervals, on MCB transects 1999-2007.



Cassin's Finch

(*Carpodacus cassinii*)

CDOW – Species of Greatest Conservation Need

PIF Species of Regional Concern – BCR 16

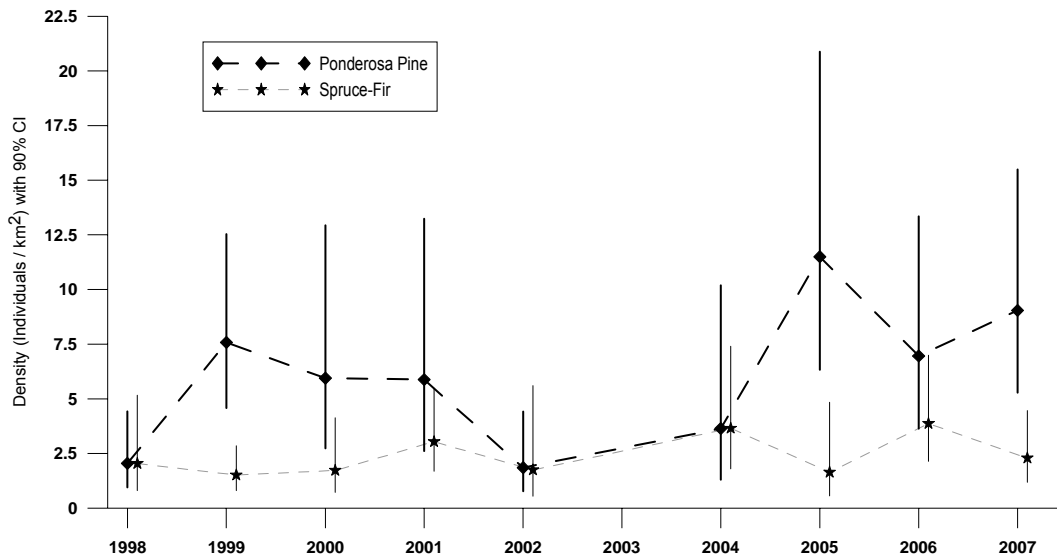
Cassin's Finches nest in all coniferous forests, but they prefer high-elevation conifers and will rarely breed in lower pinyon-juniper habitat. The species leaves the mountains only in years when nuts from coniferous trees are scarce. We detected 71 Cassin's Finches in five habitats on MCB transects in 2007 and were able to calculate a density in ponderosa pine and spruce fir habitats.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Cassin's Finch within 35 years in ponderosa pine and spruce-fir habitats using point transect data.

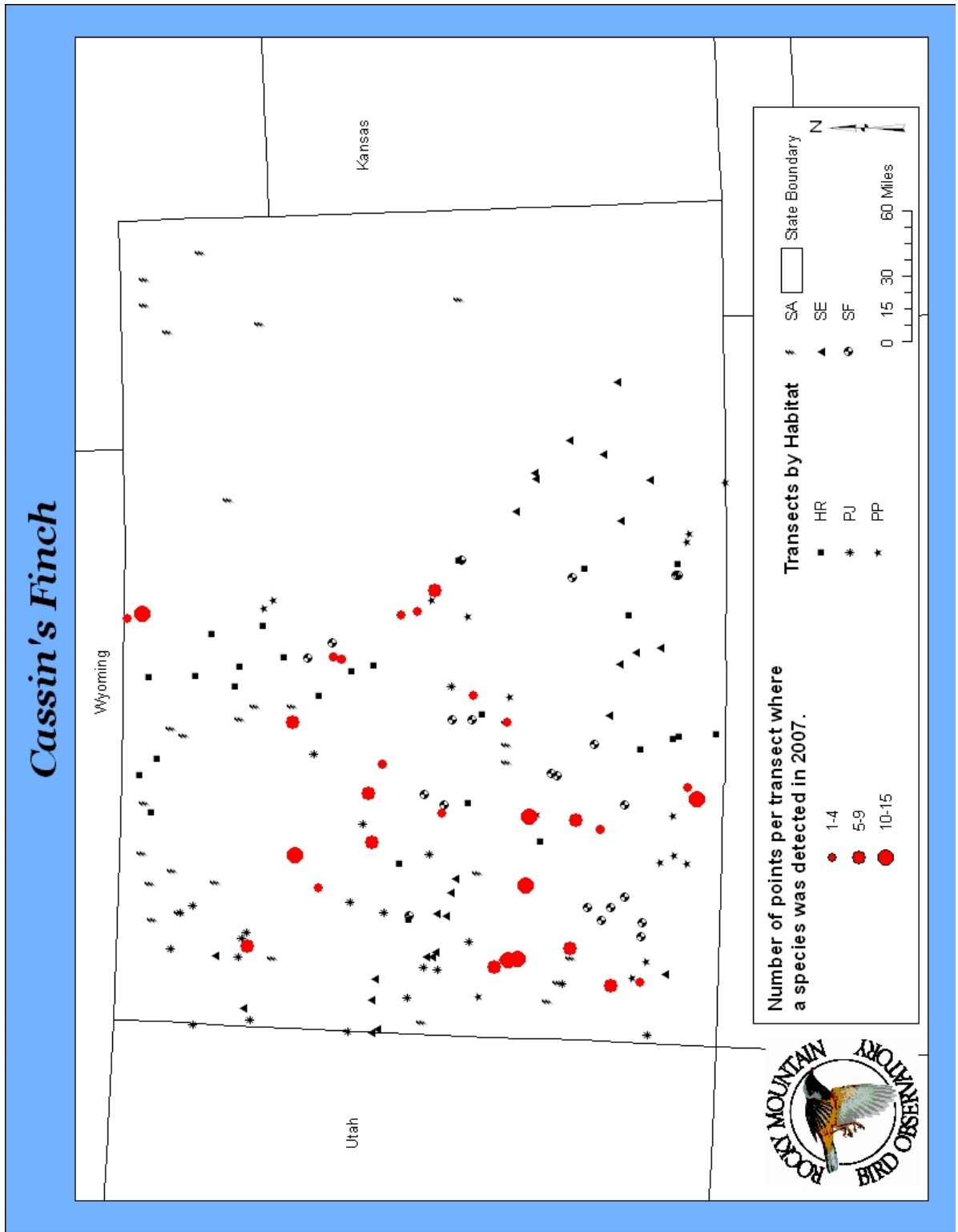
Total number of independent detections, number of individuals, and habitat-specific density estimates for Cassin's Finch on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	8
PJ	ID	--	--	--	--	1
PP	9.0	5.3	15	33	24	38
SA	ID	--	--	--	--	1
SF	2.3	1.2	4.5	41	12	13

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Cassin's Finch, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Cassin's Finch on transects in Colorado, 2007.

Red Crossbill

(*Loxia curvirostra*)

COW - Species of Greatest Conservation Need

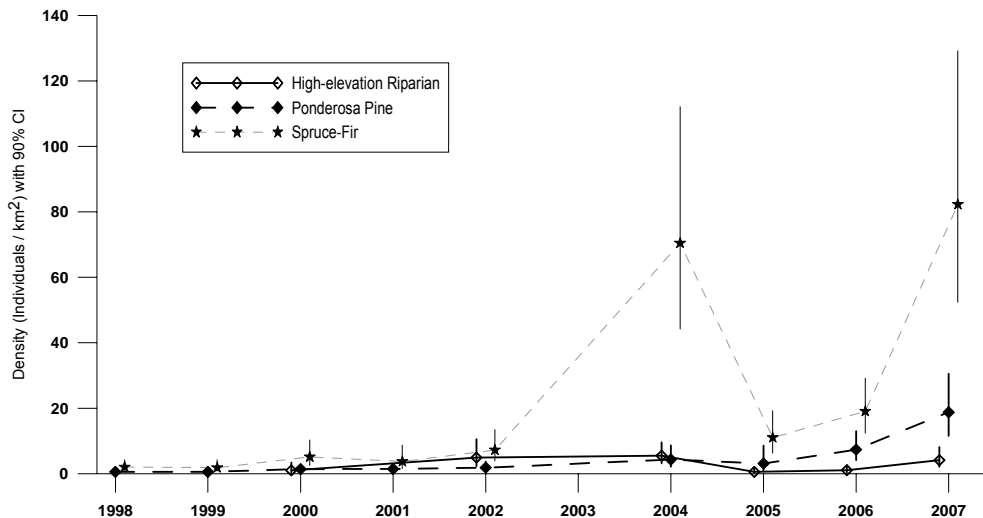
Red Crossbills have been separated into several different “types” based on their dependence on a particular species of conifer (Kingery 1998) and these types may be split into different species. In Colorado, Red Crossbills use Douglas-fir, ponderosa pine, and lodgepole pine (Kingery 1998). We detected 779 Red Crossbills in five habitats on MCB transects in 2007 and calculated a density estimate for this species in three habitats.

Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Red Crossbill within 35 years in ponderosa pine habitat and more than 40 years in high-elevation riparian and spruce-fir habitats using point transect data.

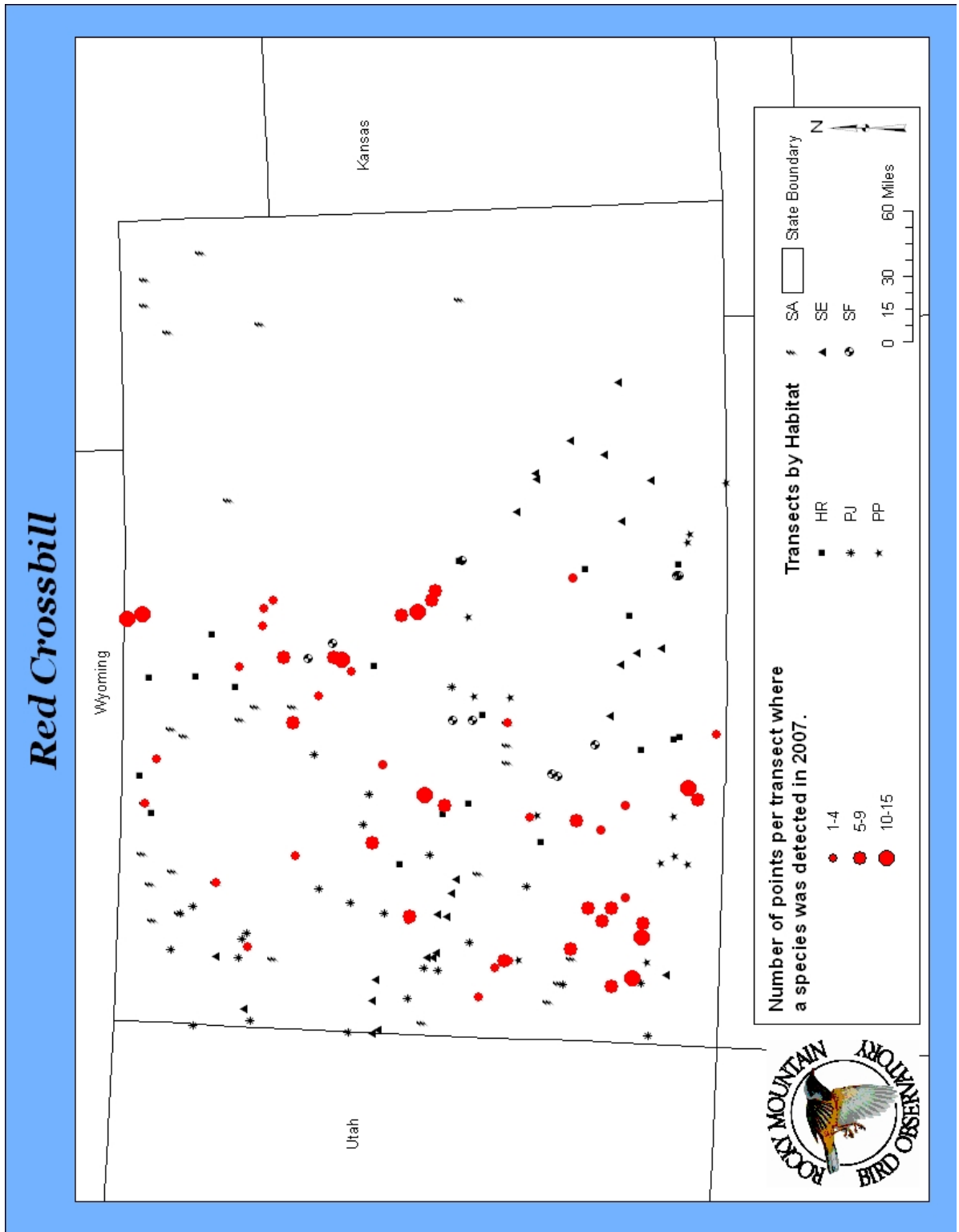
Total number of independent detections, number of individuals, and habitat-specific density estimates for Red Crossbill on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	4.1	2.1	8.2	42	22	35
PJ	ID	--	--	--	--	5
PP	19	12	31	29	136	283
SA	ID	--	--	--	--	7
SF	82	52	129	28	126	449

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



Estimated density (birds/km²) of Red Crossbill, with 90% confidence intervals, on MCB transects 1998-2007.



RMBO point-transect locations and detections of Red Crossbill on transects in Colorado, 2007.

Pine Siskin
(*Carduelis pinus*)
PIF Species of Regional Concern – BCR 16
PIF Regional Stewardship Species – BCR 16

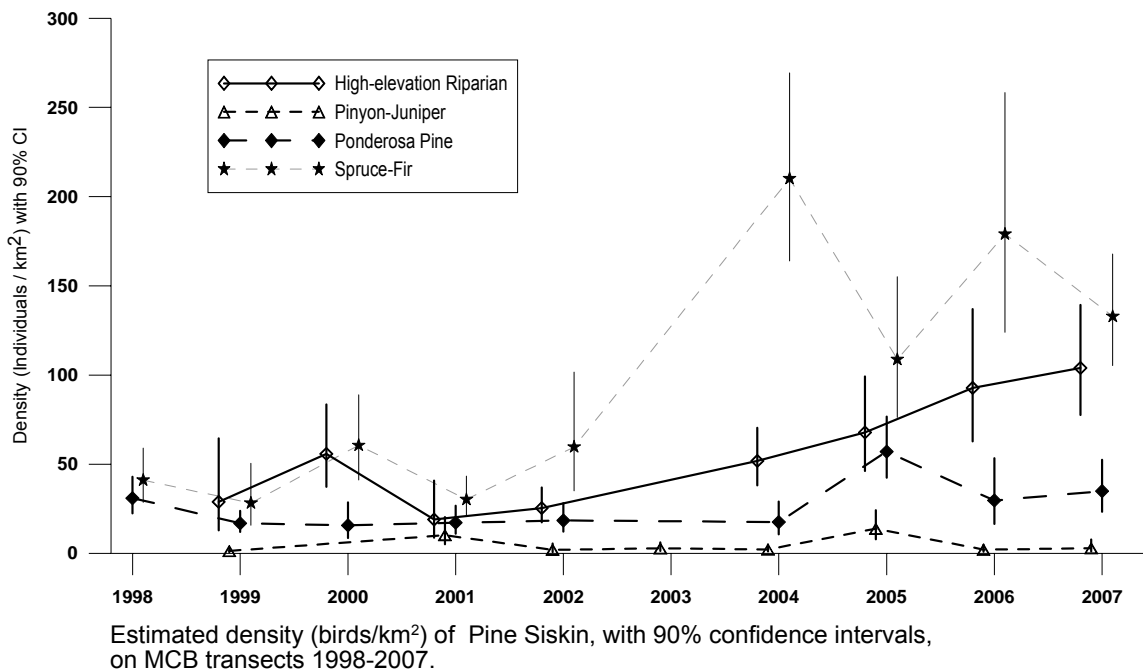
Pine Siskins nest in a variety of habitats, especially coniferous forests. In 2007, we detected 1284 Pine Siskins in six habitats on MCB transects and calculated a density estimate for this species in three habitats.

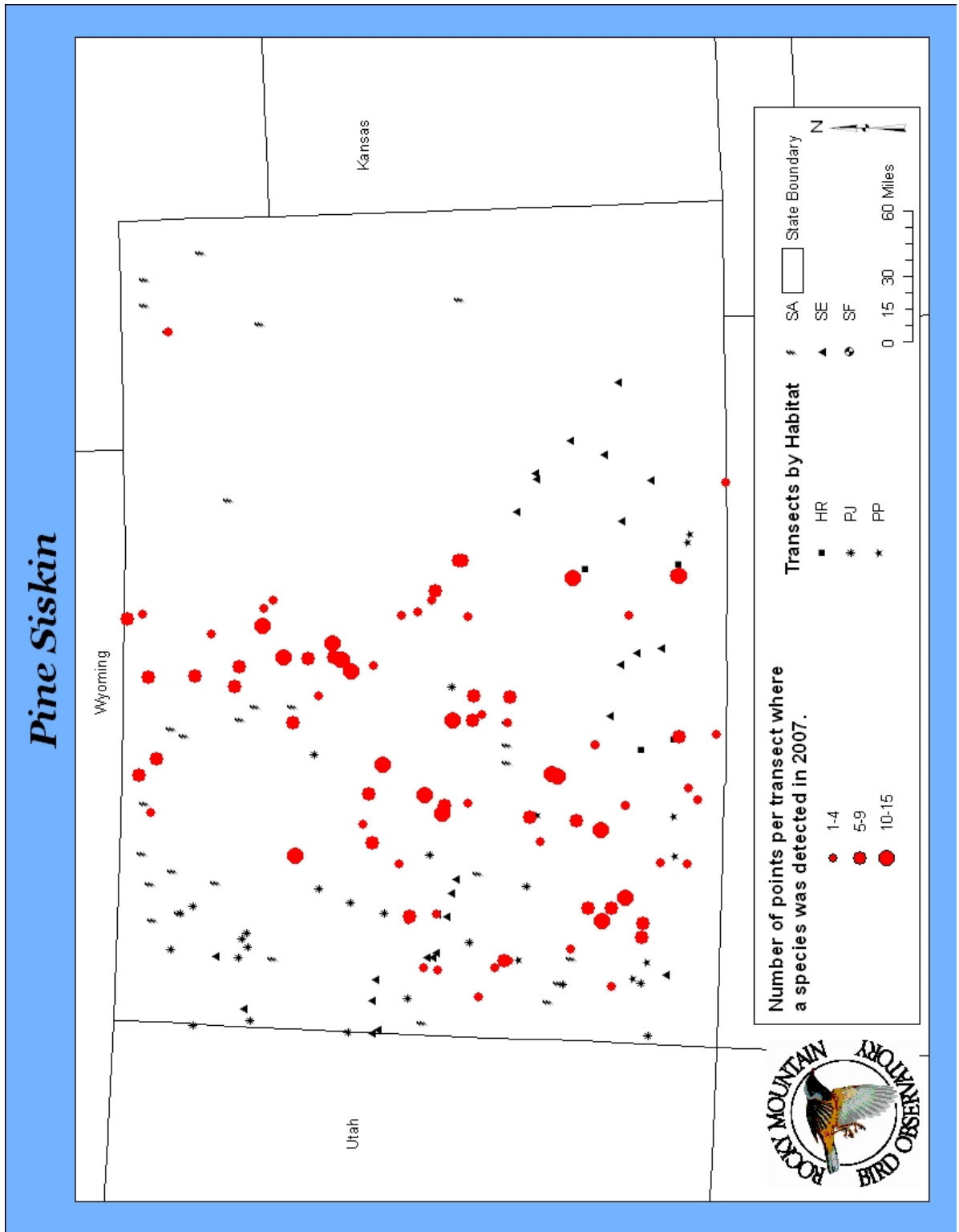
Power simulation indicates that we should be able to detect a 3% average annual population change with 80% power for Pine Siskin within 20 years in spruce-fir, within 25 years in high-elevation riparian and ponderosa pine habitats, and within 40 years in pinyon-juniper habitat using point transect data.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Pine Siskin on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	104	78	139	18	268	404
PJ	2.9	1.1	7.8	64	10	20
PP	35	23	52	24	84	143
SA	ID	--	--	--	--	3
SE	ID	--	--	--	--	1
SF	133	105	168	14	450	713

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.





RMBO point-transect locations and detections of Pine Siskin on transects in Colorado, 2007.

Evening Grosbeak
 (Coccothraustes vespertinus)
 CDOW - Species of Greatest Conservation Need

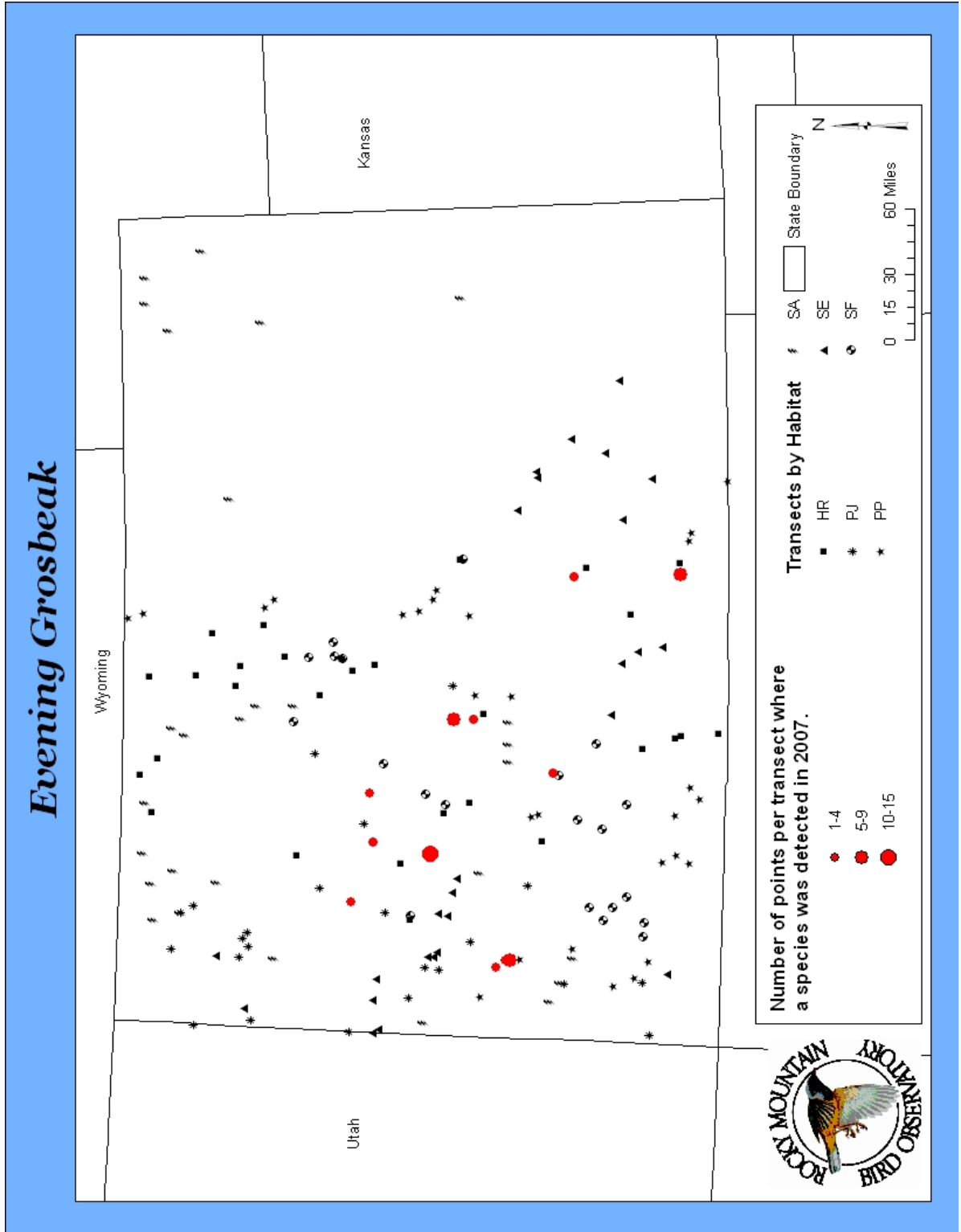
In Colorado, Evening Grosbeak nests primarily in coniferous forests, especially mixed conifer, but also ponderosa pine and spruce-fir. We detected 35 Evening Grosbeaks in four habitats on MCB transects in 2007. We were not able to calculate a density estimate for Evening Grosbeaks in any habitat.

Evening Grosbeak is probably too rare and localized in Colorado to be adequately monitored by point transects. However, in a few more seasons, using data from all years, we may be able to calculate a global detection function for this species in Spruce Fir and thereby generate annual density estimates in some forested habitats that can be used for population-trend monitoring.

Total number of independent detections, number of individuals, and habitat-specific density estimates for Evening Grosbeak on the MCB monitoring project, 2007.

Habitat	D	LCL	UCL	%CV	n	N
HR	ID	--	--	--	--	2
PJ	ID	--	--	--	--	8
PP	ID	--	--	--	--	4
SF	ID	--	--	--	--	21

D = Density (birds/square kilometer); LCL = lower 90% confidence interval of the density; UCL = upper 90% confidence interval of the density; %CV = coefficient of variation of the density; n = number of independent detections; N = number of individuals; ID = insufficient data.



RMBO point-transect locations and detections of Evening Grosbeak on transects in Colorado, 2007.

APPENDIX C. SPECIES ACCOUNTS FOR SPECIES OF MANAGEMENT INTEREST WHICH ARE TRACKED BY THE SPECIAL SPECIES PROGRAM.

In this section we present accounts for bird species for which the special species program has gathered significant information since 1998. These species are of management interest, as designated by the USFS, the USFWS, the CDOW, or PIF. For the U.S. Forest Service, we include species designated as Region 2 Sensitive Species (R2SS). For the USFWS, we include species designated as Birds of Conservation Concern for Bird Conservation Region 16 & 18 (BCR16 and 18; USFWS 2002). For the Colorado Division of Wildlife, we include species designated as State Threatened or Endangered or Species of Greatest Conservation Need. For PIF we include species listed in the PIF Species Assessment Database for Bird Conservation Region 16 and 18 (PIF Species Assessment Database 2005). We also include accounts for six waterbird species that we have been tracking and believe should continue receiving attention.

Barrow's Goldeneye
(*Bucephala islandica*)
BLM Sensitive Species
CDOW - Species of Greatest Conservation Need

Beginning in 2000, MCB has conducted an annual volunteer-based waterfowl count in late November or early December, canvassing as much of the state's open water as possible. The focus of this count is Barrow's Goldeneye, but all waterfowl and other water-associated birds are tallied.

The first North American nesting confirmation of Barrow's Goldeneye was recorded at the mouth of the Blue River in Middle Park in 1876 (Brewer 1879). Over the next few years, several more observations were reported and a few specimens and eggs were collected in Middle Park. Breeding was also reported in La Plata County, and in 1886, downy young were seen at the upper lake of St. Vrain Creek in Boulder County (Bailey and Niedrach 1965). Following that observation, this species inexplicably disappeared from the state as a breeding bird, and for a century was considered only a rare winter visitor to the state.

In 1988, field workers for the Colorado Breeding Bird Atlas project found Barrow's Goldeneyes at a small lake in the Flat Tops Wilderness. This was followed by confirmations of breeding at other lakes in the area from 1990 through 2004 (Potter 1998c). White River National Forest and the Colorado Division of Wildlife initiated a waterfowl inventory on the Flat Tops in 1992 and counted 45 young (9 broods) and 25 females, for a total of 70 Barrow's Goldeneye (Cunningham-Massey 1993). Since 1992, White River National Forest Biologists have conducted searches for broods in six years, counting from 0 to 15 broods. Interviews with Colorado Division of Wildlife personnel conducted in 1995 resulted in the belated discovery of other observations of goldeneye broods in the 1980s and in observations of hens entering spruce cavities (C. Reichert pers. comm.).

In 1999, a small group of birders attempted a one-day count of several of these sites in the vicinity of the Flat Tops where Barrow's Goldeneyes had been regularly observed in late fall. They found 229 birds at eight sites. In 2000, MCB expanded on the 1999 count, recruiting volunteers to canvass as much open water as possible looking for wintering Barrow's Goldeneyes. This count has been repeated in late November or early December in subsequent years. Over nine years of counts, Barrow's Goldeneyes have been counted at 34 sites, but a dozen sites have accounted for a preponderance of the birds on each count. Most of these are sites near the known breeding area in the Flat Tops Wilderness Area, and Lake Avery in Rio Blanco County has accounted for approximately 25% of the total. Three of the sites with high counts are farther from the Flat Tops: Jerry Creek Reservoirs in Mesa County, Blue Mesa Reservoir in Gunnison County, and Horsetooth Reservoir in Larimer County. Yearly

presence of Barrow's Goldeneyes at these sites may suggest an influx of birds from outside of the state or undiscovered breeding areas within the state.

In the 2007 early winter count, volunteers tallied 214 Barrow's Goldeneyes at 16 sites.

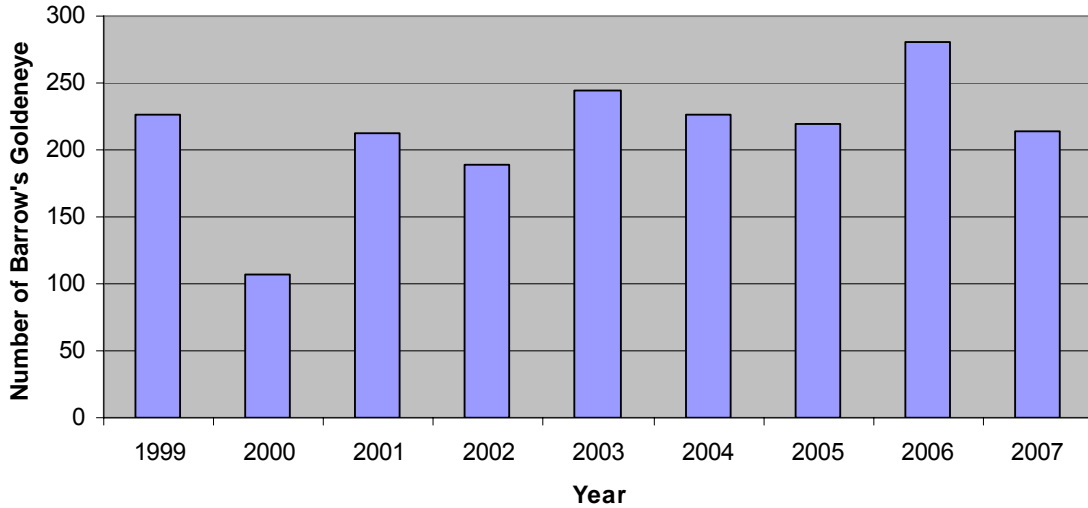


Figure 1. Number of Barrow's Goldeneyes counted during early winter waterfowl counts, 1999-2007.

Pied-billed Grebe
(*Podilymbus podiceps*)

At the turn of the 20th century, Pied-billed grebes were considered a rare breeder in the northern third of the state (Cooke 1897). By mid-century, they were known to be regular nesters on ponds and shallow reservoirs throughout the eastern plains and in suitable locations in the mountain parks and western valleys (Bailey and Niedrach 1965). Unlike other grebe species, Pied-billed does not nest colonially and vigorously defends a substantial territory. Most small lakes and ponds support no more than one or two breeding pairs, and large lakes and reservoirs seldom support more than a few. Instances of breeding pairs in double figures at a site are extremely rare.

The Colorado Breeding Bird Atlas project detected Pied-billed Grebes in 63 priority blocks and confirmed breeding in 23 (Potter 1998b). Without more extensive observation than Atlas protocol generally afforded, the secretive nature and extended breeding period of this bird make confirmation relatively difficult, so nearly all Atlas observations may represent breeding birds. The Atlas sample projects possible nesting at approximately 350-400 sites statewide, and a population of 705-2290 breeding pairs (Kingery 1998).

MCB's monitoring effort on this species has been limited to recording birds detected on secretive marshbird surveys, creating a catalog of breeding sites, and recording observations made incidental to colony counts and other surveys. In 2007, because wetland transects and secretive marshbird surveys were not conducted we recorded no detections of this species. We did receive reports of breeding from Arapaho National Wildlife Refuge and Lake John in 2007 and our developing catalogue of confirmed and probable nesting sites now includes 120 locations.

It seems unlikely that MCB's randomly placed wetland transects will produce sufficient detections to provide monitoring data for this species. Two possible monitoring strategies seem feasible. An expanded set of secretive marshbird surveys following the most recent revision of the nationally proposed protocol (Conway and Nadeau 2006) could produce a sufficient number of detections to provide an accurate index to the population. A second alternative, which may be more precise, would involve developing a dual frame sampling scheme utilizing the catalog of sites where breeding has been confirmed as one frame and a list of potential sites as the second (Haines and Pollack 1998).

Eared Grebe

(*Bucephala islandica*)

CDOW - Species of Greatest Conservation Need

Eared Grebes probably have nested in Colorado since long before settlement, the first recorded nest confirmation occurring in the San Luis Valley in 1874. (Henshaw 1875). Bailey and Niedrach (1965) report that record and note that "there are numerous references in the literature to nesting elsewhere."

Although nesting occasionally occurs on the plains, most colonies have been located at reservoirs in mountain parks, especially North Park and the San Luis Valley. Eared Grebes have adapted easily to the construction of artificial bodies of water, and we have confirmed nesting at only two natural lakes, Big Lake in Rio Grande County and Glade Lake in Dolores County. They lay 3-7 eggs in a nest constructed of floating vegetation, most frequently smartweed. Nests are usually in plain view in open water, but occasionally are somewhat concealed in cattails or bulrushes.

The only effort at quantifying the statewide population prior to MCB has been the Breeding Bird Atlas project, the projections of which "do not work well for highly colonial species" (Kingery 1998). The Atlas effort confirmed breeding in 12 priority blocks and projected a population of 545-1292 breeding pair. In favorable years, counts at Walden Reservoir, Jackson County, and at San Luis Lakes, Alamosa County, reached 750 and 450 active nests respectively (Nelson and Carter 1990). MCB began counts in 1998 with a survey of 93 known, suspected, and potential locations (Giroir and Leukering 1999). We have documented nesting at 49 sites since beginning surveys in 1998.

During the first eight years of tracking Eared Grebes, MCB documented a decline in the breeding population. This decline can probably be attributed primarily to the effects of drought, although untimely high water levels may have been a factor in the relatively low number of nests in 2004 and 2005. Due to water management changes related to the Closed Basin Project, San Luis Lake no longer has suitable nesting habitat.

In 2007, MCB received information for four breeding sites, all in Jackson County, where 433 nests were counted.

Western Grebe

(*Aechmophorus occidentalis*)

CDOW - Species of Greatest Conservation Need

Only a rare migrant in the 19th century (Cooke 1897), Western Grebes became increasingly common in Colorado through the 20th century along with a growing number of reservoirs, and the first nests were recorded in 1940 (Bailey and Niedrach 1965). Western grebes build floating nests of cattails or bulrushes along the edges of reservoirs. Nest success is dependent on water levels remaining relatively stable through the incubation period, a circumstance that is not very reliable at Colorado reservoirs.

The Colorado Breeding Bird Atlas project confirmed breeding in three priority blocks (southeast block of each quadrangle to be the block in which field work was focused) and projected a statewide population of 321-677 breeding pairs. Unless the population has actually been depressed from prior years, MCB surveys since 1988 indicate that this projection is an example of the Atlas numbers being unreliable for colonial species (Kingery 1998).

Since 1998, we have recorded nesting at 29 different sites; most of these sites (21), however, have been used only once during the period, and no site has been active in all years.

In 2007, an estimated total of 169 nests were reported from seven breeding locations. This is the first year that breeding by the species has been suspected at Steamboat Lake in Routt County.

Clark's Grebe
(*Aechmophorus clarkii*)

In 1985, Clark's Grebe was accorded full species status after being considered a color morph of Western Grebe for nearly a century. One result of this classification is that virtually nothing is known of its distribution or abundance in Colorado prior to the split.

The Colorado Breeding Bird Atlas project confirmed breeding in two priority blocks (and another 5 locations), and projected a statewide population of 146 breeding pairs (Kingery 1998). Unless the population has actually been depressed from prior years, MCB surveys since 1988 indicate that this projection is an example of the Atlas projections generally exaggerating numbers for colonial species.

We have confirmed nesting at 14 sites since beginning surveys in 1998, but ten of those have been active in only one year during that period. In 2007, we received a report of one pair during the breeding season at a new location for this species; Steamboat Lake in Routt County.

American White Pelican
(*Pelecanus erythrorhynchos*)
BLM Sensitive Species
CDOW - Species of Greatest Conservation Need

Nesting of American White Pelican in Colorado first occurred in 1962 when an estimated 200-250 adults fledged approximately 60 young at Riverside Reservoir in Weld County (Bailey and Niedrach 1965). Since then, additional colonies have become established at Antero Reservoir in Park County in 1990 and at MacFarlane Reservoir in Jackson County in 1992. The Antero colony has been intermittently inactive in the past decade due to periodic draining of the reservoir. Riverside and MacFarlane colonies have produced young annually since they were established.

The historic counts of juveniles produced in Colorado show marked fluctuation, as do the annual counts at each of the breeding colonies. Recent counts at Riverside have not approached the 1800 fledged in 1994 (Potter 1998a). There is some concern that erosion is reducing the size of the island where the pelicans breed at this site (David Klute pers. comm.). Obtaining permission to count juveniles at Riverside Reservoir is essential if this species is to be monitored in Colorado.

In 2007, we received a report of approximately 200 juvenile American White Pelicans at MacFarlane Reservoir in Jackson County.

Double-crested Cormorant
(*Phalacrocorax auritus*)

Cormorants were uncommon in Colorado before 1930, and nesting in the state was first recorded at Barr Lake in 1931 (Bailey and Niedrach 1965). By the 1980s the population had grown to approximately 1000 breeding pairs (Ryder 1995). Cormorants first nested on the Western Slope in 2002 at Fruitgrowers Reservoir in Delta County.

Cormorants build tree-top nests, often in company with Great Blue Herons. There is some concern that cormorants displace the herons, but at some colonies (e.g., Barr Lake) the two species have co-existed for decades. Cormorants also nest on the ground on barren islands, and all three of Colorado's American white Pelican breeding sites have also supported sizeable cormorant colonies.

The Colorado Breeding Bird Atlas project confirmed breeding in only one priority block (and another 15 locations), and its mid-range projection indicated a statewide population of 1108 breeding pairs (Kingery 1998), which is very close to the running three-year averages of MCB surveys since 1988.

In 2007, eight sites were surveyed and 918 active nests were counted. The total number of active nests has remained stable for the past eight years.

American Bittern

(*Botaurus lentiginosus*)

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

Accounts of American Bittern in Colorado indicate that it has long been a common summer resident throughout the state (Cooke 1897, Sclater 1912, Bailey and Niedrach 1965). American Bitterns have been most frequently recorded in along the South Platte and Arkansas drainages and in the San Luis Valley (Andrews and Righter 1992). They also occur regularly, but in smaller numbers, in North Park and Browns Park. Reports from northeastern Colorado indicate a decline in that region, but quantitative data are lacking (Ryder et al. 1979).

The Colorado Breeding Bird Atlas project detected American Bitterns in 10 priority blocks and confirmed breeding in three (Yeager 1998). The secretive nature of this bird makes confirmation relatively difficult, so nearly all Atlas observations may represent breeding birds, which would indicate more than 60 active sites statewide. The Atlas sample projected a population of 209-497 breeding pairs (Kingery 1998).

MCB's monitoring effort on this species has included recording observations on its set of randomly placed wetland transects and on a small set secretive marshbird surveys, and to creating a catalog of breeding sites. MCB wetland transects probably will not consistently produce sufficient detections to provide monitoring data for this species. In 2005, the last year secretive marshland surveys were conducted in Colorado, twelve Bitterns were detected. We continued compiling breeding season detections for future surveying, and our database now contains 53 sites where breeding in the past six years by this species has been suspected or confirmed. In 2007, American Bitterns were reported at Cowdry Lake in Jackson County, Fruitgrowers Reservoir in Delta County, and Steamboat Lake in Routt County.

There are two possible monitoring strategies for this species that seem feasible in Colorado. First, an expanded set of secretive marshbird surveys following the most recent revision of the nationally proposed protocol could produce an adequate number of detections to provide an accurate index to the population (Conway and Nadeau 2006). A second alternative, which would provide density estimates rather than indices, would involve developing a dual frame sampling scheme utilizing the catalog of sites where breeding has been confirmed as one frame and a list of potential sites as the second (Haines and Pollack 1998).

Great Blue Heron
(*Ardea herodias*)

Great Blue Herons have nested in Colorado for at least as long as bird records have been kept. Cooke (1897) described this species as a not uncommon summer resident, "seldom going above 5000 feet." Bailey and Niedrach (1965) indicated that Great Blue Herons "are common birds throughout Colorado along the streams and shores of the larger reservoirs."

We now know that Great Blue Herons nest well above 5000 feet in Colorado; the highest colonies thus far located are above 9000 feet elevation near Aspen and Crested Butte. Several colonies occur along each of the major river systems in the state except the Rio Grande; the reason for this species' near absence in that drainage is not known.

Great Blues build bulky, conspicuous tree-top nests, mostly in cottonwoods but a few in ponderosa pine and spruce. They generally begin nesting activities in late February or early March—somewhat later at higher elevations. They generally lay three to five eggs, which hatch in 25-29 days. The young remain in the nest for two to three months (Dexter 1998). The early onset of nesting—well before trees leaf out—provides an opportunity to conduct direct nest counts from the perimeter of the colony without disturbing the nesting birds.

Colonies may be active for many years but also may be quite ephemeral. Large colonies tend to be long-lived, smaller colonies less so. Some of our larger colonies have been active for more than 25 years; single-nest colonies are also frequently single-year colonies. Each year it is necessary to survey suitable habitat to locate new colonies; many are located in winter as the nests are conspicuous when the leaves are off the trees.

Surveys by amateur birders and wildlife biologists resulted in locating 23 and 18 colonies in 1965 and 1973 respectively (Ryder et al. 1979). CDOW biologists conducted an extensive inventory of Great Blue Herons in 1978-1983. (Miller and Graul 1987). During the first three years of the inventory, researchers located 53 colonies and computed a sum of highest counts for each colony of 874 active nests. In the following three years they located 54 active colonies and computed a sum of highest count of 1451 active nests.

During eight years of field work (1987-1995) covering 1/6 of the state, the Colorado Breeding Bird Atlas project confirmed nesting in 22 priority blocks, and projected approximately 132 colonies active during the period of study (this figure ignores the possibility of multiple colonies within any block). The Atlas used a logarithmic scale of abundance; formulae used to derive population estimates from abundance codes generated an estimate of 2262-6136 breeding pair. These estimates include a caveat that Atlas extrapolations for colonial species

may be unsatisfactory (Kingery 1998). Indeed, they seem to greatly overestimate the population.

MCB began its inventory effort in 1999 by surveying the sites reported by Graul and Miller. We conducted extensive searches for used nests in the winters of 1999-2000 and 2000-2001. In our first three years we located active colonies at 100 sites and for comparison with the earlier study computed a sum of highest counts of 2217 active nests, approximately 50% higher than that inventory (Levad and Leukering 2002). Because the sum of highest count probably overestimates the population (but not as severely as the Atlas procedure), we determined that a running three-year average would better reflect the true size of the population and would be a better measure of population changes.

The MCB special species database now contains 236 sites where this species has bred or breeding is suspected. This includes a numbers of sites that may be more accurately described as parts of a larger colony or as new locations of colonies that have moved a short distance. While it is important to track all locations for logistical purposes, for reporting purposes we have lumped many of these "sub-locations," and indicate 130 colonies confirmed by our monitoring effort.

In 2007, we surveyed 67 sites of which 54 had at least one active nest and a total 1268 active nests were counted.

Great Egret
(*Ardea alba*)

This species has nested in Colorado only since 1972 when one or two pairs began nesting in a large Great Blue Heron Colony on Boulder Creek. The number of nests there gradually grew, peaking at 19 nests in 2000. For no apparent reason, the next year, most of the egrets (and many of the herons) moved to a heronry near Longmont. In 2002, they completed the move, and since that year nests in Colorado were at this site, which is now included in St. Vrain State Park. Great Egrets have also initiated single nests in single years at Riverside Reservoir (1983) and Milton Reservoir (2002). Great Egrets were also present in small numbers at San Luis Valley sites in 2002 through 2005 during the nesting season, but breeding was not confirmed there.

The Great Egrets of Boulder Creek and St. Vrain State Park have been counted by CDOW personnel annually since 1993. In 2007, we received reports for two of historical nest sites; St. Vrain State Park hosted 25 active nests and Boulder Valley Farm was not active. Although there has been some fluctuation, it seems the count of active nests indicate a small, slowly growing population.

Snowy Egret

(*Egretta thula*)

CDOW - Species of Greatest Conservation Need

Nesting in Colorado by the Snowy Egret was first confirmed in 1937 at Barr Lake in Adams County; the first confirmation in the San Luis Valley followed shortly in 1940. Nesting records now exist for 20 sites in Colorado, 6 of those in the San Luis Valley; however, in most years only three to five sites are active.

This species most often nests in bulrush marshes, often in association with other marsh-nesting species such as Black-crowned Night Herons, Cattle Egret, and White-faced Ibis. These habits may make accurate counts difficult to conduct without excessive disturbance of the birds.

Ron Ryder of CSU and refuge personnel have conducted counts and banded many birds in the San Luis Valley most years since the 1950s. A high of 600 pairs nested in the San Luis Valley in 1976 (Ryder 1978).

In 2007, we received two reports of breeding by Snowy Egrets; one at the Denver City Park where one nest was found and the other came from Walden Reservoir (five nests were counted) which is a new breeding location for this species in Colorado. Snowy Egret was observed at Fruitgrowers Reservoir in Delta County during the breeding season, and it is possible that this species is breeding there. This is especially interesting because the species has not been documented as a breeder on the west slope of Colorado.

Numbers for this species have fluctuated greatly since the beginning of the MCB special species program. Most of that fluctuation is a result of greatly fluctuating water availability; some, though, may be due to the inherent difficulties in accurately counting marsh-nesting colonial waterbirds.

Black-crowned Night-Heron
(*Nycticorax nycticorax*)

Black-crowned Night-Heron is one of the few colonial waterbirds that was nesting in Colorado prior to the 20th century. Nesting was recorded at San Luis Lake in 1875 and at several locations on the eastern plains before 1900. One hundred pairs were counted at Barr Lake in 1909 (Bailey and Niedrach 1965). Through the 20th century breeding was observed at approximately 30 sites, with colonies growing, declining, appearing, disappearing, and reappearing (Andrews and Righter 1992).

Night-Herons nest in a variety of situations: they will join Great Blue Herons and Double-crested Cormorants nesting in treetops; they will nest beside Snowy Egrets and White-faced Ibis in bulrush marshes; at higher elevations, they will nest by themselves in tall willow thickets. The variety of nesting situations calls for a variety of count techniques. At tree-top sites, direct nest counts work well. At willow thickets, the most effective technique is a flush count conducted late in the incubation period or early in the brooding period. Marsh-nesting colonies are difficult to count without undue disturbance of nesting activities, so we estimate the number of active nests based upon observations made during flight-line counts, nest counts, and banding operations that involve multiple species.

In 1965, 14 colonies and in 1973, 11 colonies were reported in mail surveys (Ryder 1979). Colonies of approximately 100 nests each were reported from the San Luis valley, North Park, and Latham Reservoir in Weld County in these surveys. In the eight-year period of Colorado Breeding Bird Atlas work (1987-1995), 26 colonies were documented. Most colonies were small, containing ten or fewer breeding pairs; four (Alamosa NWR, Monte Vista NWR, San Luis Lake SWA, and Denver City Park) were reported to exceed 100 pairs each. Monitoring Colorado's Birds began counts of Black-crowned Night-Heron in 1999. Since then, we have found breeding Night-Herons at 26 locations, not all the same sites as previously recorded. The largest production during this period occurred at Monte Vista NWR and Denver City Park. Notably, Night-Herons have not nested at Latham Reservoir, Alamosa NWR, or San Luis Lakes since our counts began. The gradual increase in number of colonies since 1999 is probably due to increasing survey coverage; most new sites are small with fewer than 10 active nests.

In 2007, five sites were surveyed and a total of 198 active nests were counted.

White-faced Ibis

(Plegadis chihi)

BLM Sensitive Species

CDOW - Species of Greatest Conservation Need

The first nesting of White-faced Ibis in Colorado was reported in the San Luis Valley in 1875 (Sclater 1912). About 60 pairs nested at Trites Lake (Russell Lakes SWA) in 1940 (Bailey and Brandenburg 1941). The population apparently declined in the 1960s (Ryder 1967), and in the 1970s, CDOW surveys found as few as nine nests in the Valley (Ryder et al., 1979). The San Luis Valley flocks began to increase the 1980s and in 1993 over 470 breeding pairs were counted (Rilling and Falzone-Schrim 1993). During the 1990s, small (<5 nests), intermittent colonies nested at widely scattered locations across the state, including marshes in Moffat, Jackson, Weld, Kiowa, Gunnison, and Montezuma counties (Ryder 1998). In 2000, the numbers skyrocketed, and a total of 2000 active nests was estimated for the San Luis valley, followed by a nest estimate of 3670 in 2001.

White-faced Ibis has been tracked regularly since 1950 when Ron Ryder began his work with colonial waterbirds in the San Luis Valley. The Breeding Bird Atlas confirmed breeding at nine locations and projected a minimum population of 1283 breeding pair (Kingery 1998). MCB began coordinating surveys with USFWS in the San Luis Valley in 2000. Since 2005, however, the USFWS employee that shared information with us left the refuge and we have not received any information since then. In 2008, RMBO will make extra effort to determine if these counts are still being conducted by the USFWS and to request this information.

Historically, this species has been dramatically affected by drought conditions, in the severe drought of 2002 its breeding numbers crashed significantly. The population began to recover in 2003 and 2004 as more suitable nesting and foraging habitat became available. Because this species is very difficult to monitor without undue disturbance of nesting activities, the population estimates have a fairly wide margin of error.

Osprey

(*Pandion haliaetus*)

CDOW - Species of Greatest Conservation Need

Although Ospreys have apparently nested in Colorado at least since the late 19th century, the early literature contains few specific nest records. Late in that century, a pair was recorded nesting at Twin Lake near Granite in Lake Co (Scott, 1879). In the first decade of the 20th century, nests were apparently established at Sweetwater Lake in Garfield County as well as in Summit County (Sclater 1912). A pair was reported to have been nesting on the ground near San Luis Lake in Alamosa County in 1954 (Bailey and Niedrach 1965). No doubt there were a number of unpublished observations.

Throughout their range, Ospreys suffered a sharp decline in the 1960s as a result of exposure to DDT and other pesticides. At that time, only a small population--a few pairs in western Jackson County near Big Creek Lakes--was known to nest in Colorado (Barrett 1998). Since DDT has been banned, the population has continually increased.

Between 1987 and 1995, the Colorado Breeding Bird Atlas project documented nesting in 10 priority blocks and projected a statewide population of 110 breeding pairs (Kingery 1998). For the past seven years, MCB has compiled data on nesting Ospreys. Most of the data have been obtained from surveys conducted by US Forest Service and CDOW biologists; several other nests have been monitored regularly by volunteers, and MCB staff surveyed the few remaining sites. The MCB database currently contains historical information on 140 sites, including some nest trees and platforms that have fallen or have been destroyed and a number of platforms that have not yet been used.

The surveys indicate a general expansion of the Osprey nesting range in Colorado during the past 12 years, particularly into the suburban areas of Boulder and Fort Collins and into the lower Colorado River valley as far downstream as Mesa County (Fig. 25). Grand County, the Big Creek Lakes area in northwestern Jackson County, and the reservoirs in the upper San Juan Basin remain areas of concentration as they were during the Atlas period. Grand County has accounted for approximately half of the state's active nests each year (27 in 2000, 26 in 2001, 30 in 2002, 28 in 2003, 29 in 2004, and 32 in 2005). The three sites for which we have very early records, Summit County, Twin Lake, and Sweetwater Lake, all presently support active nests, but no Ospreys have been reported nesting in the San Luis Valley since the 1954 record.

In 2007, we solicited reports from volunteers and agency biologists at nine sites (all active) that were already in our database. Surveys conducted 2000 through 2005 indicate a continuing expansion of this species' range in Colorado and a slight increase in numbers.

Continued monitoring of Osprey, with re-emphasis on the importance of the MCB special species program, should be relatively simple as Osprey nests are conspicuous, land management agencies and wildlife agencies track many of the nests, and volunteer nest-watchers are easy to recruit for this charismatic species.

Black Rail

(*Laterallus jamaicensis*)

CDOW - Species of Greatest Conservation Need

USFWS Bird of Conservation Concern – BCR 18

A statewide survey of rails detected Colorado's first Black Rail in May, 1975, at Ft. Lyon in Bent County (Griese et al. 1980). In May and June, 1991, Black Rails were detected and photographed at Bent's Old Fort in Crowley County (Bridges 1992). The birds in both of these observations were territorial and may have nested; however, despite intensive efforts from 1991 through 1994, Colorado Breeding Bird Atlas field workers were unable to confirm breeding, and the Atlas recorded the species as territorial, but unconfirmed as a Colorado breeding species. During the 1990s, observations became common in the Arkansas River valley, and it became apparent that the area's marshes supported a significant population, perhaps one of the largest inland populations extant.

In 2001, MCB conducted a tape-callback survey of the marshes known to have Black Rails and recorded 73 detections. After that effort, we designed a survey following the NAWCP protocol. It encompasses points at John Martin Reservoir, Ft. Lyon SWA, and three small, unnamed sites. Two of three prescribed annual iterations were conducted in 2003, none in 2004, and one in 2005. Logistics and funding restrictions have limited our ability to continue the surveys.

Completing the three iterations of the Ft. Lyon Study Area secretive marshbird surveys may provide an adequate index to this population. Adding points to this survey or creating a second study area to include as many of the known occupied marshes as possible would increase the number of detections.

In 2005, ten detections of the species were recorded during secretive marshbird surveys in the extensive marshes around Fort Lyon State Wildlife Area and John Martin Reservoir. In 2007, no secretive marshbird surveys were conducted.

Forster's Tern

(*Sterna forsteri*)

CDOW - Species of Greatest Conservation Need

Although a few Forster's Terns were reported to be breeding in the San Luis Valley somewhat earlier (Ridgway 1873), the first detailed nesting record was at Barr Lake in 1900 (Bailey and Niedrach 1965). The colony there apparently peaked in the first decade of the 20th century when up to 100 pairs nested. This colony declined and disappeared by 1970. There were other small, sporadically occupied colonies reported elsewhere on the eastern plains, but they are poorly documented. A colony was found at Lake John in North Park in 1977, and since then, nesting there has been regular and more recently has also occurred at nearby Walden Reservoir.

The Colorado Breeding Bird Atlas Project confirmed nesting at two sites, San Luis Lakes SWA and Lake John Annex, and projected a statewide population of 63 breeding pairs (Kingery 1998). Since MCB surveys began in 1998, breeding has occurred only at three North Park sites, Lake John Annex, Walden Reservoir, and Cowdry Reservoir, where the annual estimates have ranged from 20 to 42 active nests. No nesting has been documented in the San Luis Valley since 1993.

In 2007, 19 active nests were counted; all in the North Park area. Sixteen were at Walden Reservoir and three were at 18 Island Reservoir, which is a new breeding location for this species.

Black Tern

(*Chlidonias niger*)

CDOW - Species of Greatest Conservation Need
USFS Region 2 Sensitive Species

The Black Tern was an uncommon but regular breeder in northeastern Colorado in the 19th and early 20th centuries, with most records coming from the Barr Lake area (Cooke 1897, Bailey and Niedrach 1965). No breeding has been recorded in eastern Colorado for many years.

In February of 2003, the Intermountain Waterbird Conservation Plan working group designated this species as one of the three highest priority species for conservation in BCR 16 (Southern Rocky Mountains/Colorado Plateau).

The Breeding Bird Atlas project (1987-1995) confirmed breeding at three sites, two in the San Luis Valley and one in North Park. From 1998 to 2004, MCB located a few pairs each year in the San Luis Valley and North Park that were most likely nesting.

In 2006 & 2007, no evidence of nesting by Black Terns was reported in Colorado; however, the marshes south of Alamosa, which were occupied as recently as 2001, were not surveyed. Although this species was never a common breeder in Colorado, it now seems that it may no longer nest in the state.

Western Yellow-billed Cuckoo

(*Coccyzus americanus occidentalis*)

BLM Sensitive Species

State Special Concern – State Special Concern

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

USFWS Bird of Conservation Concern – BCR 16

In the 1950s and 1960s Yellow-billed Cuckoos were found breeding annually on the western slope of Colorado near Grand Junction (Righter et al. 2004). Also, cuckoos were regularly detected as recently as the early 1980s along the Uncompahgre and Gunnison Rivers near Delta (Rich Levad, pers. comm.). During the first Colorado Breeding Bird Atlas (1987-1994) breeding was confirmed in only one location on the western slope; on the Yampa River in Routt County (Kingery 1998). Before the 1990s cuckoos were considered uncommon but not rare as they have since become in the past few decades on the western slope.

In 2007, Yellow-billed Cuckoos were detected in the North Fork of the Gunnison River valley (Delta County) by RMBO staff and volunteers. Cuckoos have been heard and/or seen during the breeding season near the town of Hotchkiss every summer since 2003 and since 2005 near the town of Paonia. Other reports on the western slope since 2001 have come from Grand Junction, Orchard Mesa, and Plateau City in Mesa County and Nucla in Montrose County during the breeding season. RMBO has also detected cuckoos during the breeding season at Pike's Stockade (McIntyre Springs) in the San Luis Valley in 2004 and 2006 which is considered part of the range of the western subspecies.

RMBO is attempting to raise funds to initiate surveys for the Western Yellow-billed Cuckoo in 2008. If funded, these surveys will take place in the North Fork of the Gunnison River valley in 2008 and expand to other locations on the western slope in following years.

Burrowing Owl

(*Athene cunicularia*)

State Special Concern – State Threatened Species

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

PIF Species of Regional Concern – BCR 18

PIF Regional Stewardship Species – BCR 18

USFWS Bird of Conservation Concern – BCR 16 & 18

Burrowing Owls are fairly common summer residents on the eastern plains of Colorado and uncommon to rare in the San Luis Valley and in the valleys of the West Slope. Historically, the largest western Colorado breeding concentrations of this species were found in desert and agricultural areas of the Grand Valley, where some pairs still breed. Smaller numbers of owls annually occupy a few scattered locations in Moffat and Rio Blanco counties, in the Uncompahgre River valley, in Dry Creek Basin, and on the Ute Mountain Indian Reservation in Montezuma County.

This species is migratory, arriving in the region in the latter part of March and departing in September. Its prey includes small rodents, but the bulk of its diet consists of grasshoppers and beetles. Burrowing Owls nest in burrows, primarily in prairie dog towns in desert grasslands and in heavily grazed pastures. They occasionally use the burrows of badgers and ground squirrels. Colorado's Burrowing Owl population has decreased in recent years. The expansion of recreation and development may be a contributing factor to the population decline although colonies at relatively undisturbed sites also have disappeared. The decline in populations of prairie dogs due to extermination efforts and, more recently, outbreaks of sylvatic plague may also contribute to the decline.

RMBO compiled a catalog of 462 sites throughout Colorado where Burrowing Owls have been observed during the nesting period, mostly from an expansive survey conducted by RMBO's Prairie Partners program in 1999 (Hutchings et al. 1999). On the west slope, the inventory derives mostly from a survey conducted in 2002 (Levad 2002). We followed up the previous inventories with a survey of all sites where nesting attempts occurred in 2002-2004.

In 2007, three reports came from locations in Mesa, Delta, and Montezuma counties on the west slope of Colorado. The special species database now contains 121 sites where this species has been detected during the breeding season on the western slope of Colorado.

Black Swift

(*Cypseloides niger*)

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

At the end of the 19th Century, Black Swift was considered a locally abundant summer resident in Colorado (Drew 1881, Bendire 1895, Cooke 1897). Nesting was first confirmed at Niagara Gulch and Cataract Gulch, both near Silverton (Knorr 1950). From 1949 through 1958, Knorr located approximately 80 nests at 27 sites in 10 counties. His work extended the known geographical distribution of Black Swift breeding in Colorado north to the Front Range and the White River Plateau and east to the eastern flanks of the Sangre de Cristo Mountains (Knorr 1961). After Knorr's work, only eight more colonies were discovered by others in the next 50 years.

In 1998, RMBO joined forces with U.S. Forest Service biologists to inventory Black Swifts, beginning a database that catalogues known and potential nest sites. The database now contains 426 entries—waterfalls, caves, and other potential Black Swift nesting sites; we have visited and conducted at least a preliminary evaluation of 369 sites. We have documented 102 sites that have been occupied by Black Swifts in at least one year, including the 27 colonies located by Knorr in the 1950s. We have found 25 of Knorr's 27 colonies; all of these have been active during our survey period. We have also surveyed the eight colonies that were located between Knorr's work and ours; these, too, have all been occupied. Our surveys since 1998 have documented an additional 67 occupied sites.

Colorado's Black Swift Colonies range in size from a single pair up to 18 pairs—the highest number recorded at Box Canyon Falls in Ouray County (Hirshman 1998). Estimates of colony size during our surveys average 2.5 pairs.

In 2007, RMBO volunteers and agency cooperators visited 18 waterfalls, surveying 14 of the 102 previously known nest sites and searching for evidence of nesting at four previously unevaluated sites. They detected 46 adults at five sites and confirmed breeding at five, locating 24 active nests. Since 1998, this effort has now evaluated 368 waterfalls. The database contains 60 waterfalls that have not yet been evaluated. This survey work is beginning to “provide the necessary baseline data on population size and geographic distribution that will be needed to establish a population management plan” (Wiggins 2004).

Lewis's Woodpecker

(*Melanerpes lewis*)

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

PIF Species of Continental and Regional Concern – BCR 16 & 18

PIF Continental and Regional Stewardship Species – BCR 16

USFWS Bird of Conservation Concern – BCR 16 & 18

*Also see point transect species account section

Early accounts indicated that Lewis's Woodpecker was a common resident from the edge of the plains to about 8,000 feet (Cooke 1897, Sclater 1912). The Lewis's Woodpecker primarily uses open ponderosa pine forest, open riparian and agricultural woodland dominated by cottonwood, and logged or burned pine forest (Tobalsky 1997). By the mid-20th century, it had established a substantial population in the agricultural areas or the Arkansas River valley. Other major centers of abundance include the ponderosa pine woodlands of southwest Colorado and the canyon country of Las Animas County. Smaller numbers inhabit riparian woodlands along the Front Range foothills in north central Colorado, the Uncompahgre Plateau, and riparian zones of west-central Colorado.

In 2007, our catalogue of known and suspected nesting sites stands at 133. Staff, volunteers, and field workers visited 13 sites, counting 33 adults and confirming breeding at six sites. A dual frame sampling effort (Haines and Pollack 1998) surveying a list of historical breeding sites and a selection of sites containing suitable habitat may be the most effective approach for monitoring this species.

Purple Martin

(*Progne subis*)

CDOW - Species of Greatest Conservation Need

USFS Region 2 Sensitive Species

*Also see point transect species account section

As recently as 25 years ago, Purple Martin was considered a migrant or accidental straggler in Colorado (Kingery and Graul 1978). Prior to initiation of the Colorado Breeding Bird Atlas project, birders had discovered only two colonies (Svoboda et al 1980, Zerbi 1985), and when Atlas work began in 1987, Purple Martin was not included on the field card. Eight years of Atlas fieldwork located nests at 15 sites, confirmed breeding by other evidence in another seven blocks, and recorded probable breeding in yet another seven (Levad 1998). Independently of the Atlas work, other researchers located several nests in northeast Delta, northeast Mesa, and northwest Gunnison counties in 1987 and 1988 (Reynolds et al. 2002). Prior to initiation of MCB, 22 colony sites had been located.

Since beginning surveys in 1999, MCB has built a database of 233 sites where Purple Martins have nested, have been suspected to nest, or potentially could nest. Each year, we have surveyed a number of previously occupied sites to determine occupancy and have searched apparently suitable habitat for previously undocumented colonies. In 2001, we began making a special effort to locate nests, and nest data were gathered for a study of habitat requirements conducted by RMBO's Forested Ecosystems Program (Gillihan and Levad 2002). Each year since then, with somewhat less concerted but more efficient efforts, we have located even more nests and birds. We attribute the increase entirely to the benefits provided by the information and experience that we have accumulated, and it should not be interpreted as suggesting a population increase. Nesting has now been confirmed at 136 Colorado sites; the past nine years of MCB field work has discovered 114 (84%) of those. The remaining sites in our database include many sites where Purple Martins have been observed, often multiple times, and no doubt include many as yet unconfirmed colonies. We estimate that there are perhaps as many as 200-250 Purple Martin colonies active in Colorado in a given year. Colonies average approximately three nesting pairs and range from one to ten pairs. Smaller sites tend to be more ephemeral and may not be occupied annually, and some sites have been lost to tree cutting and natural changes in the forest conditions (Levad 2003).

In 2007, RMBO received incidental reports from previous breeding locations in Montrose, Mesa, and Delta Counties.

Bobolink

(*Dolichonyx oryzivorus*)

CDOW - Species of Greatest Conservation Need

Two young collected near Meeker in 1909 constitute the first confirmation of breeding by Bobolinks in Colorado (Felger 1910). Substantial populations now occur in the Yampa River Valley in Routt County, in the White River valley near Meeker in Rio Blanco County, and on city of Boulder Open Space properties in Boulder County. Gunnison County and Douglas counties harbor smaller populations, and others nest sporadically at scattered locations.

MCB volunteers or agency cooperators have historically conducted counts in Routt, Rio Blanco, Moffat, and Douglas counties; Boulder Open Space personnel have conducted counts on its properties for at least the past five years. In 2007, RMBO field staff and volunteers surveyed three fields and found two occupied in Morgan and Rio Blanco counties. We received a report from Boulder County open space biologists stating that they had counted 189 Bobolinks (2775 acres surveyed). Also, we noted additional sighting by birders in Gunnison, Larimer, Rio Grande, and Routt counties during the breeding season in appropriate habitat.

APPENDIX D. LIST OF ALL BIRD SPECIES WITH SPECIAL MANAGEMENT DESIGNATION DETECTED ON POINT COUNTS IN COLORADO 1998-2007.

Species	Species Management Designation ¹						
	USFS	USFWS	BLM	CDOW	TES	PIF-BCR16	PIF-BCR18
Northern Pintail				SGCN			
Lesser Scaup				SGCN			
Greater Sage-Grouse	R2SS		SS	SGCN	SC	CC,RC	
White-tailed Ptarmigan	R2SS			SGCN			
Dusky Grouse				SGCN		CC	
Greater Prairie-Chicken	R2SS			SGCN			CC,RC
Scaled Quail				SGCN		CC,RC	CC,RC
Eared Grebe				SGCN			
Western Grebe				SGCN			
American White Pelican			SS	SGCN			
American Bittern	R2SS			SGCN			
Snowy Egret				SGCN			
White-faced Ibis			SS	SGCN			
Osprey				SGCN			
Bald Eagle				SGCN	ST		
Northern Harrier	R2SS	BCC		SGCN			RC
Northern Goshawk	R2SS		SS	SGCN			
Swainson's Hawk		BCC		SGCN		CC,RC	CC,RS
Ferruginous Hawk	R2SS	BCC	SS	SGCN	SC	RC	RC,RS
Golden Eagle		BCC		SGCN		RC	
Peregrine Falcon	R2SS	BCC		SGCN	SC		
Prairie Falcon		BCC		SGCN		RC	RC
Black Rail		BCC		SGCN			
Sandhill Crane				SGCN	SC		
Mountain Plover	R2SS	BCC	SS	SGCN	SC		

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Species Management Designation ¹						
	USFS	USFWS	BLM	CDOW	TES	PIF-BCR16	PIF-BCR18
Solitary Sandpiper		BCC					
Upland Sandpiper		BCC		SGCN			
Long-billed Curlew		BCC	SS	SGCN	SC		
Wilson's Phalarope		BCC		SGCN			
Black Tern	R2SS		SS				
Forster's Tern				SGCN			
Band-tailed Pigeon				SGCN		CC	
Yellow-billed Cuckoo (Western)	R2SS		SS	SGCN	SC		
Flammulated Owl	R2SS	BCC		SGCN		CC,RS	
Burrowing Owl	R2SS	BCC		SGCN	ST		RC,RS
Short-eared Owl	R2SS	BCC		SGCN			CC
Boreal Owl	R2SS			SGCN			
Common Nighthawk						RC	RC
Black Swift	R2SS			SGCN			
White-throated Swift				SGCN		CC,RS	CC
Black-chinned Hummingbird				SGCN			
Broad-tailed Hummingbird				SGCN		RS	
Rufous Hummingbird				SGCN			
Lewis's Woodpecker	R2SS	BCC		SGCN		CC,RC,CS,RS	CC,RC
Red-headed Woodpecker		BCC					CC,RC
Williamson's Sapsucker		BCC		SGCN		CS,RS	
Red-naped Sapsucker		BCC		SGCN			
American Three-toed Woodpecker	R2SS			SGCN			
Olive-sided Flycatcher	R2SS			SGCN		CC	
Willow Flycatcher (Southwestern)				SGCN	FE,SE	CC,RC	
Gray Flycatcher				SGCN			
Dusky Flycatcher				SGCN			
Cordilleran Flycatcher				SGCN		RS	
Say's Phoebe						RS	RS
Loggerhead Shrike	R2SS	BCC		SGCN		RC	RC

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Species Management Designation ¹						
	USFS	USFWS	BLM	CDOW	TES	PIF-BCR16	PIF-BCR18
Bell's Vireo		BCC				CC,RC	CC,RC
Gray Vireo		BCC		SGCN		CC,RC,RS	
Plumbeous Vireo						RS	
Warbling Vireo						RS	
Pinyon Jay				SGCN		CC,RC,CS,RS	CC
Clark's Nutcracker						CS,RS	
Black-billed Magpie						RS	
Chihuahuan Raven							RS
Purple Martin	R2SS			SGCN			
Violet-green Swallow						RS	
Mountain Chickadee							
Juniper Titmouse				SGCN		RC,RS	
Pygmy Nuthatch				SGCN		RC	
Rock Wren						RS	
Canyon Wren						RC	
Bewick's Wren		BCC					
American Dipper				SGCN			
Western Bluebird						RS	
Mountain Bluebird						RC,CS,RS	
Veery				SGCN			
Curve-billed Thrasher				SGCN			
Virginia's Warbler		BCC		SGCN		CC,RC,RS	
Yellow Warbler							RC
Black-throated Gray Warbler				SGCN		RC	
Grace's Warbler				SGCN		CC,RC	
Green-tailed Towhee						CS,RS	
Cassin's Sparrow	R2SS	BCC		SGCN			RC,RS
Brewer's Sparrow	R2SS	BCC		SGCN		CC,RC	CC,RC
Black-chinned Sparrow						CC	
Vesper Sparrow				SGCN			

MONITORING COLORADO'S BIRDS: 2007 FIELD SEASON REPORT

Species	Species Management Designation ¹						
	USFS	USFWS	BLM	CDOW	TES	PIF-BCR16	PIF-BCR18
Lark Sparrow							RC
Black-throated Sparrow						RC	
Sage Sparrow	R2SS			SGCN		RC	
Lark Bunting				SGCN			RC,CS,RS
Grasshopper Sparrow	R2SS	BCC					RC,CS,RS
McCown's Longspur	R2SS	BCC		SGCN			CC,CS,RS
Chestnut-collared Longspur	R2SS	BCC		SGCN			RC
Lazuli Bunting				SGCN			
Dickcissel		BCC					CC
Bobolink		BCC		SGCN			
Western Meadowlark							RS
Brown-capped Rosy-Finch				SGCN		CC,CS,RS	
Cassin's Finch				SGCN		RC	
Red Crossbill				SGCN			
Pine Siskin						RC,RS	
Evening Grosbeak				SGCN			

¹ Special management designations: USFS=United States Forest Service, R2SS=US Forest Service Region 2 Sensitive Species; USFWS=U.S. Fish and Wildlife Service, BCC=Bird of Conservation Concern for BCRs 16 & 18; BLM=Bureau of Land Management, SS=BLM Sensitive Species in Colorado; CDOW=Colorado Division of Wildlife, SGCN=Species of Greatest Conservation Need (Colorado's Wildlife Action Plan, 2005); TES= Colorado Division of Wildlife Threatened or Endangered Species List, FE=Federally Endangered Species, SE=State Endangered Species, FT=Federally Threatened Species, ST=State Endangered Species, SC=State Special Concern; PIF-BCR16=Partners In Flight Species of Concern for Bird Conservation Region 16 (from the Species Assessment Database version 2005 found at www.rmbo.org), CC=Continental Concern, RC=Regional Concern, CS=Continental Stewardship, RS=Regional Stewardship; PIF-BCR18=Partners In Flight Species of Concern for Bird Conservation Region 18 (from the Species Assessment Database version 2005 found at www.rmbo.org), CC=Continental Concern, RC=Regional Concern, CS=Continental Stewardship, RS=Regional Stewardship.

CHAPTER 2: SHORTGRASS PRAIRIE BIRD MONITORING PROGRAM

SHORTGRASS INTRODUCTION

Monitoring programs provide insight into the abundance, distribution, and population trends of birds that can help guide land managers in making biologically-based decisions and in developing sound resource management plans. Monitoring is important for large-scale conservation planning in that it tracks the status of habitats and species and can be used to test underlying management assumptions and hypotheses (Samson et al. 2003). The North American Bird Conservation Initiative (NABCI) has developed a framework for continental bird conservation using Bird Conservation Regions (BCRs), biologically based planning and implementation units that contain similar environments and bird communities. Monitoring, research and conservation programs that are developed and implemented at the BCR level are ultimately more biologically meaningful and cost-effective than those developed for smaller scales. However, much of the information needed to implement conservation plans (estimates of abundance, population change, survival and productivity, habitat availability and change, and bird habitat interactions) does not presently exist at the BCR scale (Sauer et al. 2003). The goal of NABCI is for states, Joint Ventures, federal agencies, and conservation groups within BCRs to develop “regionally-based, biologically driven partnerships.” Long term commitment by partners is needed to achieve the multiple goals of this program. Cooperative partnerships, such as that between RMBO and its partners, help relieve the burden on any single entity in supporting the costs of long-term monitoring and thus are an effective way to sustain long-term monitoring programs. Such partnerships also result in the use of standardized methodologies, which allow for greater comparability and enhanced interpretation of results region-wide.

Grassland birds have experienced steeper, more consistent, and geographically more widespread declines than any other guild of North American birds (Sampson and Knopf 1996). Several species found in this ecosystem are endemic (found nowhere else) or are closely associated with the Great Plains grasslands (Mengel 1970) such as Baird’s Sparrow, Cassin’s Sparrow, Chestnut-collared Longspur, Ferruginous Hawk, Lark Bunting, Long-billed Curlew, McCown’s Longspur and Mountain Plover. Consequently, many grassland birds are of high conservation interest.

Some managers have relied on data derived from the Breeding Bird Survey (BBS), currently the most extensive bird monitoring program in the U.S., to monitor bird populations (Robbins et al. 1989, Sauer 1993). The BBS, operational in the Great Plains since 1967, uses volunteers to conduct roadside

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

surveys of birds across North America and produces indices of population abundance at the continental scale for many common bird species (Robbins et al. 1989). BBS data collection and analyses are relatively inexpensive and have proven to be a valuable source of information on large-scale bird population trends. BBS data can produce continental-scale relative abundance maps. These maps provide a reasonably good indication of the relative abundance of species well sampled by the BBS. However, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 1993), and BBS data do not reliably predict population trends at small geographic scales such as a National Grassland, states, or even larger eco-regions (i.e., BCRs) (Sauer 2000). For these and other reasons, BBS data generally are insufficient to guide local and regional management decisions. According to the Partners in Flight, 85% of birds in the Shortgrass Prairie Bird Conservation Region (BCR 18) lack sufficient data to address current regional population trends or are declining (PIF species assessment database 2005).

In conjunction with our funding partners, Rocky Mountain Bird observatory (RMBO) has implemented three different programs to estimate population status and trend for birds in the shortgrass prairie of eastern Colorado. The three programs differed in their sampling frame, although each used Distance sampling to estimate detection probability and density for each bird species. In addition to providing methods and results from the program implemented in 2007, we also compare the methods, efficiency and strengths of the three programs.

From 1999 through 2005, we monitored shortgrass prairie habitat as a stratum under the program Monitoring Colorado's Birds (MCB). The MCB sampling design consists of 15 point count stations arranged along a transect, with 30 transects established within each stratum.

From 2001 through 2005 we monitored birds of eastern Colorado under the Section Surveys program (Hanni et al. 2004). This program used the Public Land Survey System which is comprised of Townships, Ranges and Sections (approximately 1 x 1 mile). The Section was the sampling unit, with three point counts placed randomly along the roads that border the Section. The study area consisted of three strata: native prairie, land in the Conservation Reserve Program (CRP) in Weld county and dry-land agriculture. The Section Survey design is logistically efficient for obtaining a large sample size on a large number of species. However, there was a concern over road bias and the effect any bias may have on estimating population size and trend. Therefore project partners decided to change the study design to reduce road bias in the samples.

In 2007, we monitored shortgrass prairie birds under a new program, Colorado's Shortgrass Prairie Bird Monitoring Program. This program used a spatially balanced study design with native prairie habitat of eastern Colorado as the area of inference. Point transects consisting of 15 points were established irrespective of roads within each sample selected. Colorado's Shortgrass Prairie

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

Bird Monitoring Program was designed to provide trend information for breeding birds which will allow managers to identify declining bird species and develop sound management plans in accordance with Colorado's Comprehensive Wildlife Conservation Plan.

METHODS

Study Area:

The study area is located in the Shortgrass Prairie Bird Conservation Region (BCR 18) of eastern Colorado (figure 1). The landscape is a patchwork of native shortgrass prairie, agriculture and grasslands planted under the Conservation Reserve Program. Our area of inference was native habitat in BCR 18 approximately east of longitude 105° 1' 30" West.

Sample Selection:

The sampling design used to survey within the study area was an equal probability spatially balanced design (Stevens and Olsen, 2004). A spatially balanced study design creates a more efficient sampling plan, as it ensures that samples are evenly distributed across the population of interest. As a result this also reduces the variance of the parameter estimates (Stevens et al, 2004).

We used a GIS tool called "Reversed Randomized Quadrant-Recursive Raster algorithm" (Theobald et al. 2007) in ArcMap 9.1. The South West ReGap landcover layer (Lowry et al. 2005) was used to ensure half of the area within our samples was in Western Great Plains Shortgrass Prairie habitat classification. This spatial layer is a regional landscape classification file developed using remote sensing and decision tree techniques to discriminate between different landcover types.

The spatially balanced algorithm selected sampling units from a grid of 7 km x 7 km cells overlaid on the study area. Although our target number of samples was 50, a total of 270 samples were selected as we anticipated that some samples on private land would be inaccessible to the field personnel. Transect start points were the center of the grid and transects extended at a random bearing from the start point.

The same point transect protocol and analytical methods were used as in chapter one of this report.

Density estimates for Monitoring Colorado Birds (MCB) and Section Surveys (SS) in grasslands for 2005 table 2 were obtained from Monitoring Colorado birds 2005 report (Beason et al. 2006) and Section-based Monitoring of Breeding Birds within the Shortgrass Prairie Bird Conservation Region (BCR 18) (Sparks and Hanni, 2006) respectively.

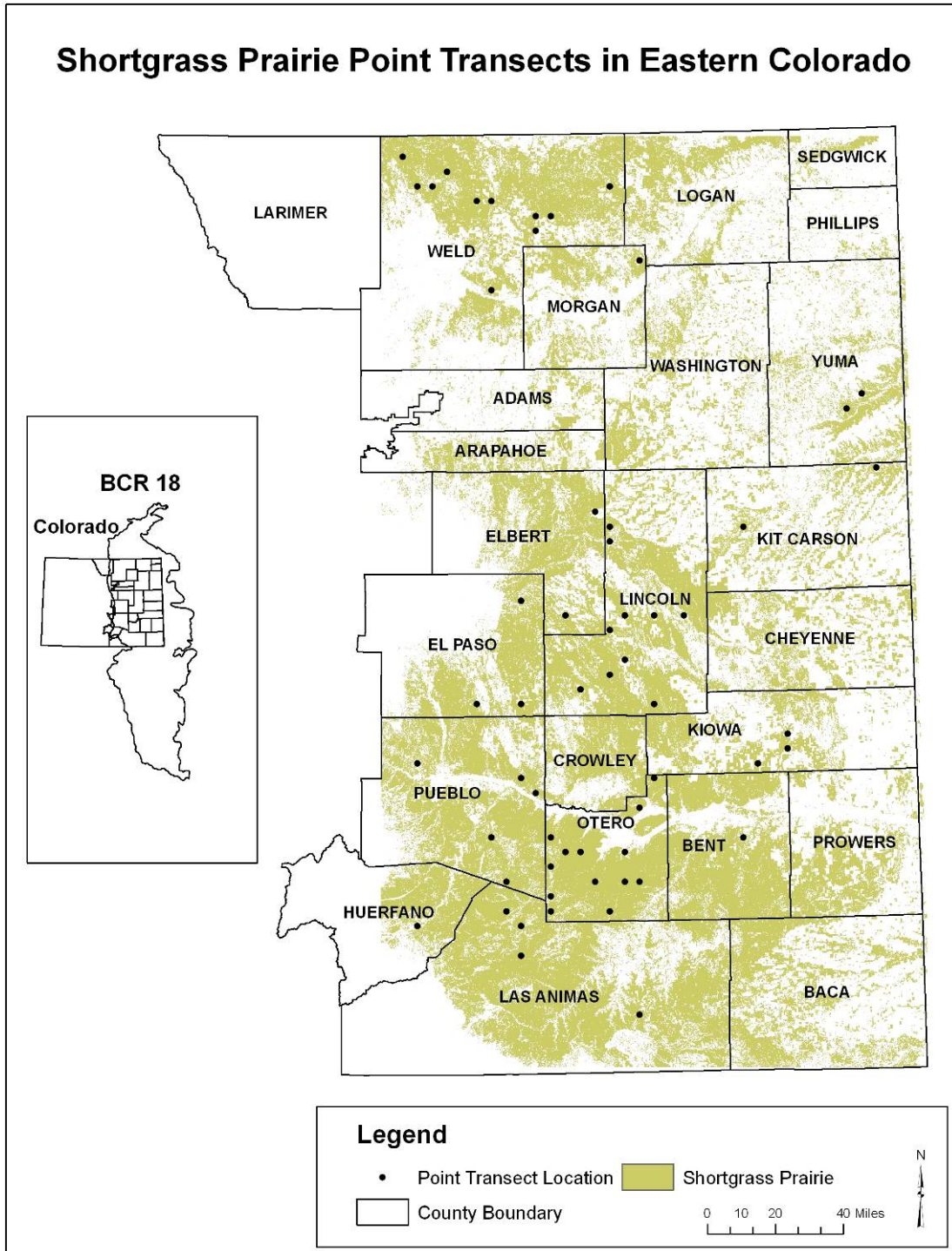


Figure 1. Location of point transects within the Shortgrass prairie study area.

RESULTS

In 2007, we conducted a total of 870 point counts along 58 transects in Shortgrass Prairie habitat. All transects were surveyed between 14 May and 10 July. We detected a total of 6,436 individual birds of 73 different species (Appendix A).

The point-count transect data yielded robust density estimates ($CV < 50\%$) for 12 species (Table 1). These 12 species represent 17% of all species detected on shortgrass prairie point-count transects during 2007, but represent approximately 87% of all individual birds observed during this time. Horned Lark had the highest density estimate of all species detected in shortgrass prairie, and Common Nighthawk had the lowest.

Table 1. Estimated densities of breeding birds in shortgrass prairie habitat in Colorado, 2007.

Species	D	LCL	UCL	%CV	n
Killdeer	3.2	2.0	5.4	31	74
Mourning Dove	35.2	22.0	56.2	29	247
Common Nighthawk	0.4	0.3	0.6	26	40
Western Kingbird	7.3	4.8	11.2	26	143
Horned Lark	161.0	133.2	194.7	11	1123
Northern Mockingbird	1.5	0.8	2.6	36	73
Cassin's Sparrow	5.7	2.9	11.3	43	57
Brewer's Sparrow	10.9	7.5	15.9	23	205
Lark Sparrow	8.6	4.7	16.0	38	94
Lark Bunting	83.8	66.6	105.4	14	1481
Red-winged Blackbird	3.3	1.6	6.8	46	63
Western Meadowlark	23.7	20.4	27.6	9	782
Common Grackle	7.84	3.7	16.8	48	40

D = estimated density (birds/km²); LCL and UCL = lower and upper 90% confidence limits on D; %CV = percent coefficient of variation of D; n = number of detections used to estimate D.

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

Table 2. Density estimates for Monitoring Colorado Birds (MCB) and Section Surveys (SS) in grasslands for 2005.

Common Name	D-SS	D-MCB	LCL-SS	LCL-MCB	UCL-SS	UCL-MCB	CV-SS	CV-MCB	n-SS	n-MCB
Killdeer	2.04	0.75	1.12	0.37	3.73	1.51	31%	36%	89	39
Mourning Dove	17.44	6.00	14.39	3.81	21.12	9.45	10%	23%	701	191
Western Kingbird	11.47	3.53	9.31	1.85	14.13	6.74	11%	33%	384	59
Horned Lark	112.05	80.13	104.75	58.35	119.86	110.04	3%	16%	3723	1182
Northern Mockingbird	0.57	0.64	0.42	0.26	0.78	1.56	16%	47%	81	36
Cassin's Sparrow	11.97	8.62	10.37	4.03	13.81	18.44	7%	39%	904	188
Brewer's Sparrow	2.93	4.40	1.82	1.48	4.73	13.04	25%	58%	66	46
Lark Sparrow	12.90	7.92	10.01	3.65	16.61	17.20	13%	40%	404	46
Lark Bunting	34.84	20.90	31.13	15.25	39.00	28.68	6%	16%	2311	763
Grasshopper Sparrow	9.23	18.02	6.96	10.16	12.24	31.96	14%	29%	154	195
McCown's Longspur	2.72	4.87	1.79	1.45	4.14	16.38	22%	66%	123	121
Western Meadowlark	21.68	20.86	19.31	15.68	24.34	27.75	6%	14%	2797	1027

D = density estimate in birds/km²; LCL and UCL = lower and upper 90% confidence limits on D; %CV = coefficient of variation of D; n = number of observations used to estimate D

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

Table 3. Species we are able to monitor (n≥40) and Coefficient of Variation (CV) under Colorado’s Shortgrass Prairie Bird Monitoring Program (SG), Monitoring Colorado Birds (MCB) within grasslands and Section Surveys (SS).

Species	After 1 year			After 3 years			After 6 years			CV% 2007	Average CV% 2001-2005	
	SG	MCB	SS	SG	MCB	SS	SG	MCB	SS	SG	MCB	SS
Ring-necked Pheasant			X			X		X	X			34
Scaled Quail			X			X			X			29
Long-billed Curlew						X			X			30
Killdeer			X			X			X	31	48	20
Rock Pigeon			X	X			X		X			
Eurasian Collared-Dove							X					
Mourning Dove	X	X	X	X	X	X	X	X	X	29	39	8
Burrowing Owl			X			X	X	X	X		79	21
Say's Phoebe						X			X			26
Eastern Kingbird						X			X			30
Common Nighthawk	X	X	X	X	X	X	X	X	X	26	47	20
Western Kingbird	X	X	X	X	X	X	X	X	X	26	32	11
Loggerhead Shrike			X			X	X	X	X			26
Chihuahuan Raven			X			X		X	X			18
Horned Lark	X	X	X	X	X	X	X	X	X	11	16	5
American Robin						X			X			27
Northern Mockingbird	X	X	X	X	X	X	X	X	X	36	50	16
Cassin's Sparrow	X	X	X	X	X	X	X	X	X	43	41	12
Brewer's Sparrow	X	X	X	X	X	X	X	X	X	23	57	23
Vesper Sparrow						X		X	X		70	34
Lark Sparrow	X	X	X	X	X	X	X	X	X	38	45	11
McCown's Longspur		X	X		X	X	X	X	X		73	28
Chestnut-collared Longspur						X			X			43
Dickcissel			X						X			53
Lark Bunting	X	X	X	X	X	X	X	X	X	14	24	7
Grasshopper Sparrow			X			X			X		29	16
Red-winged Blackbird	X		X		X					46	56	18
Western Meadowlark	X	X	X	X	X	X	X	X	X	9	17	7

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

Species	After 1 year			After 3 years			After 6 years			CV% 2007	Average CV% 2001-2005	
	SG	MCB	SS	SG	MCB	SS	SG	MCB	SS	SG	MCB	SS
Common Grackle	X		X			X			X	48		31
Brown-headed Cowbird			X	X		X	X		X		41	20
Bullock's Oriole			X			X			X			28

Colorado's Shortgrass Prairie Bird Monitoring = SG, Monitoring Colorado Birds = MCB, Section Surveys = SS.

DISCUSSION

Based on 2007 data we were able to achieve density estimates with associated $CV \leq 50\%$ for 12 bird species. Twenty of the birds detected during this monitoring effort are on Colorado's list of Species of Greatest Conservation Need and we are able to monitor 3 of the 20 species, Cassin's Sparrow, Brewer's Sparrow and Lark Bunting.

Substantial effort was put in to contacting private landowners under this monitoring program. We first contacted the County assessor to obtain landowner information for selected samples. The next step involved calling the landowner or conducting on-site visits to obtain permission to access their land. We were successful 63% of the time and unsuccessful 37%. Omitted from these percents are landowners for whom we were unable to obtain contact information.

Section Surveys is a road based monitoring design RMBO used to survey the shortgrass prairie of eastern Colorado in previous years. This monitoring technique is more efficient in that it is logistically easier to conduct surveys from the road. Road-based surveys overcome private land access issues which are a major logistical constraint for monitoring wildlife in the prairie. It is also more efficient in that we are able to obtain a large sample size (number of sections = 1,261) within a season (Hanni et al. 2004). Section Surveys on average could monitor 22 bird species with number of detections ≥ 40 and a $CV \leq 50\%$ (Hanni et al. 2004). The coefficient of variation is also lower using Section Surveys compared to Monitoring Colorado Birds (number of transects = 30) and Colorado's Shortgrass Prairie Bird Monitoring Program (number of transects = 58). This is due to a significantly larger sample size.

However the consequence of Section Survey monitoring is that it may not reflect true density for some species because all samples are from roadsides, which support certain features (e.g., telephone poles and fences) disproportionately more than the landscape as a whole, and may attract more birds of some species (e.g., raptors, shrikes). Grasshopper Sparrow's have been observed in ditches with tall grass another feature that is found disproportionately along roads. We use Distance sampling theory in our monitoring programs to incorporate detection probability a nuisance parameter, to estimate density (Buckland et al. 2001). Distance sampling theory also states that, for unbiased estimates samples must be placed randomly within the population of interest to develop unbiased detection functions. Placing survey points along roads attract certain birds, which violates this tenet.

The encounter rates change for some birds depending on whether they were sampled from the road or interior of the landscape. To understand potential biases in density between Section Surveys and Monitoring Colorado Birds we compared density estimates (Table 3) using 2005 data. Densities that were significantly higher (non-overlapping confidence intervals) under Section Surveys

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

were for Mourning Dove, Western Kingbird and Lark Bunting. Rigorous assessment of road biases in bird monitoring would require a study design targeting this effect; e.g., aligning transects perpendicular to roads and evaluating density as a function of distance from roads. Roads are such a ubiquitous part of the shortgrass prairie that road based bird monitoring may not have a significant effect on trend estimation for many bird species. Section Surveys would use density as an index for population trends.

Monitoring Colorado Birds in native prairie is able to monitor 11 species on average with a $CV \leq 50\%$. One consideration of habitat based monitoring is that habitats change over time which may confound the results since the landscape is changing and trend information may not reflect the change for a given habitat in the landscape over a long period of time but this may be overcome if up to date landcover layers are available every couple of years so transects may be reestablished in the desired habitat.

Although data from the Monitoring Colorado Birds program resulted in density estimates with higher CVs than data from the Colorado's Shortgrass Prairie Bird Monitoring Program, the latter program had a much larger sample size.

Colorado's Shortgrass Prairie Bird Monitoring Program major short coming is that we are only able to estimate density for 3 species on the Species of Greatest Conservation Need list. We think that by using shrubland habitat and prairie dog colonies as a strata we would be able to monitor more priority bird species such as Mountain Plover, Burrowing Owl and Loggerhead Shrike. Another consideration for targeting species that are low density or restricted in distribution in Colorado such as Mountain Plover, Upland Sandpiper, McCown's Longspur, Chestnut-collared Longspur and Long-billed Curlew, would be to implement dual frame sampling. Dual frame sampling is 2 sampling frames used to cover the population of interest. If we were interested in targeting Longspurs frame A would cover eastern Colorado and frame B would cover the north central portion of the state in which these species are restricted. Independent probability samples are taken from both frames and the data are then combined to estimate parameters of interest (Lohr and Rao 2000). Dual frame sampling can be extended to multiple frame sampling.

The costs for Section Surveys was approximately \$19 per point, although each point was only surveying 180 degrees from the point. Monitoring Colorado Birds was approximately \$76 per point and Colorado's Shortgrass Prairie Bird Monitoring Program was approximately \$81 per point. We were able to monitor more species with more precision under Section Surveys for less money but the results may be biased compared to the other 2 programs.

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**APPENDIX A. SPECIES DETECTED AND NUMBER OF DETECTIONS
ON SHORTGRASS PRAIRIE TRANSECTS, 2007.**

Common Name	Scientific Name	Number of Detections
Canada Goose	<i>Branta canadensis</i>	4
Mallard	<i>Anas platyrhynchos</i>	22
Blue-winged Teal	<i>Anas discors</i>	8
Northern Pintail	<i>Anas acuta</i>	10
Ring-necked Pheasant	<i>Phasianus colchicus</i>	3
Wild Turkey	<i>Meleagris gallopavo</i>	1
Scaled Quail	<i>Callipepla squamata</i>	2
Western Grebe	<i>Aechmophorus occidentalis</i>	1
American White Pelican	<i>Pelecanus erythrorhynchos</i>	4
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	10
Great Blue Heron	<i>Ardea herodias</i>	7
Cattle Egret	<i>Bubulcus ibis</i>	7
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	1
Turkey Vulture	<i>Cathartes aura</i>	6
Swainson's Hawk	<i>Buteo swainsoni</i>	6
Red-tailed Hawk	<i>Buteo jamaicensis</i>	14
Ferruginous Hawk	<i>Buteo regalis</i>	3
American Kestrel	<i>Falco sparverius</i>	2
Prairie Falcon	<i>Falco mexicanus</i>	2
American Coot	<i>Fulica americana</i>	4
Sandhill Crane	<i>Grus canadensis</i>	4
Killdeer	<i>Charadrius vociferus</i>	99
Mountain Plover	<i>Charadrius montanus</i>	5
American Avocet	<i>Recurvirostra americana</i>	4
Upland Sandpiper	<i>Bartramia longicauda</i>	2
Long-billed Curlew	<i>Numenius americanus</i>	4
California Gull	<i>Larus californicus</i>	2
Rock Pigeon	<i>Columba livia</i>	27
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	9
Mourning Dove	<i>Zenaida macroura</i>	361
Burrowing Owl	<i>Athene cunicularia</i>	13
Common Nighthawk	<i>Chordeiles minor</i>	56
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	3
Say's Phoebe	<i>Sayornis saya</i>	1

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

Common Name	Scientific Name	Number of Detections
Western Kingbird	Tyrannus verticalis	205
Eastern Kingbird	Tyrannus tyrannus	4
Loggerhead Shrike	Lanius ludovicianus	10
Western Scrub-Jay	Aphelocoma californica	2
Black-billed Magpie	Pica hudsonia	1
American Crow	Corvus brachyrhynchos	48
Chihuahuan Raven	Corvus cryptoleucus	7
Horned Lark	Eremophila alpestris	1463
Bank Swallow	Riparia riparia	85
Cliff Swallow	Petrochelidon pyrrhonota	14
Barn Swallow	Hirundo rustica	81
House Wren	Troglodytes aedon	4
American Robin	Turdus migratorius	60
Northern Mockingbird	Mimus polyglottos	81
European Starling	Sturnus vulgaris	119
Western Tanager	Piranga ludoviciana	1
Cassin's Sparrow	Aimophila cassinii	66
Chipping Sparrow	Spizella passerina	4
Brewer's Sparrow	Spizella breweri	223
Vesper Sparrow	Poocetes gramineus	1
Lark Sparrow	Chondestes grammacus	117
Sage Sparrow	Amphispiza belli	1
Lark Bunting	Calamospiza melanocorys	1940
Grasshopper Sparrow	Ammodramus savannarum	16
Song Sparrow	Melospiza melodia	3
Lincoln's Sparrow	Melospiza lincolnii	3
McCown's Longspur	Calcarius mccownii	14
Lazuli Bunting	Passerina amoena	2
Indigo Bunting	Passerina cyanea	1
Dickcissel	Spiza americana	1
Red-winged Blackbird	Agelaius phoeniceus	89
Western Meadowlark	Sturnella neglecta	896
Brewer's Blackbird	Euphagus cyanocephalus	3
Common Grackle	Quiscalus quiscula	89
Brown-headed Cowbird	Molothrus ater	23
Bullock's Oriole	Icterus bullockii	5
House Finch	Carpodacus mexicanus	3

Shortgrass Prairie Bird Monitoring Program: 2007 Field Season Report

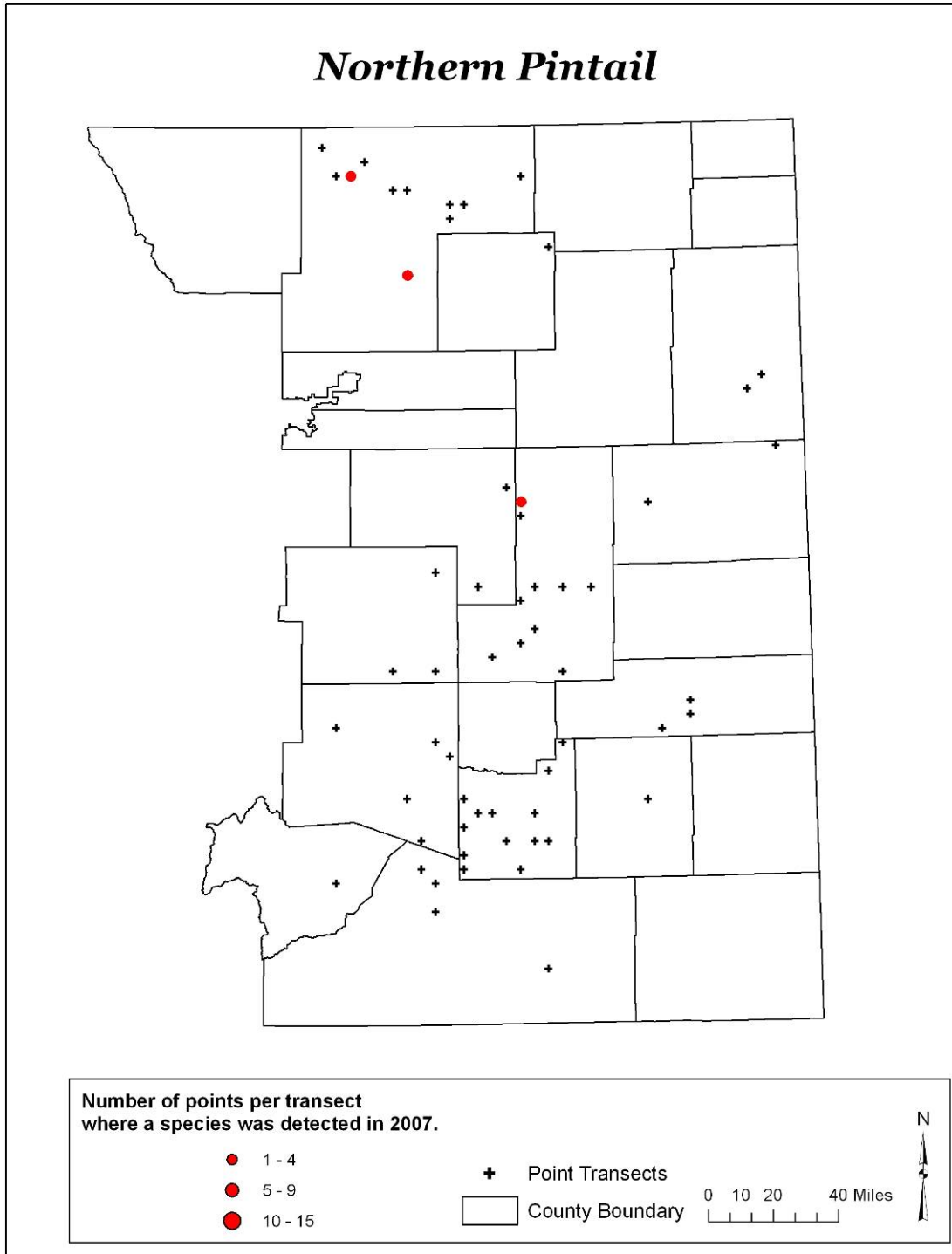
Common Name	Scientific Name	Number of Detections
American Goldfinch	<i>Carduelis tristis</i>	3
House Sparrow	<i>Passer domesticus</i>	41

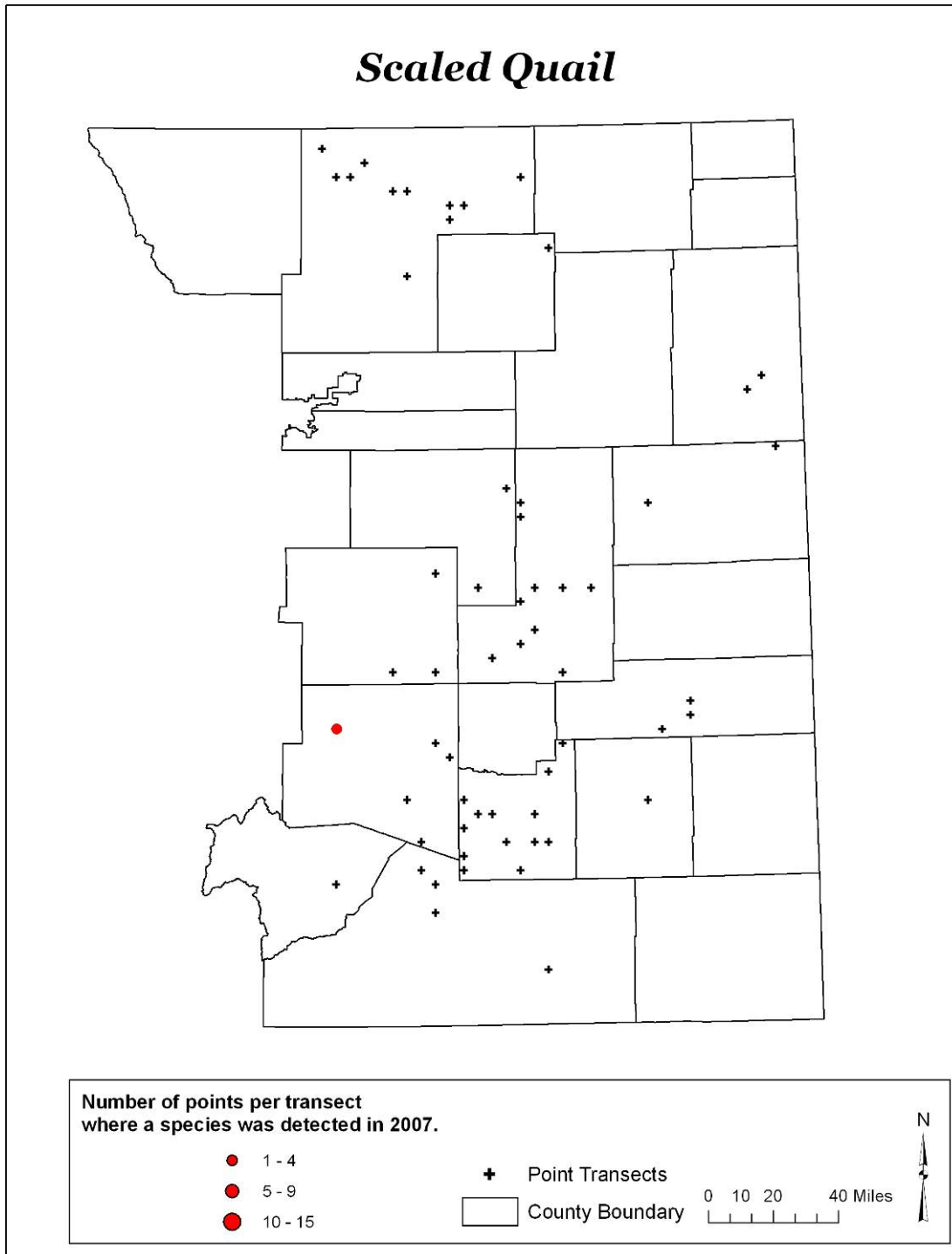
**APPENDIX B. COLORADO'S SPECIES OF GREATEST
CONSERVATION NEED AND PARTNERS IN FLIGHT SPECIES OF
CONTINENTAL CONCERN AND REGIONAL CONCERN (BCR 18)
DETECTED DURING POINT COUNTS IN 2007.**

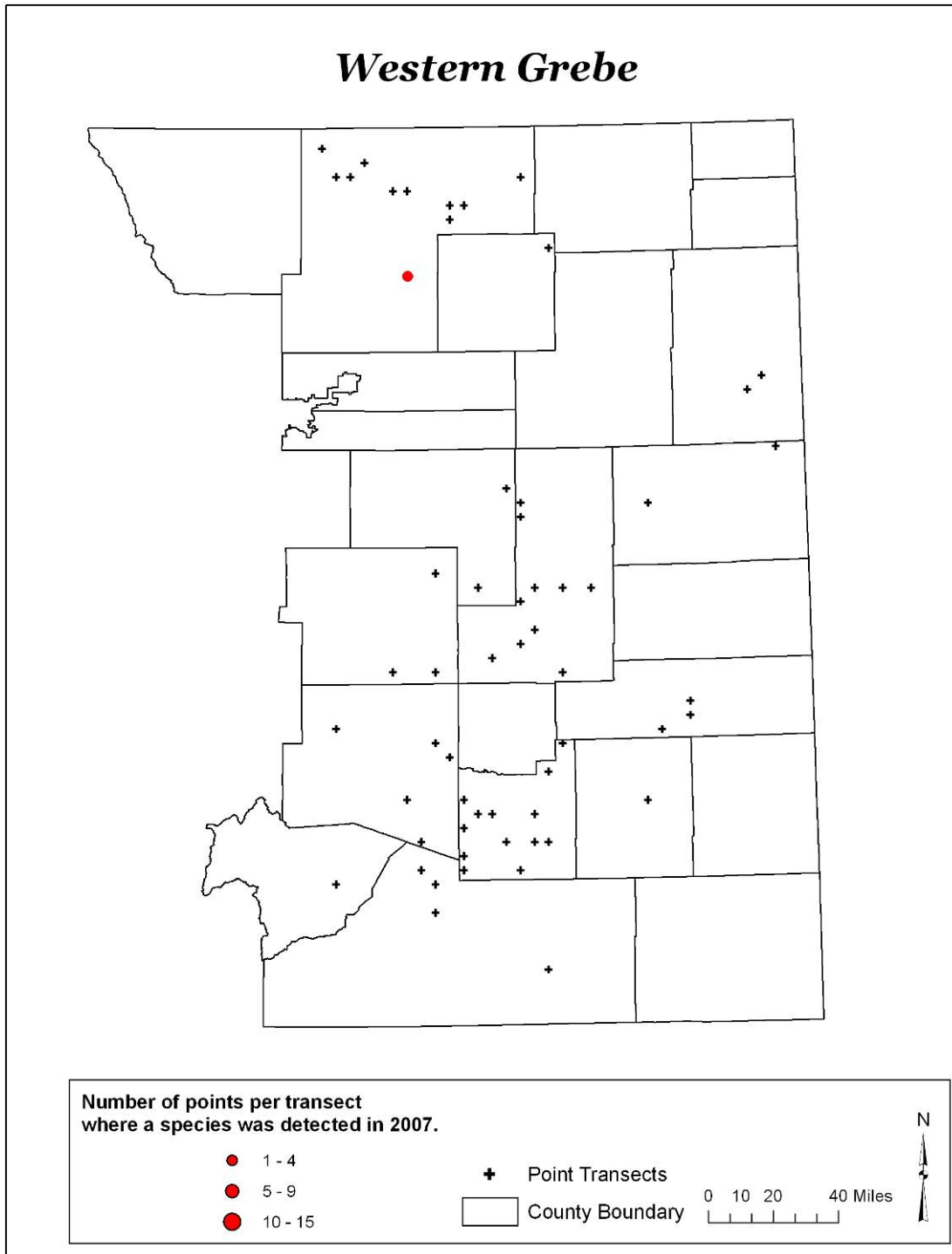
Common Name	Scientific Name	SGCN	PIF-CC	PIF-RC
Northern Pintail	<i>Anas acuta</i>	X		
Scaled Quail	<i>Callipepla squamata</i>	X	X	X
Western Grebe	<i>Aechmophorus occidentalis</i>	X		
American White Pelican	<i>Pelecanus erythrorhynchos</i>	X		
Swainson's Hawk	<i>Buteo swainsoni</i>	X	X	X
Ferruginous Hawk	<i>Buteo regalis</i>	X		X
Prairie Falcon	<i>Falco mexicanus</i>	X		X
Sandhill Crane	<i>Grus canadensis</i>	X		
Mountain Plover	<i>Charadrius montanus</i>	X		
Upland Sandpiper	<i>Bartramia longicauda</i>	X		
Long-billed Curlew	<i>Numenius americanus</i>	X		
Burrowing Owl	<i>Athene cunicularia</i>	X		X
Common Nighthawk	<i>Chordeiles minor</i>			X
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>		X	X
Loggerhead Shrike	<i>Lanius ludovicianus</i>	X		X
Cassin's Sparrow	<i>Aimophila cassinii</i>	X		X
Brewer's Sparrow	<i>Spizella breweri</i>	X	X	X
Vesper Sparrow	<i>Pooecetes gramineus</i>	X		X
Lark Sparrow	<i>Chondestes gramineus</i>			X
Sage Sparrow	<i>Amphispiza belli</i>	X		X
Lark Bunting	<i>Calamospiza melanocorys</i>	X		X
Grasshopper Sparrow	<i>Ammodramus savannarum</i>			X
McCown's Longspur	<i>Calcarius mccownii</i>	X	X	X
Lazuli Bunting	<i>Passerina amoena</i>	X		
Dickcissel	<i>Passerina cyanea</i>		X	X

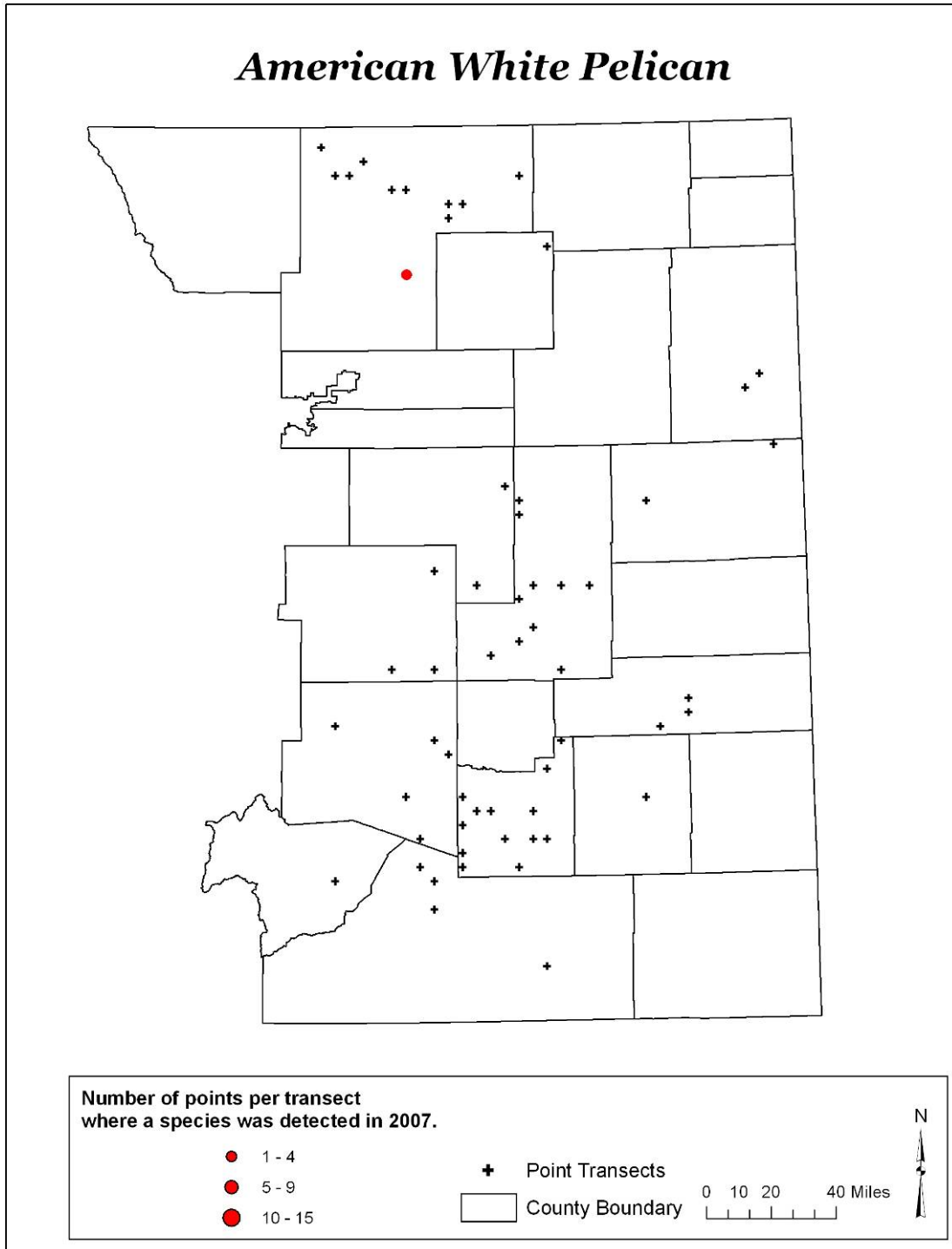
SGCN = Species of Greatest Conservation Need, PIF CC = Partners In Flight Species of Continental Concern (BCR18), PIF RC = Partners In Flight Species of Regional Concern (BCR18).

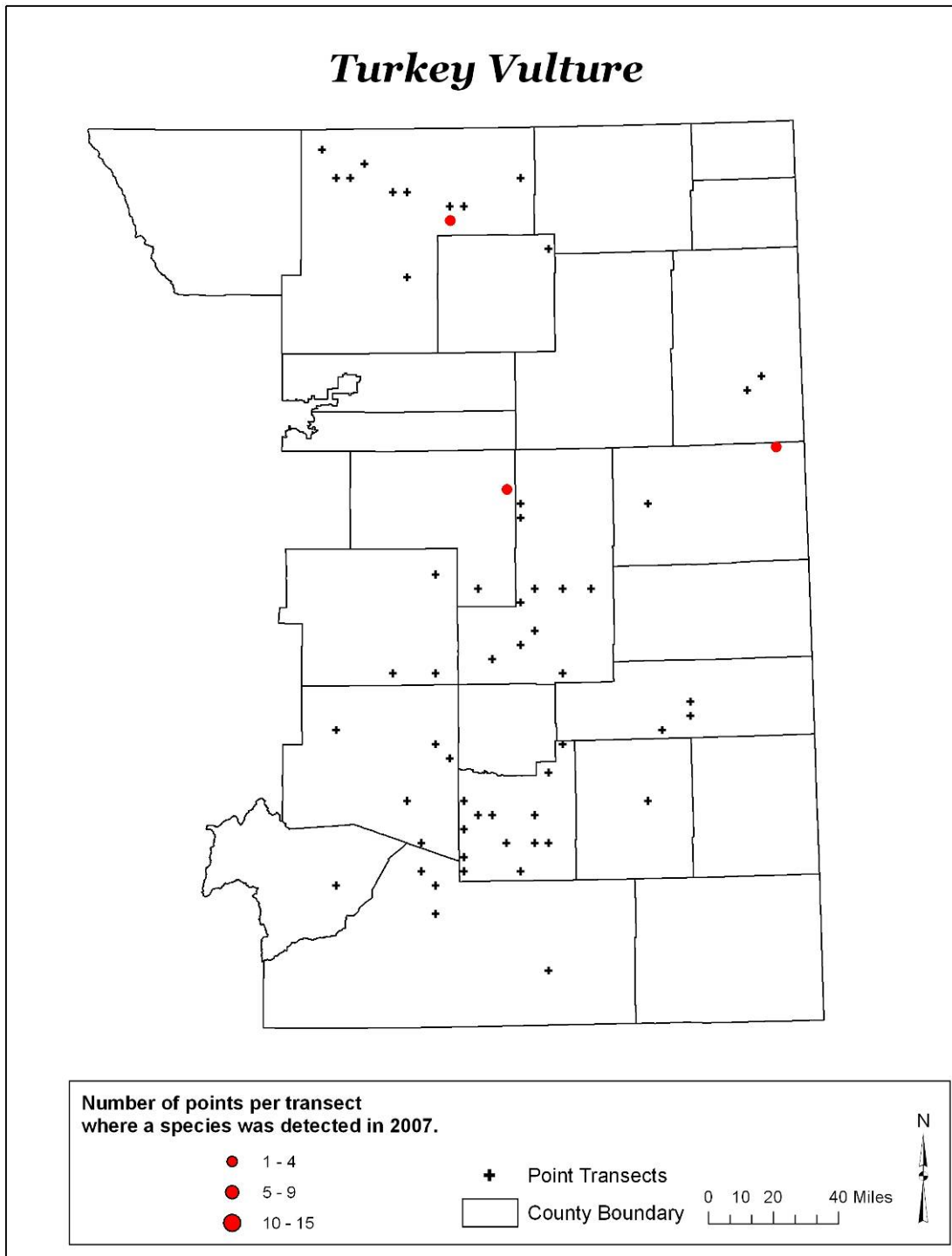
APPENDIX C. BIRD DISTRIBUTION MAPS FOR THE SHORTGRASS PRAIRIE. EACH DETECTION POINT IS SCALED ACCORDING TO THE TOTAL NUMBER OF POINTS PER TRANSECT (15) A BIRD WAS DETECTED.

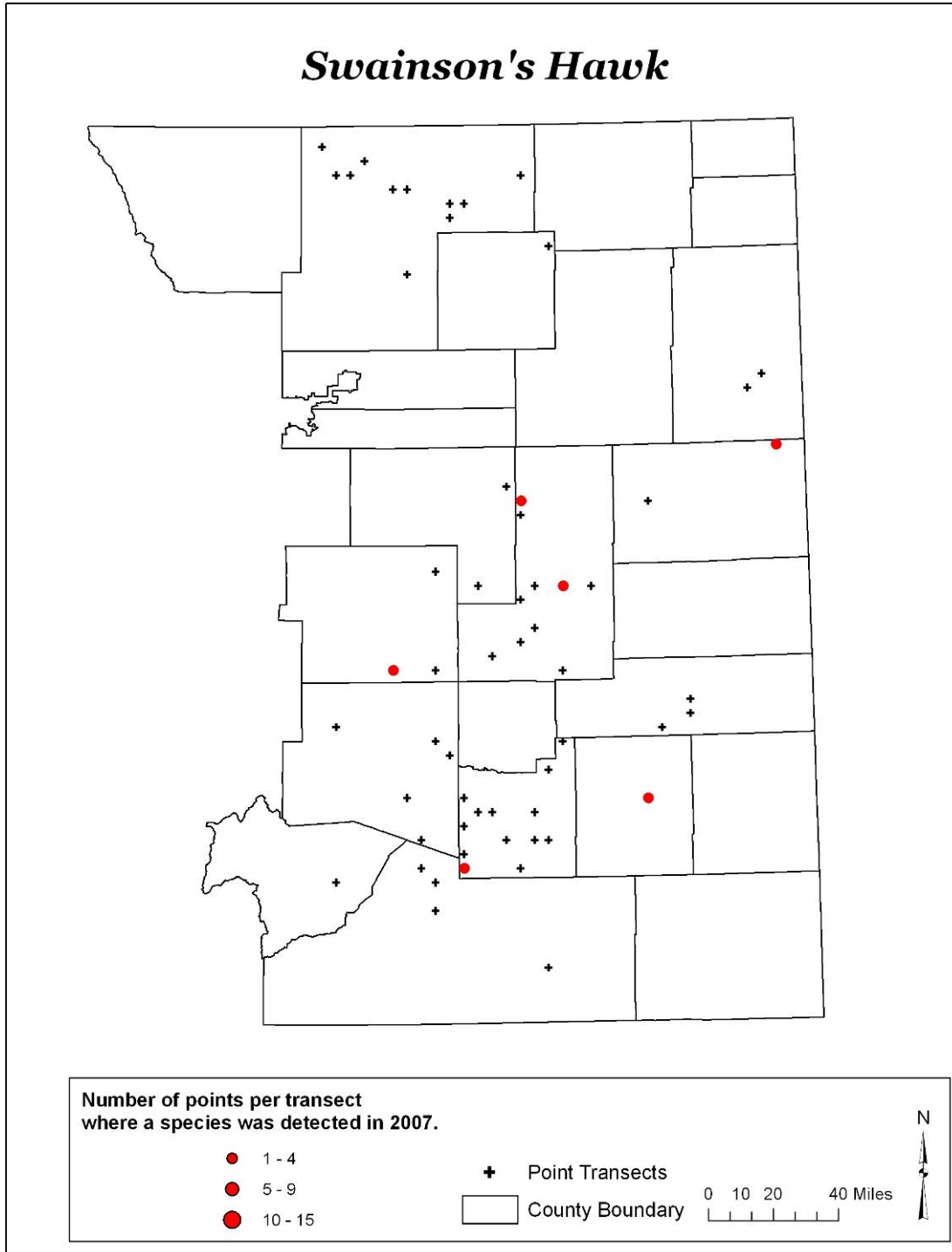


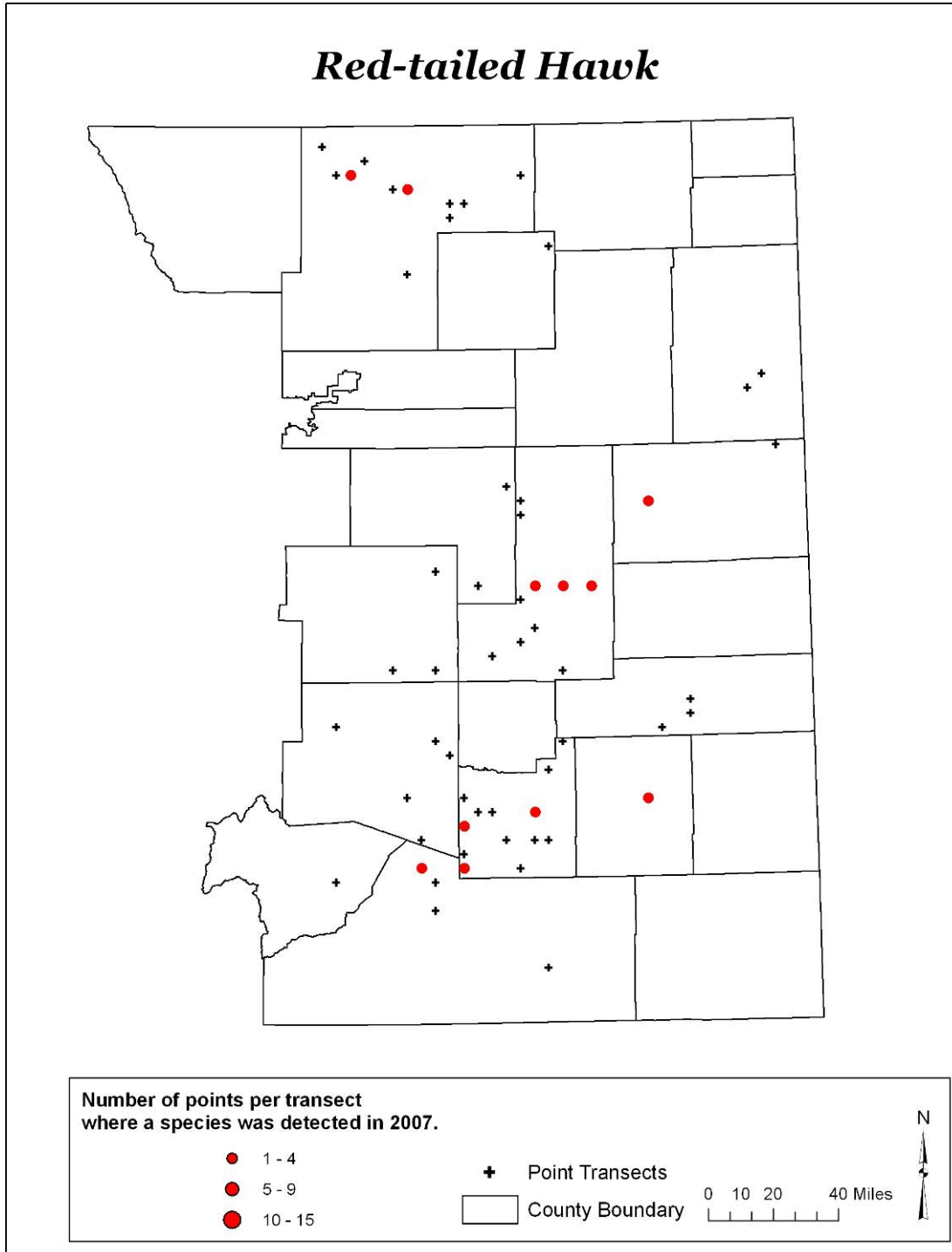




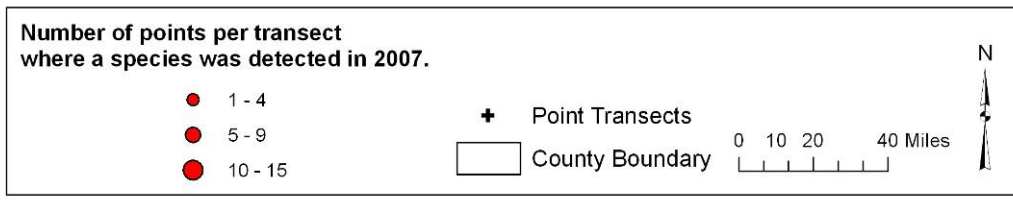
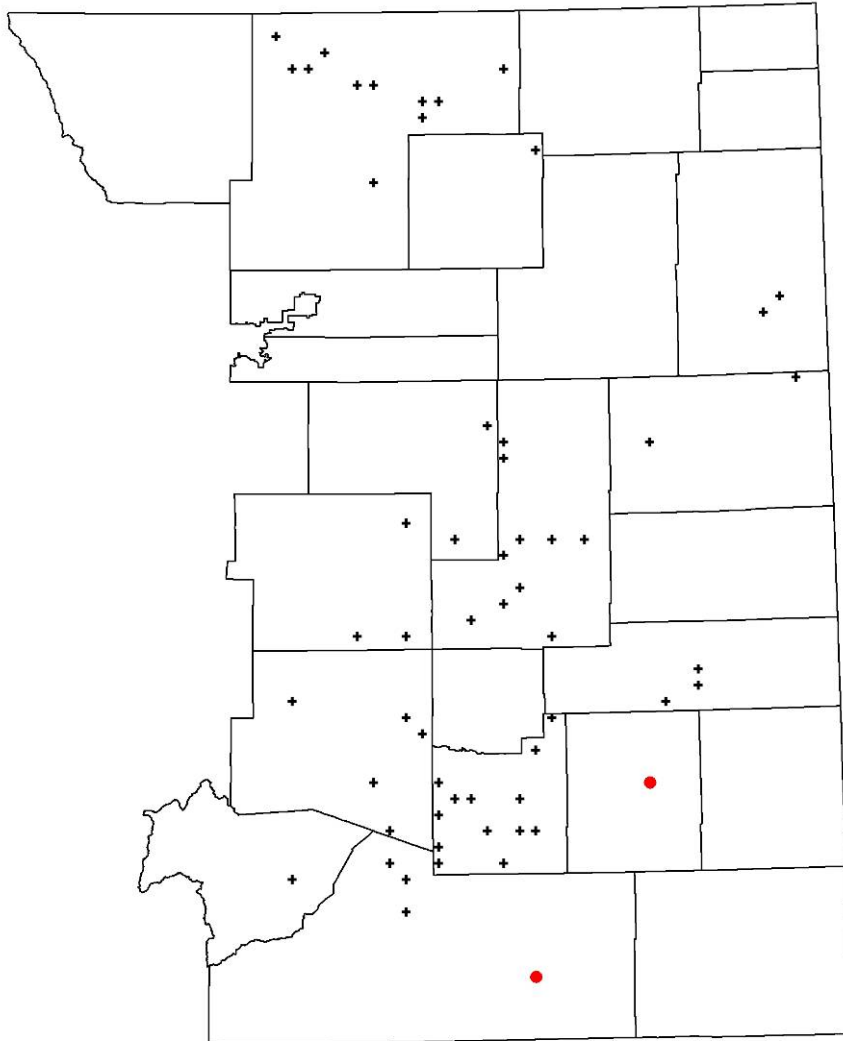


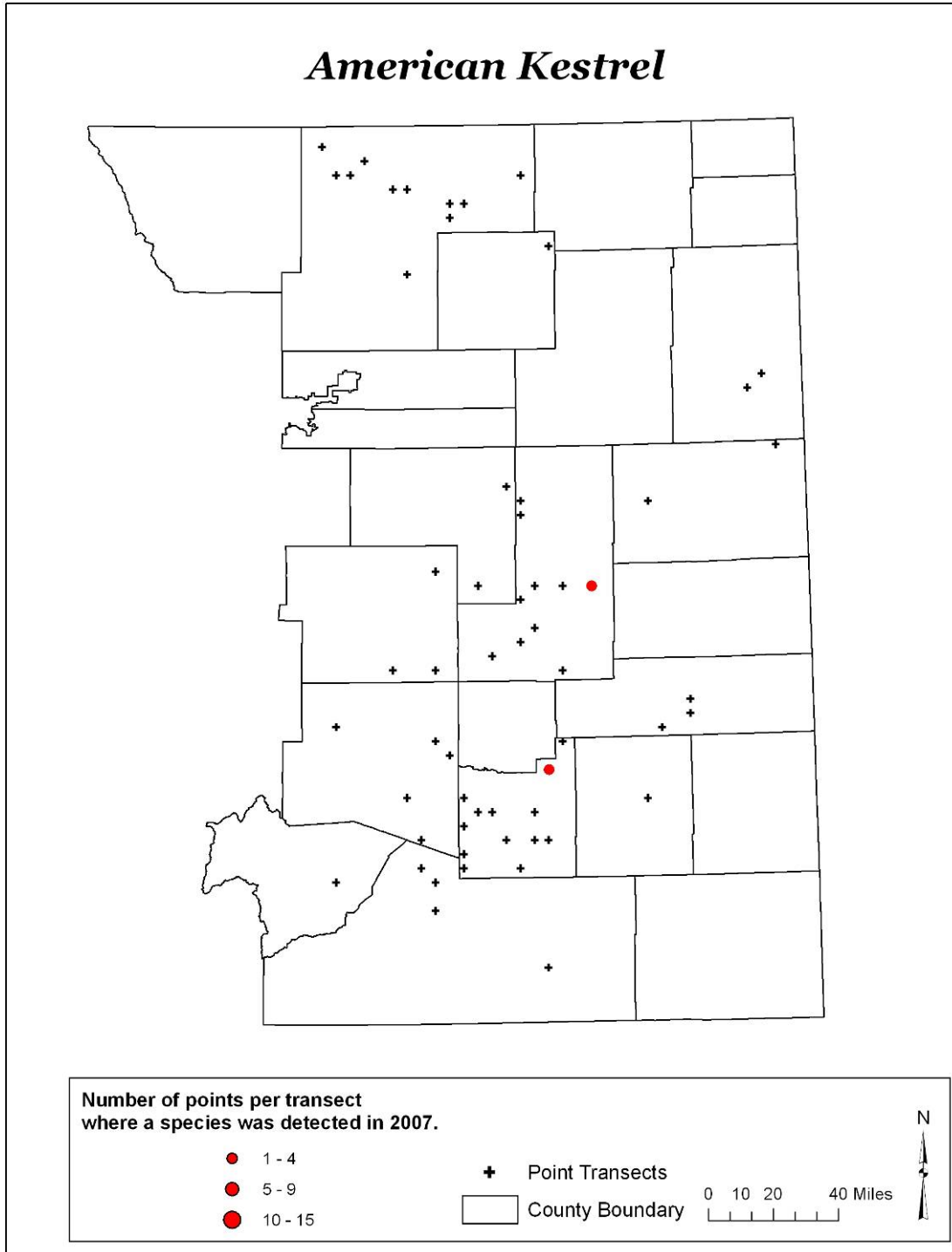




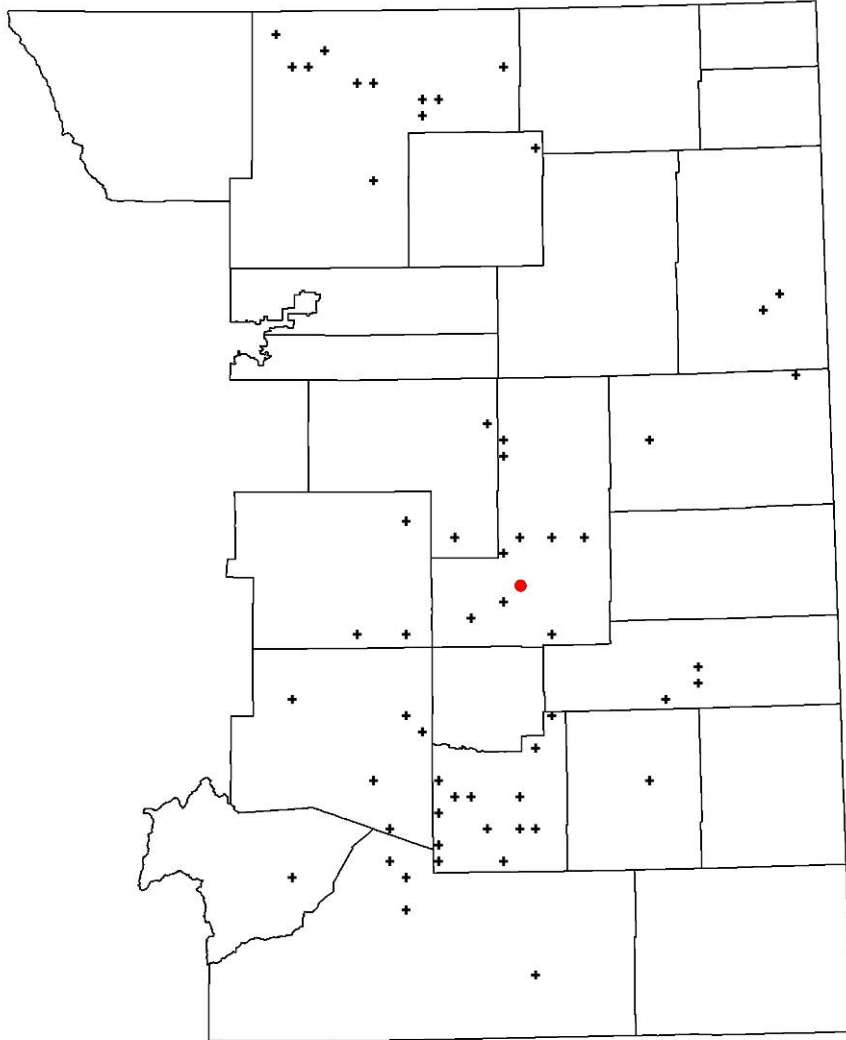


Ferruginous Hawk





Prairie Falcon



Number of points per transect
where a species was detected in 2007.

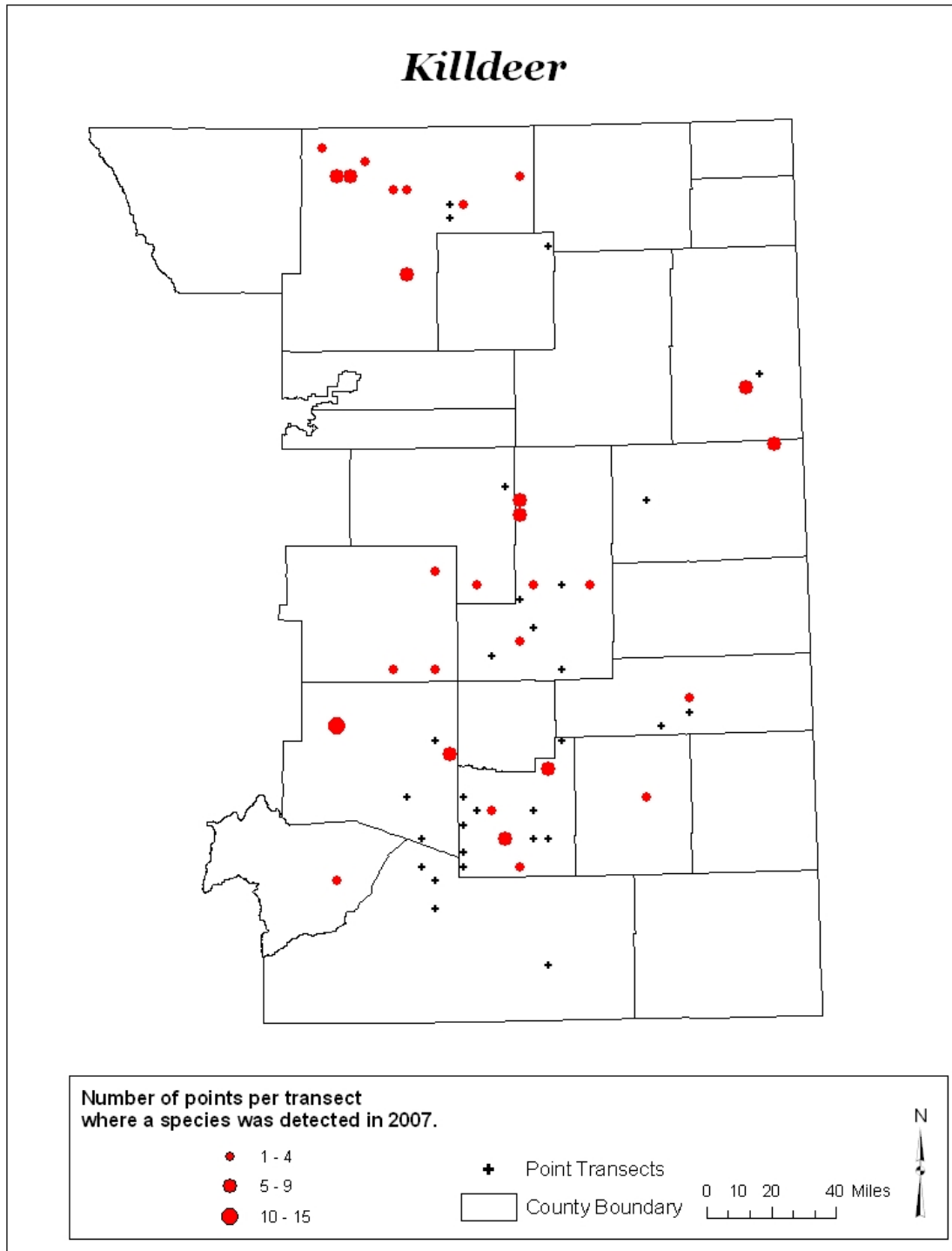
- 1 - 4
- 5 - 9
- 10 - 15

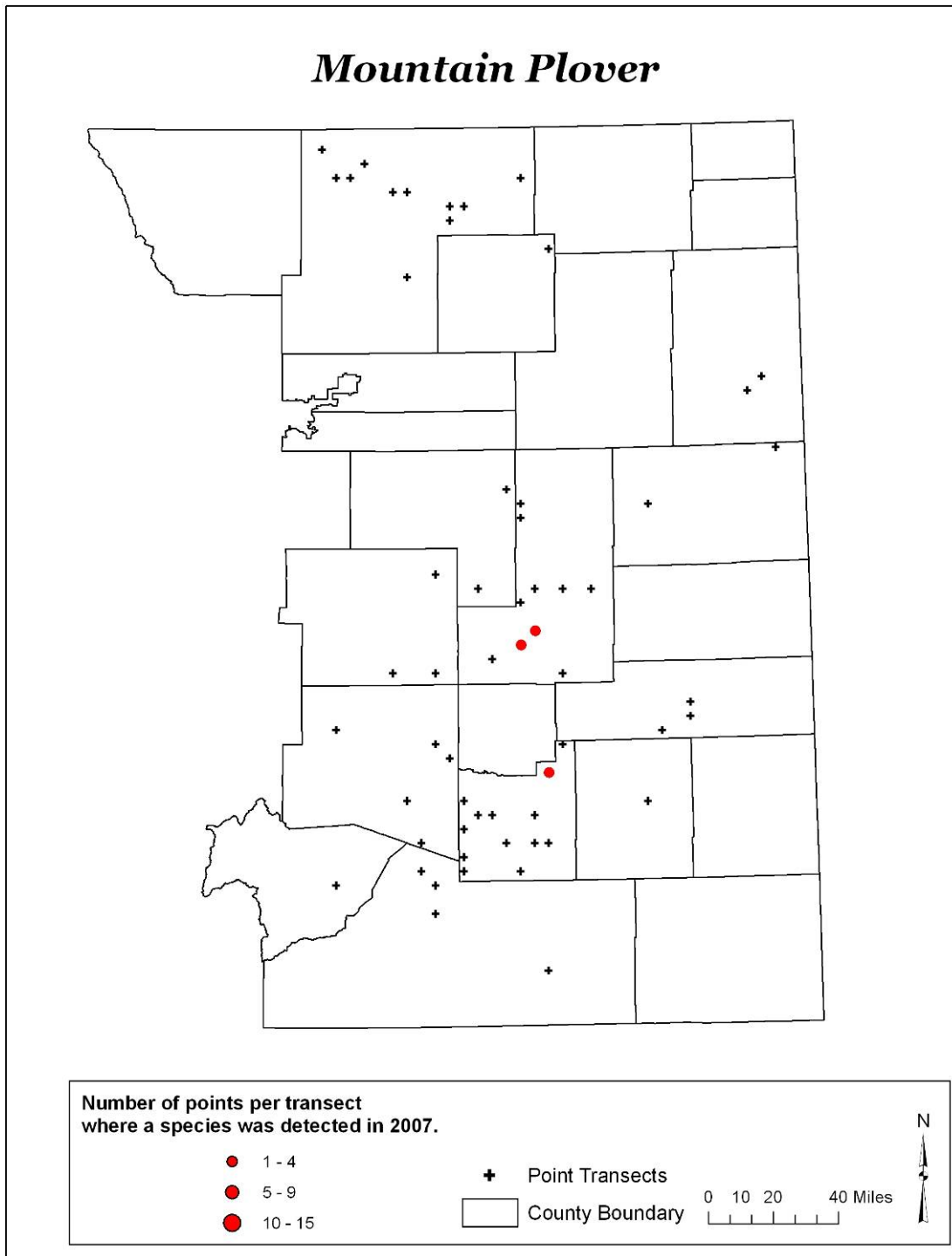
+ Point Transects

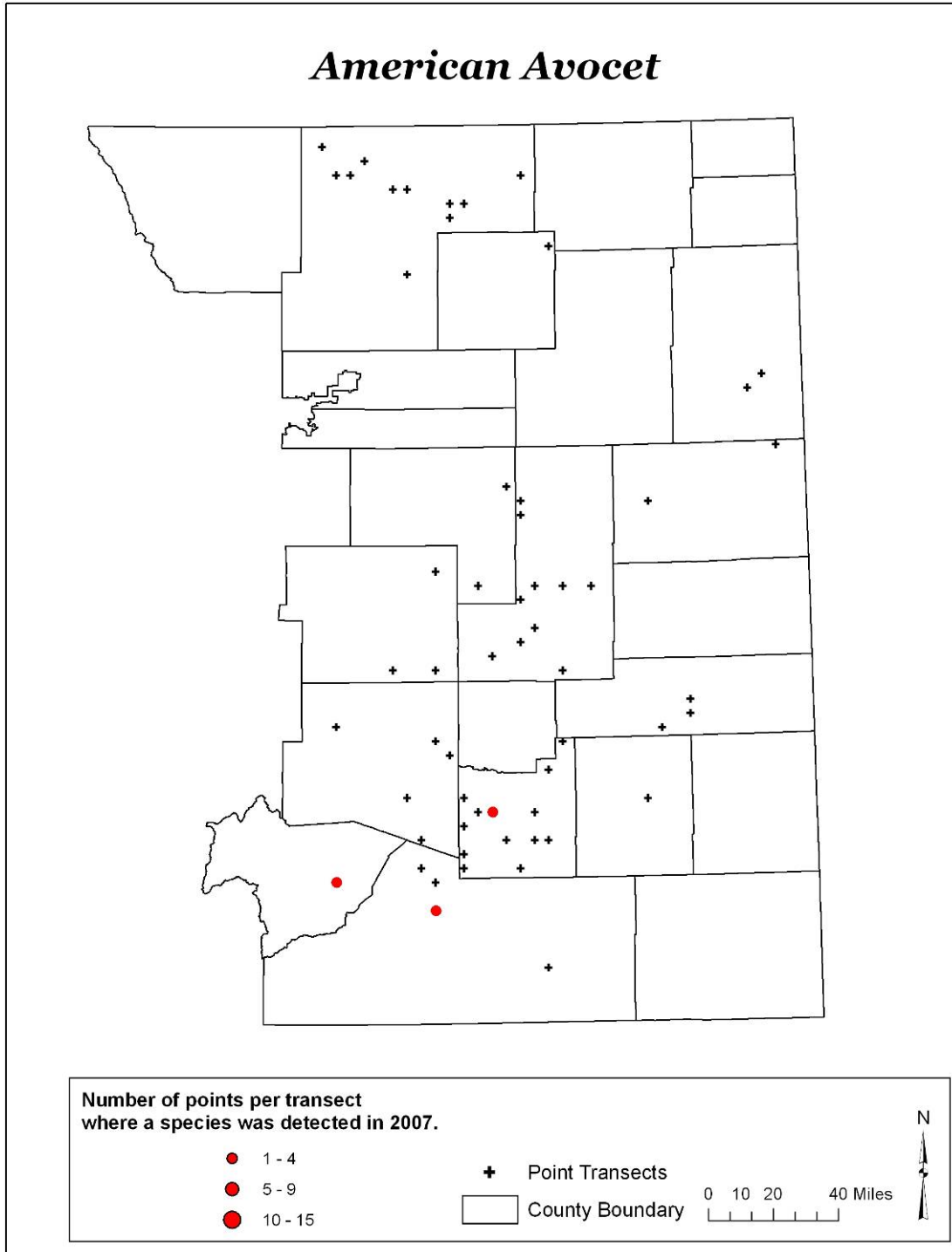
□ County Boundary

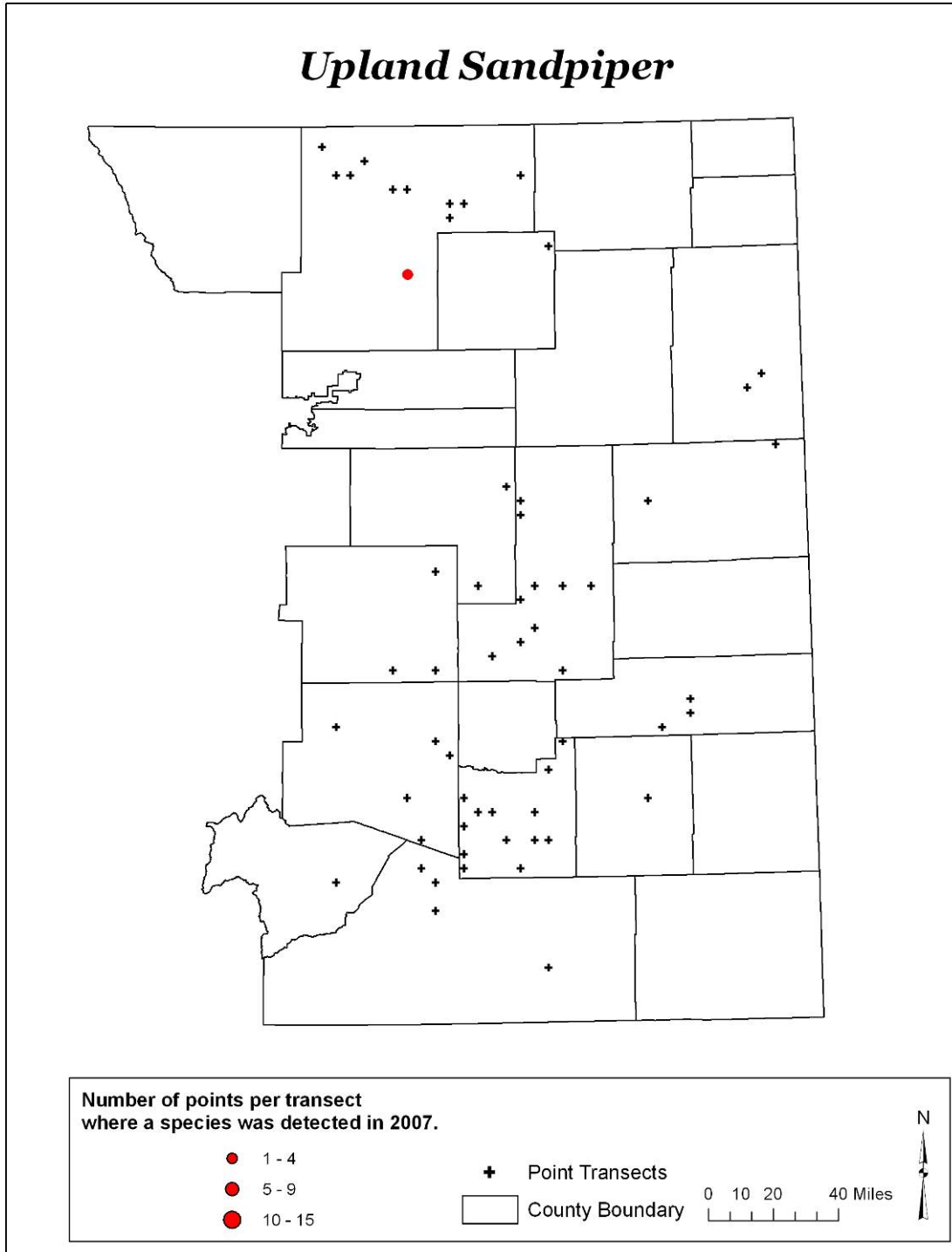
0 10 20 40 Miles

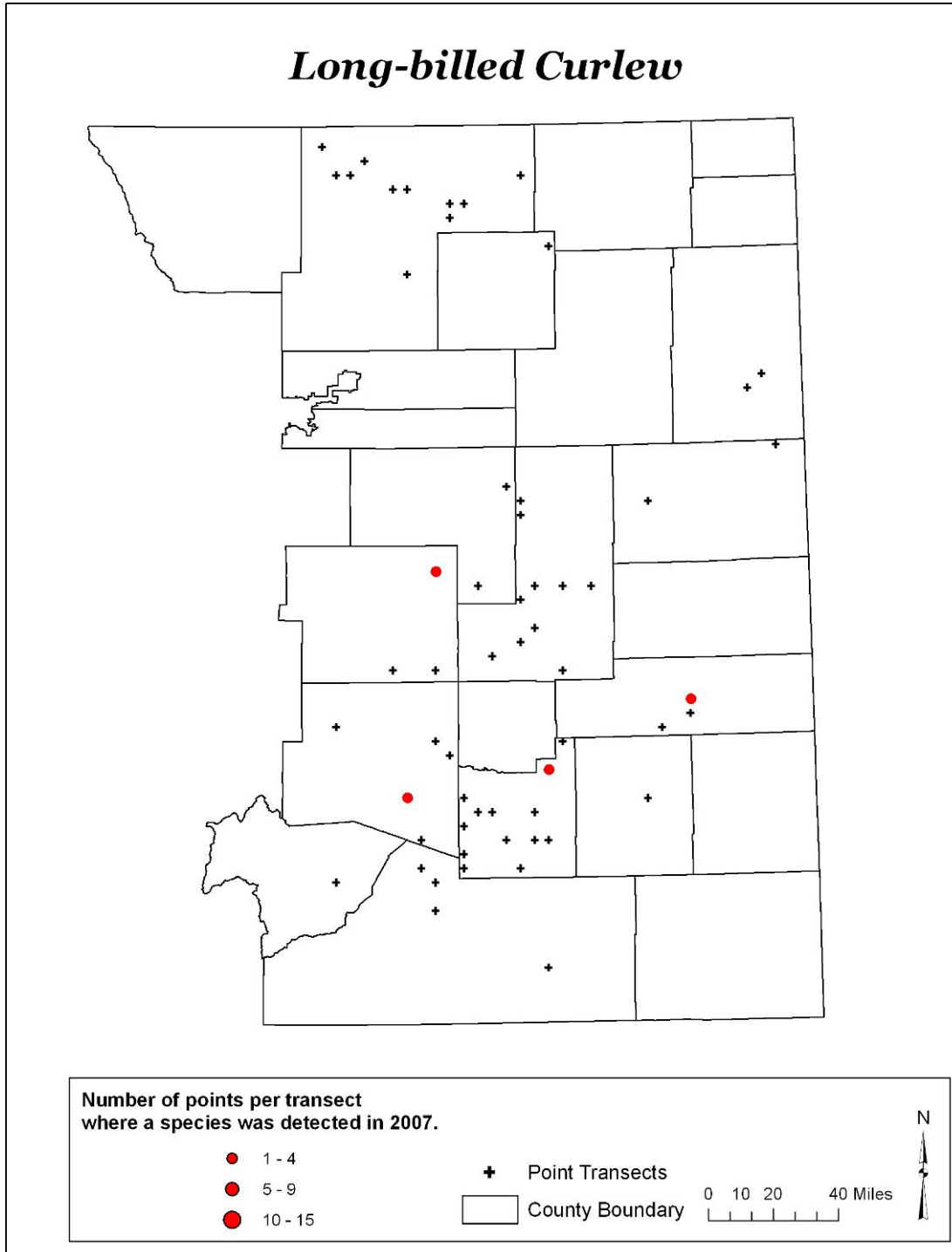




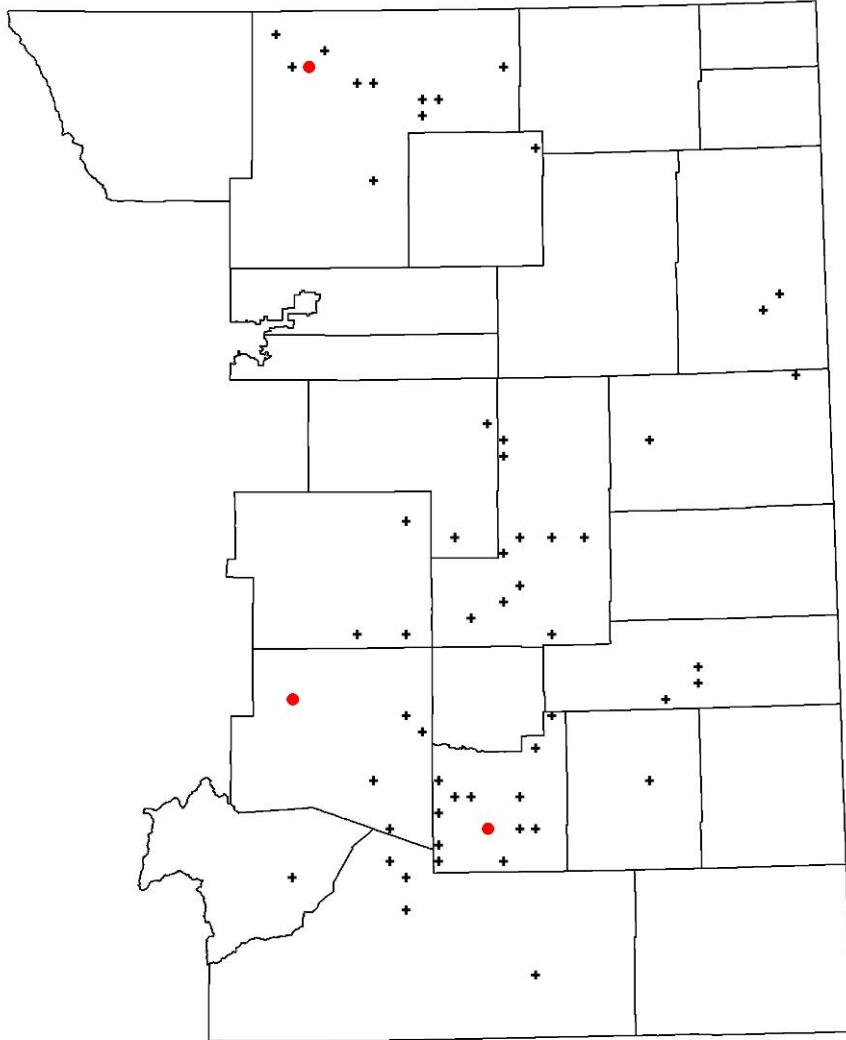








Eurasian Collared-Dove



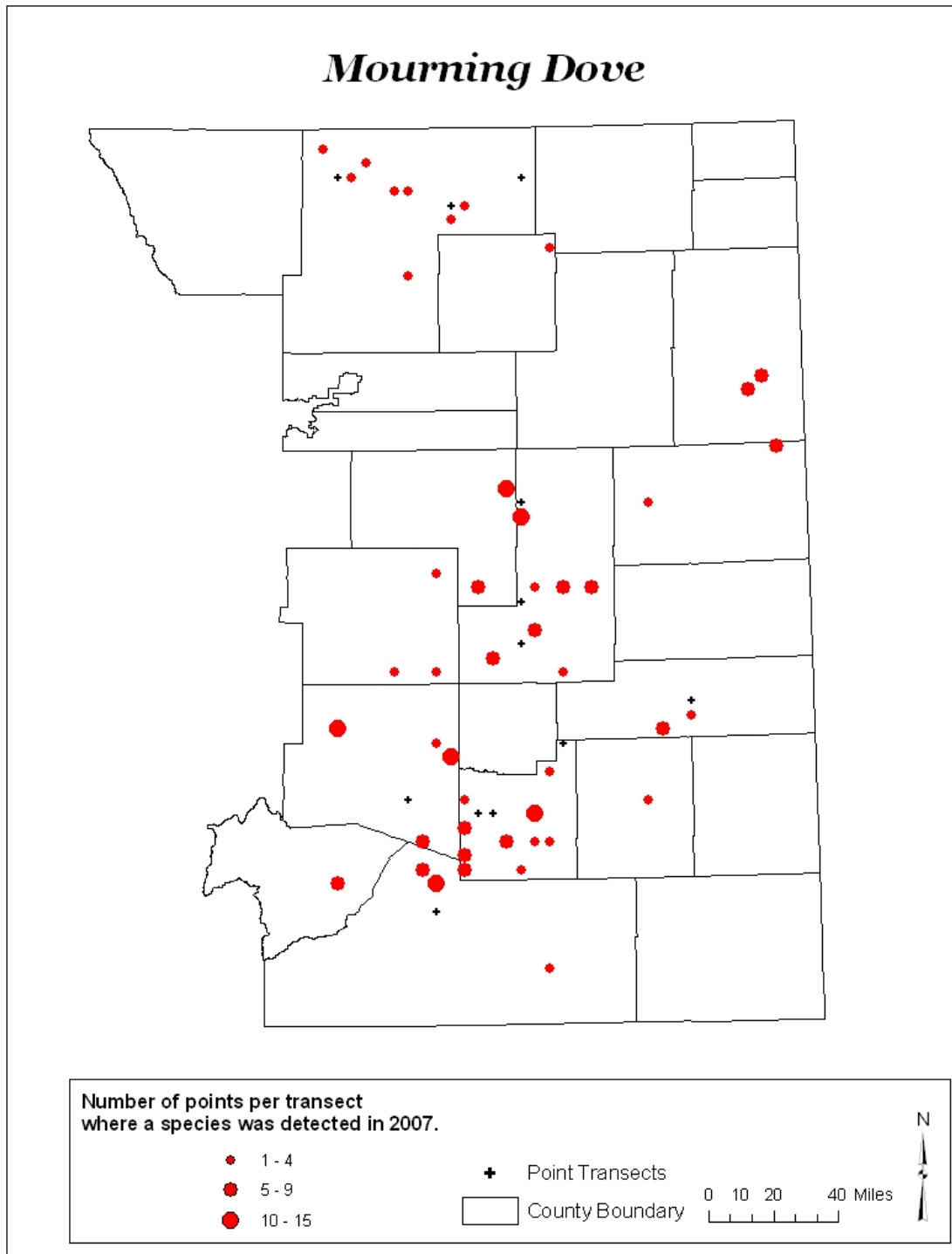
Number of points per transect where a species was detected in 2007.

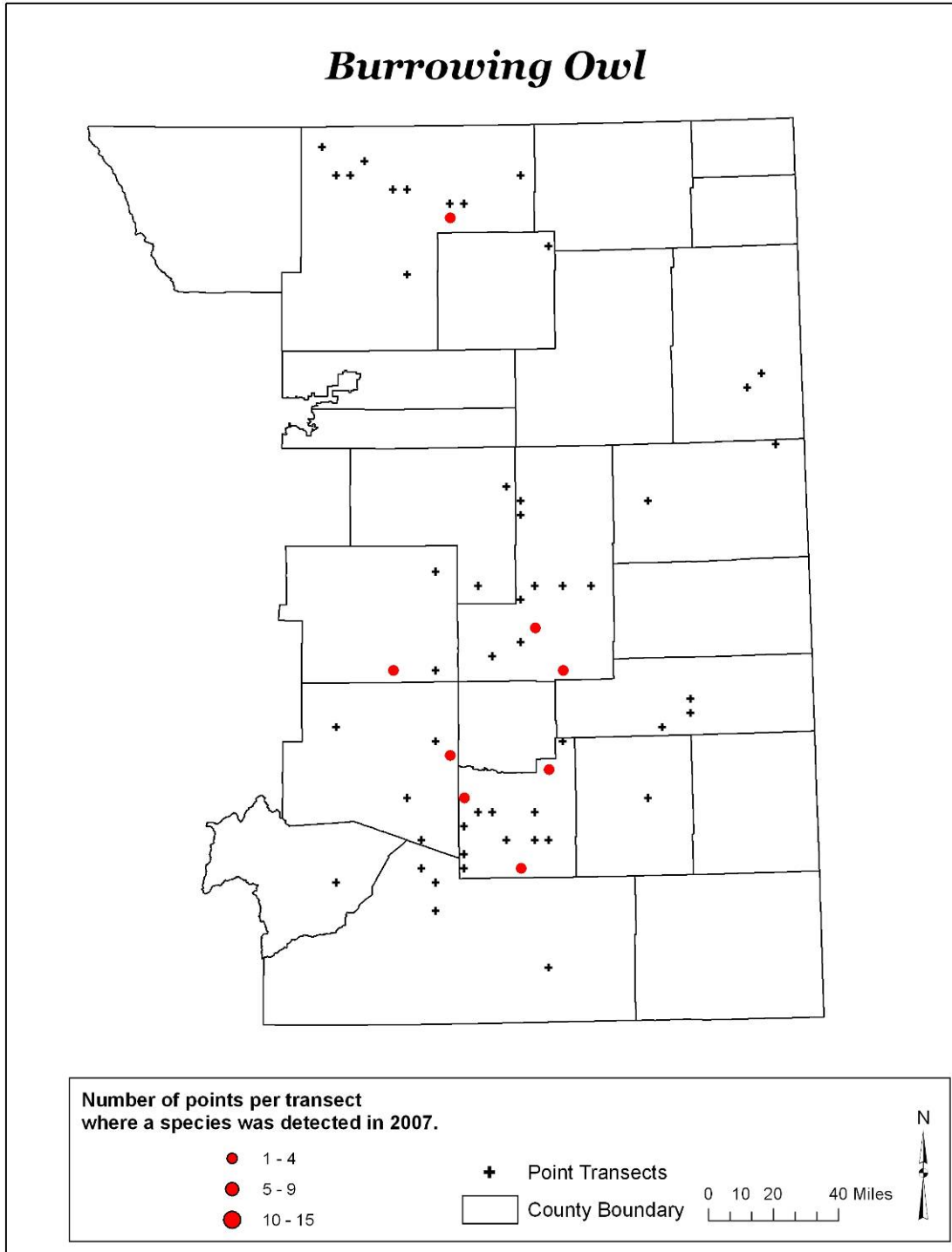
- 1 - 4
- 5 - 9
- 10 - 15

+ Point Transects
□ County Boundary

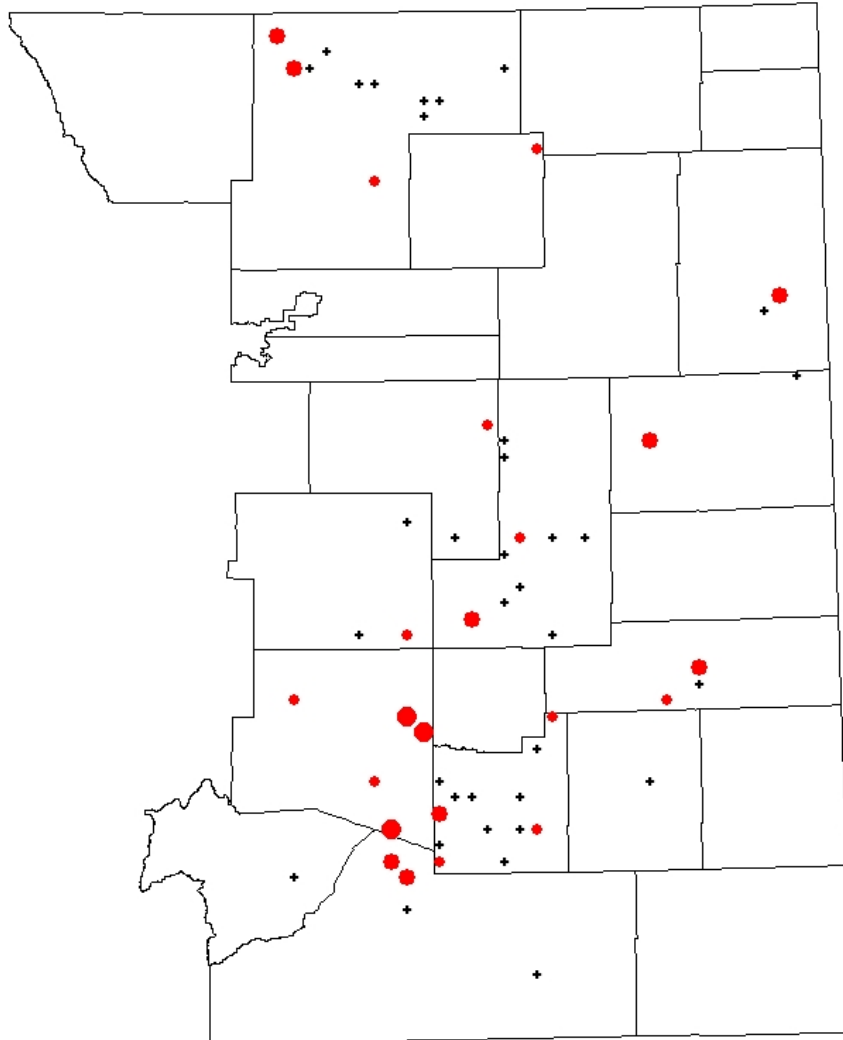
0 10 20 40 Miles







Common Nighthawk



Number of points per transect
where a species was detected in 2007.

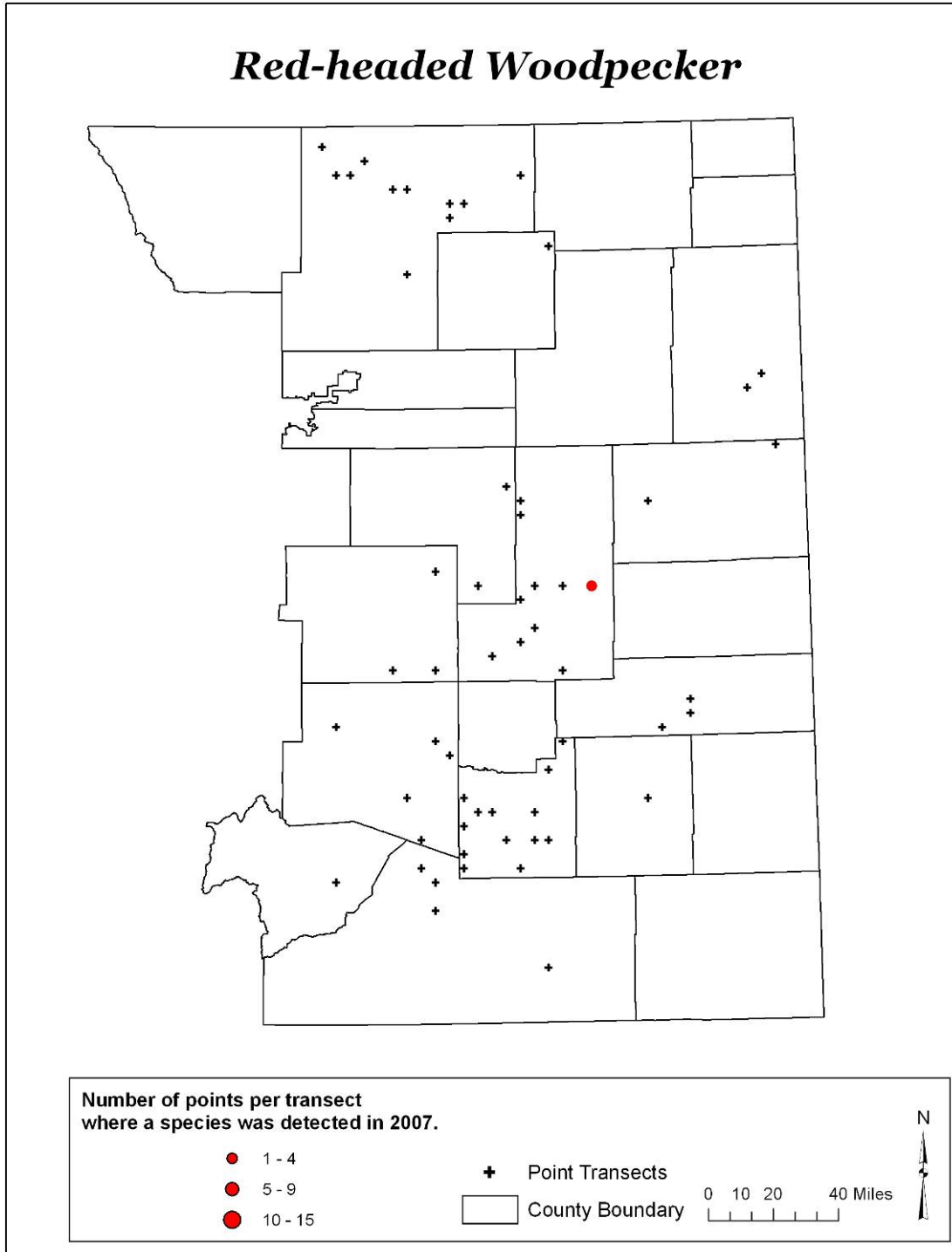
- 1 - 4
- 5 - 9
- 10 - 15

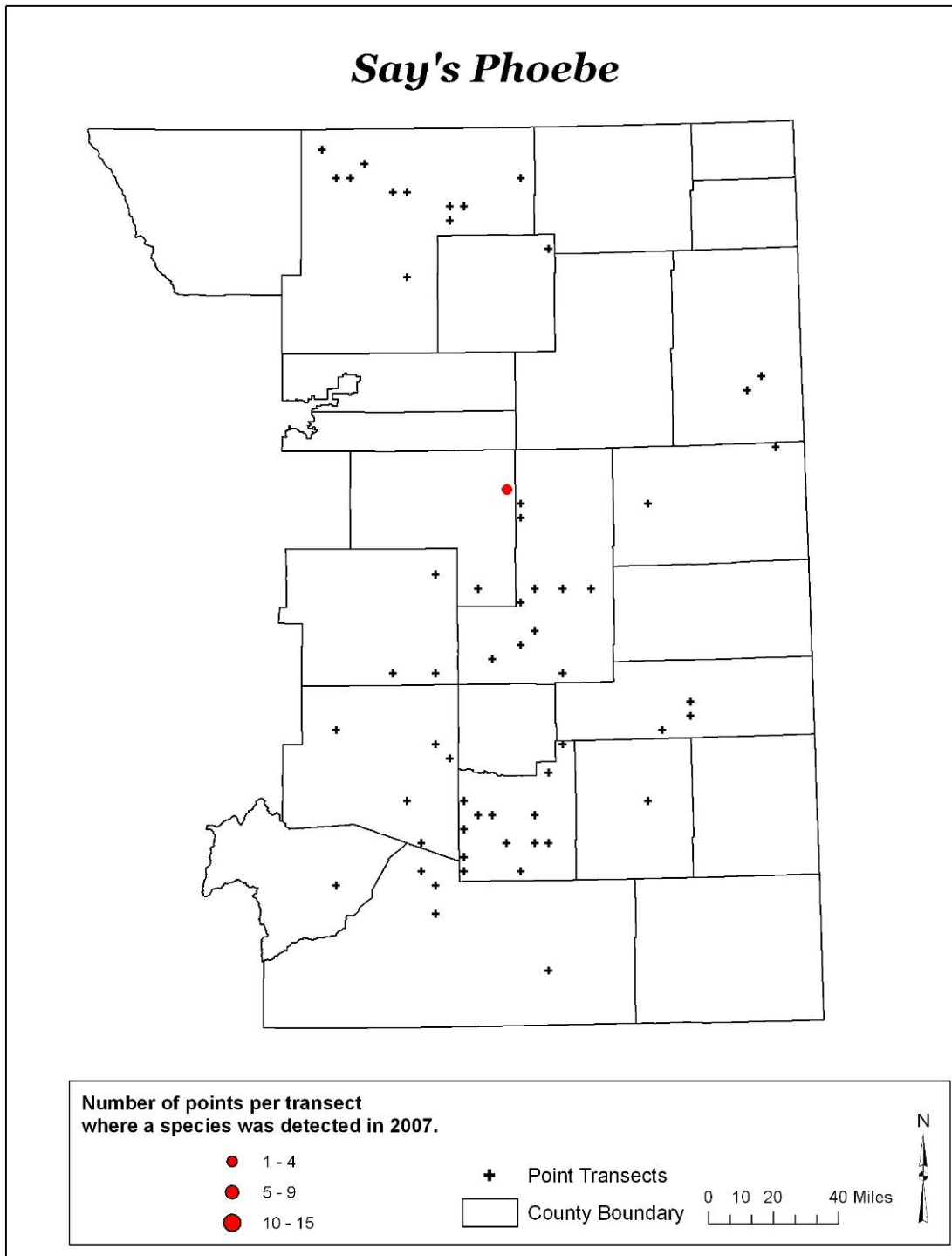
+ Point Transects

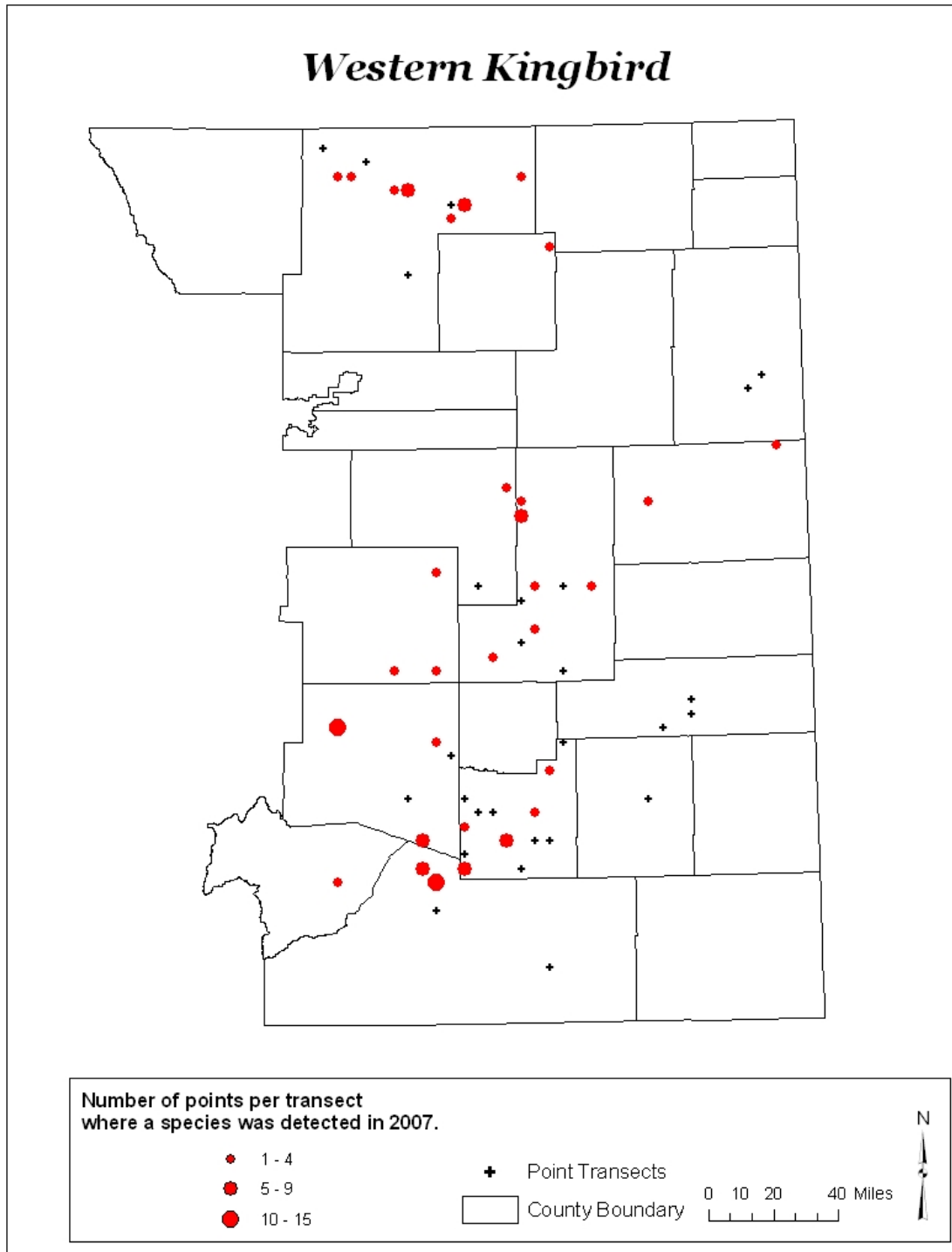
□ County Boundary

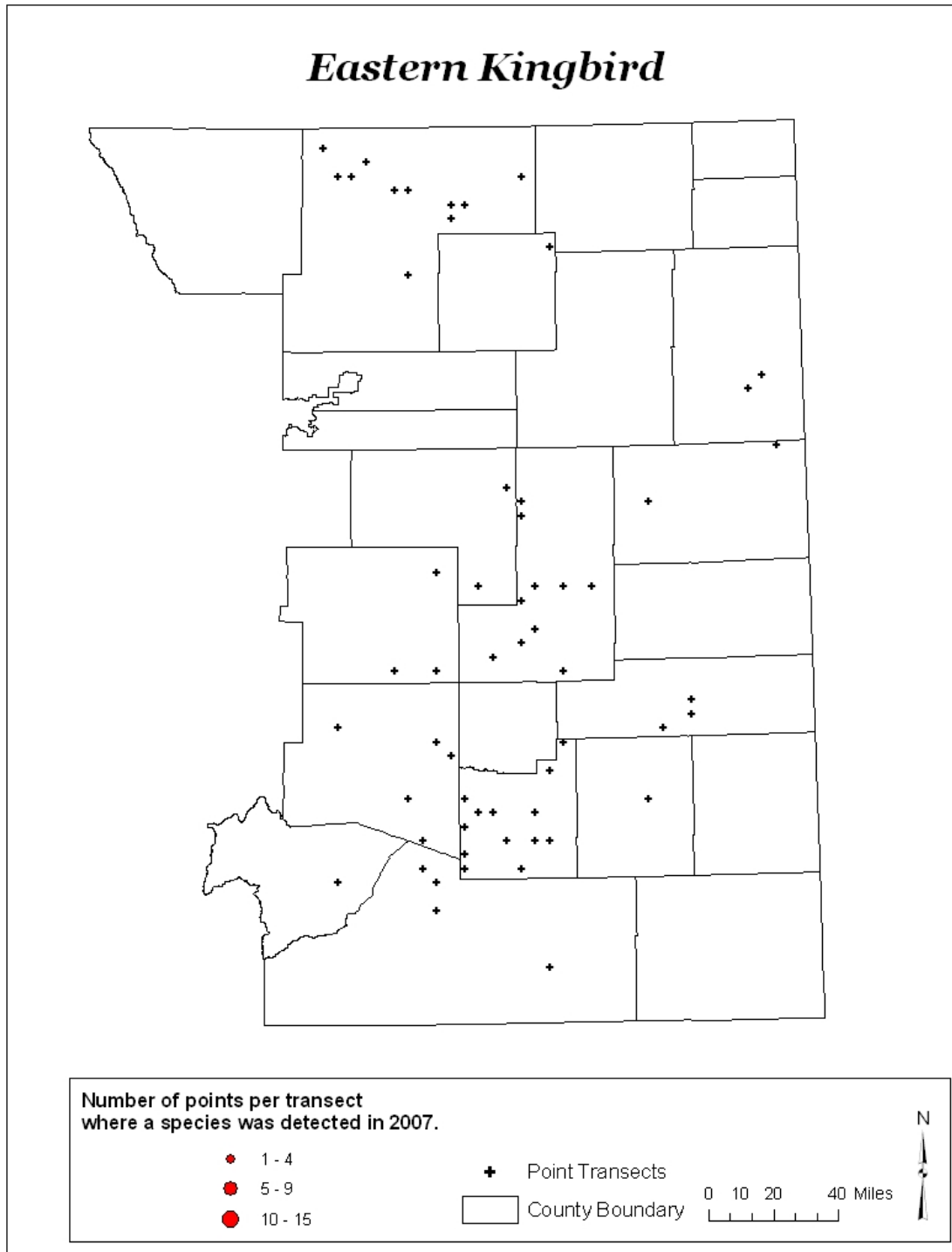
0 10 20 40 Miles



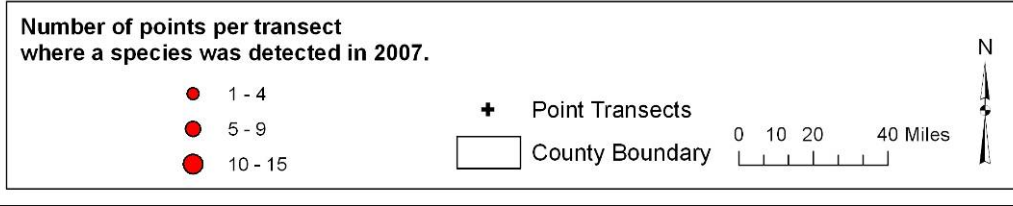
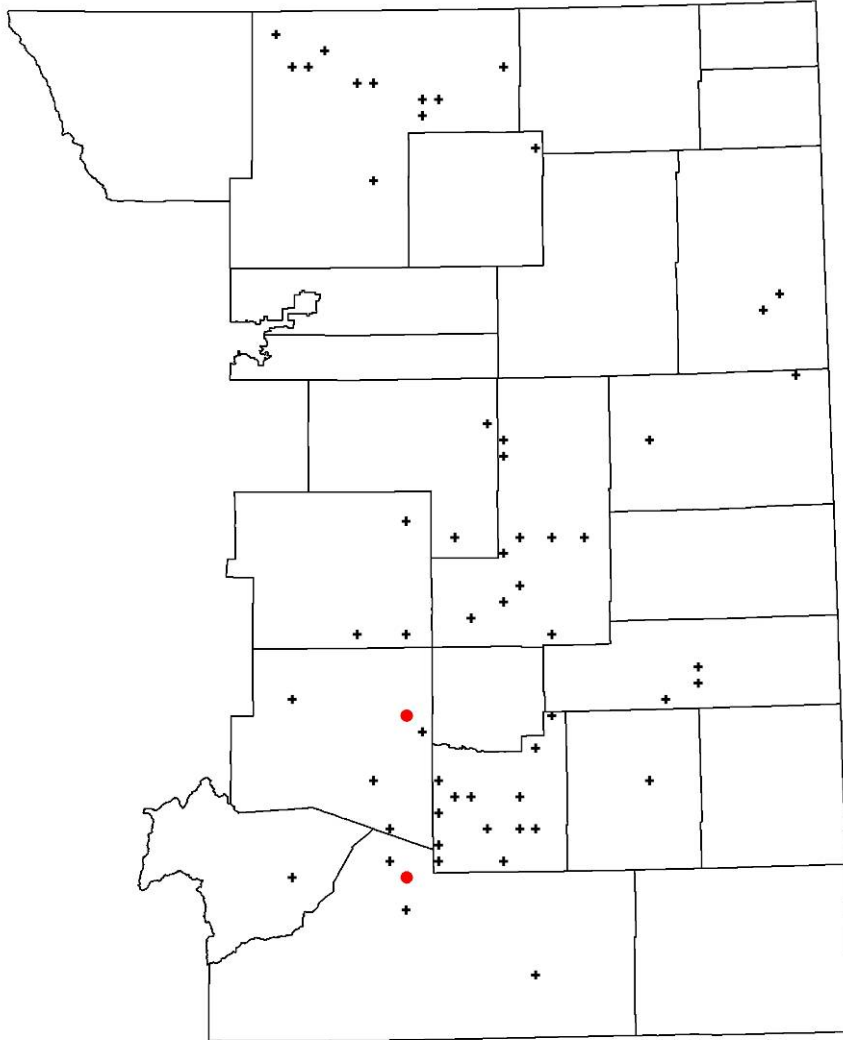


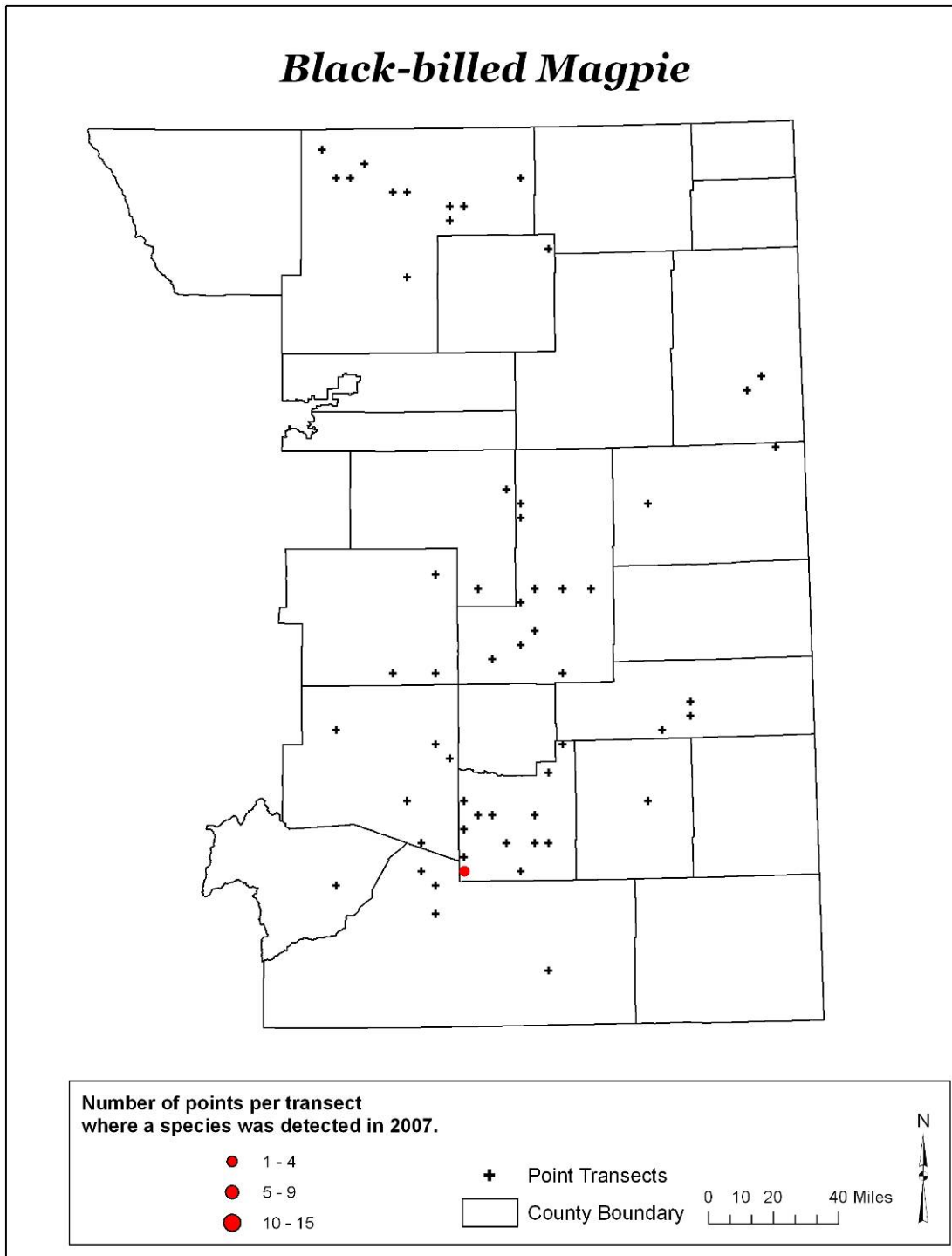


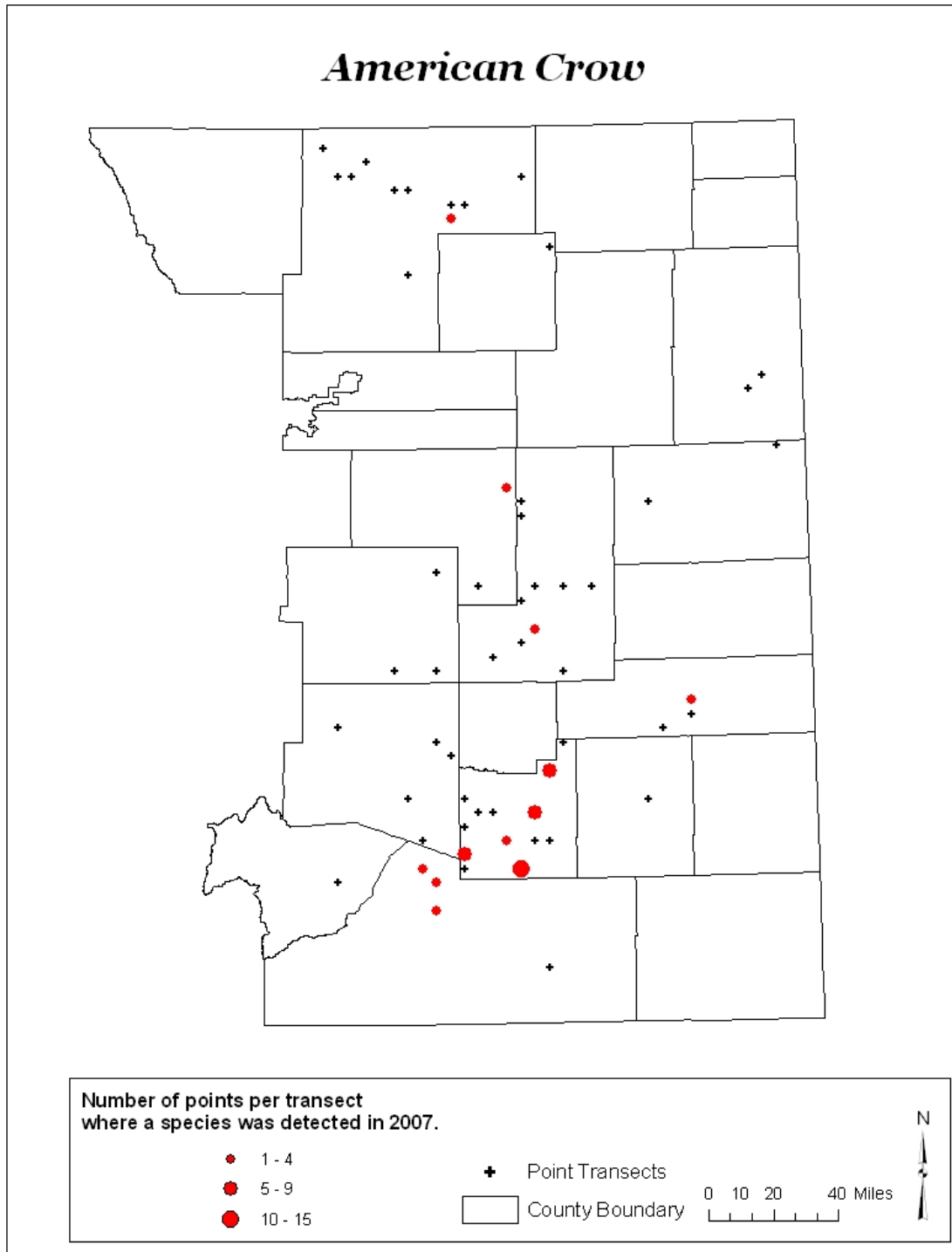


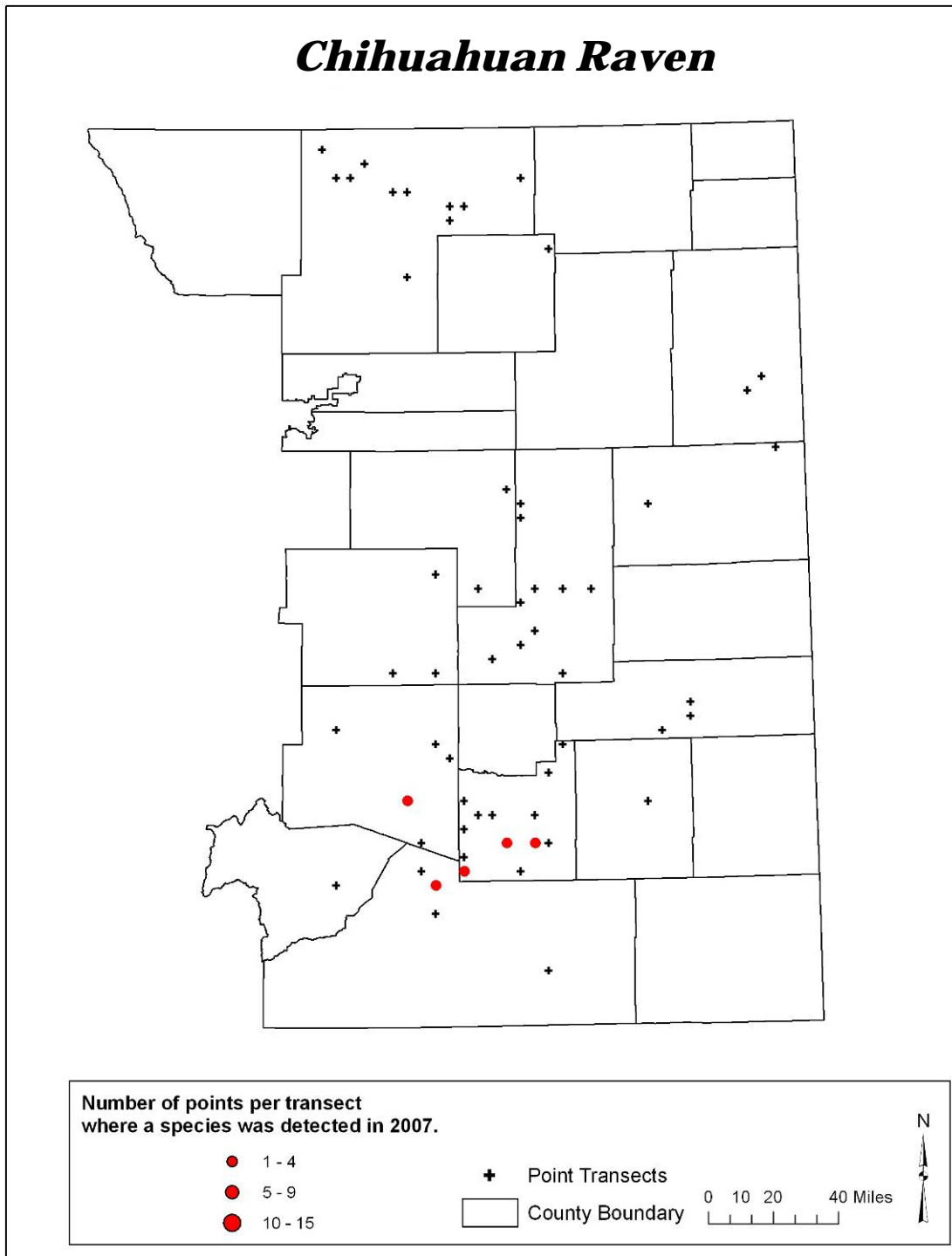


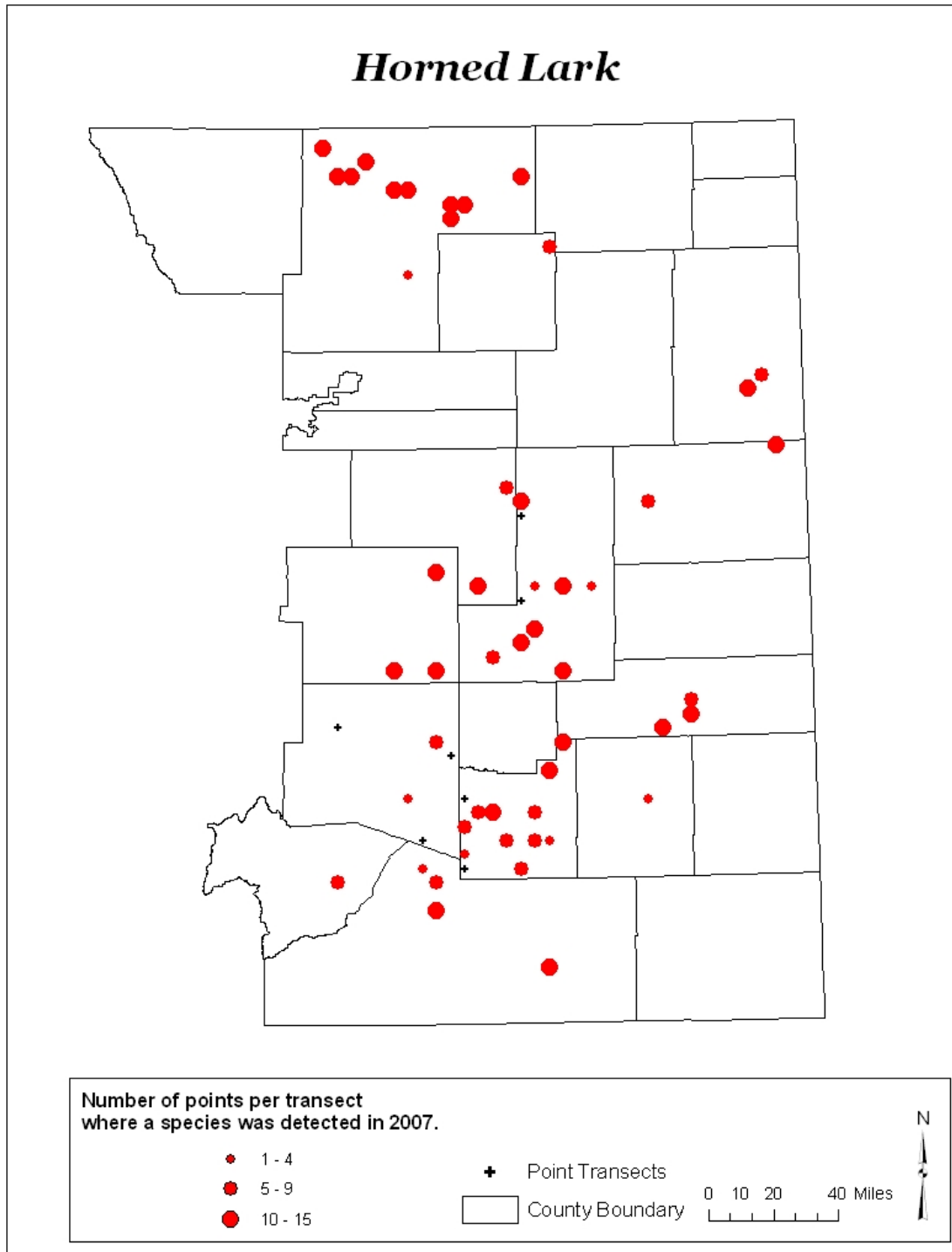
Loggerhead Shrike

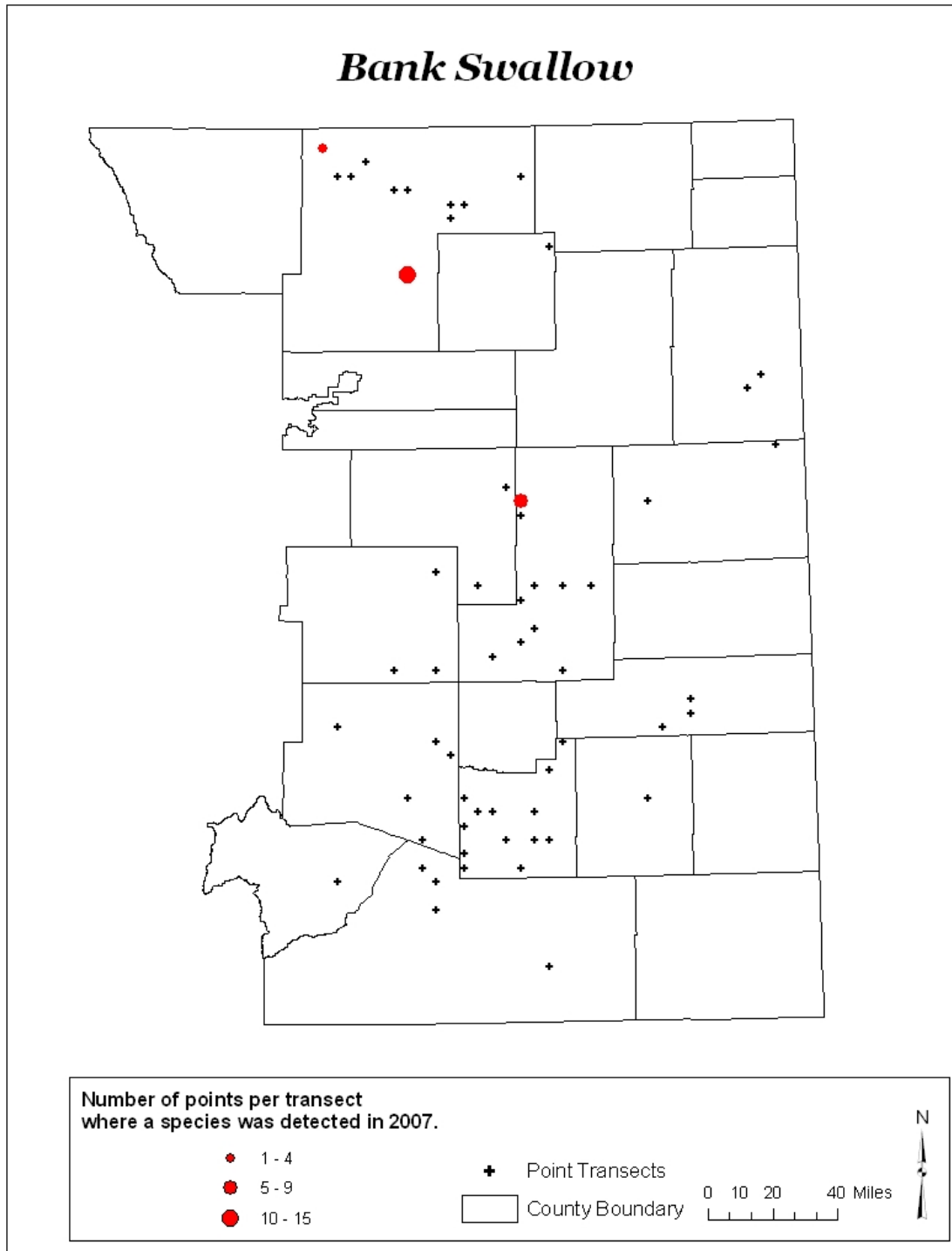


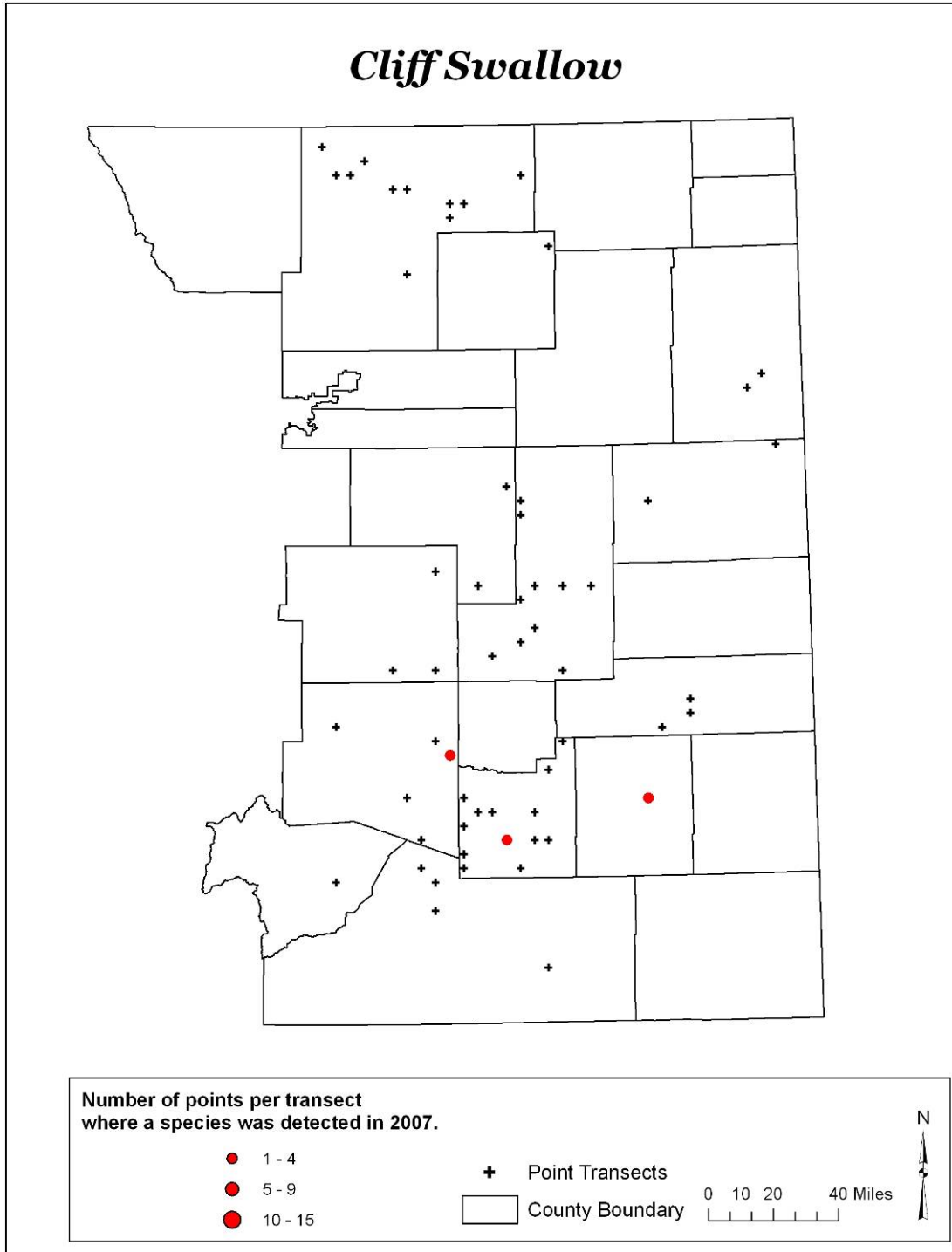


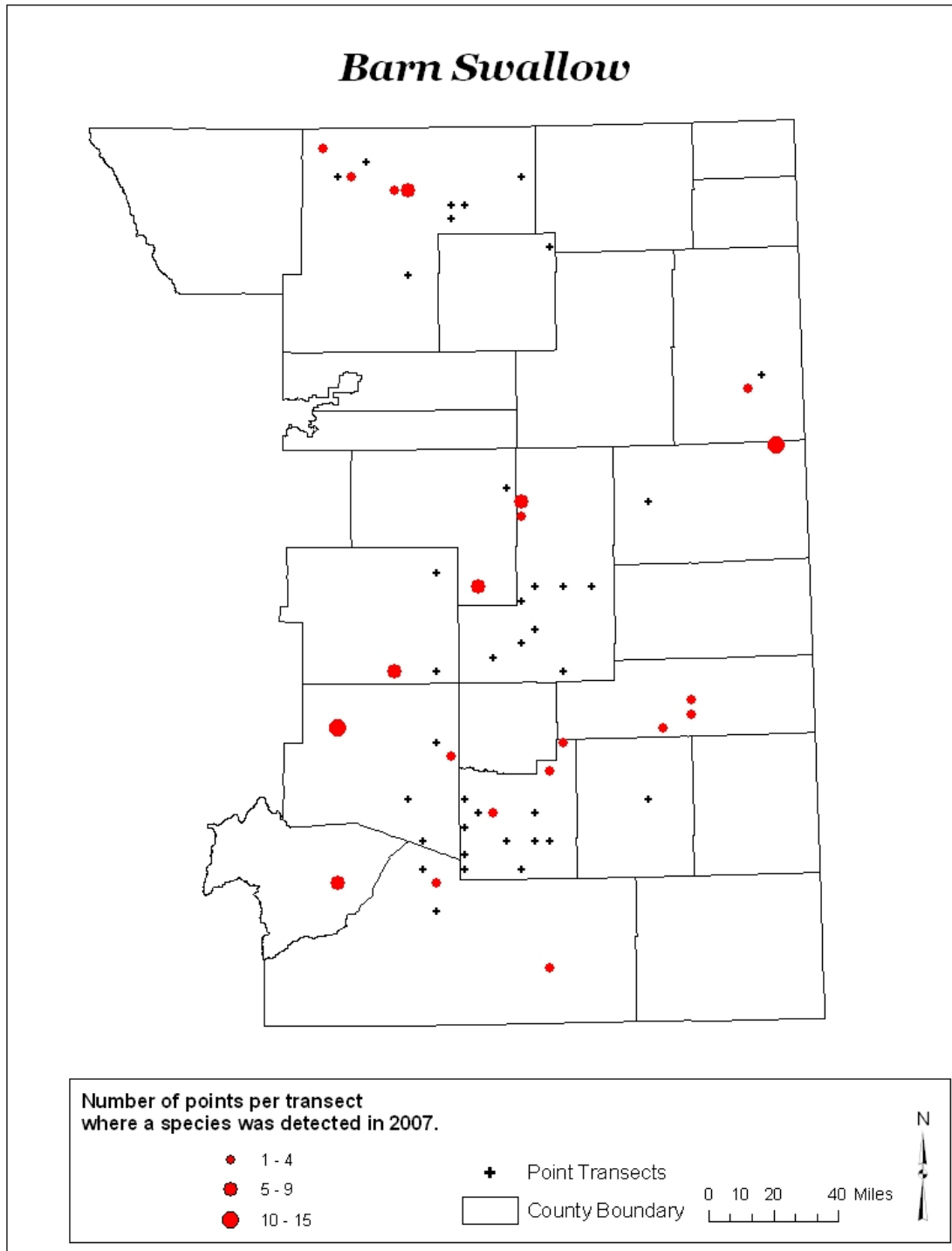


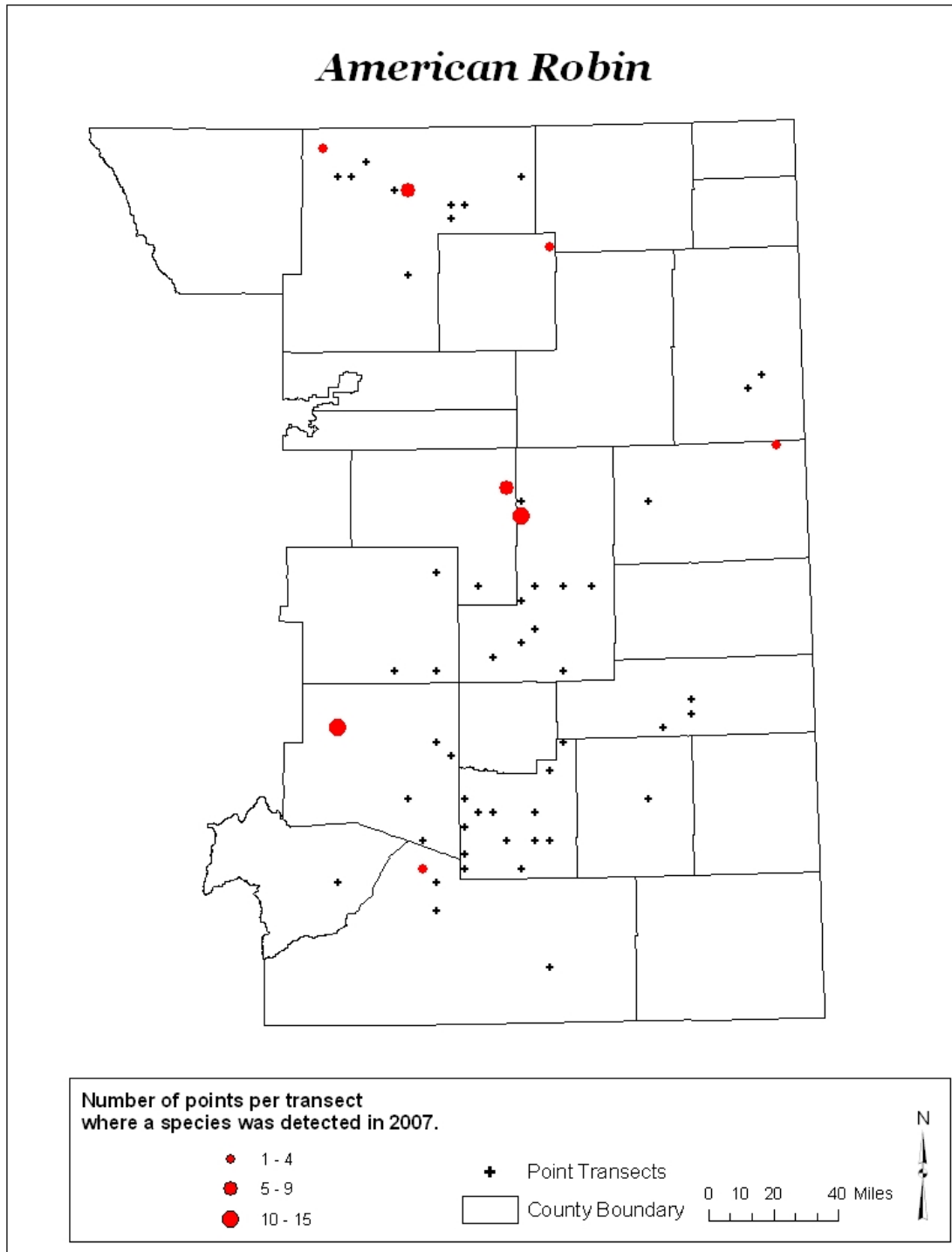


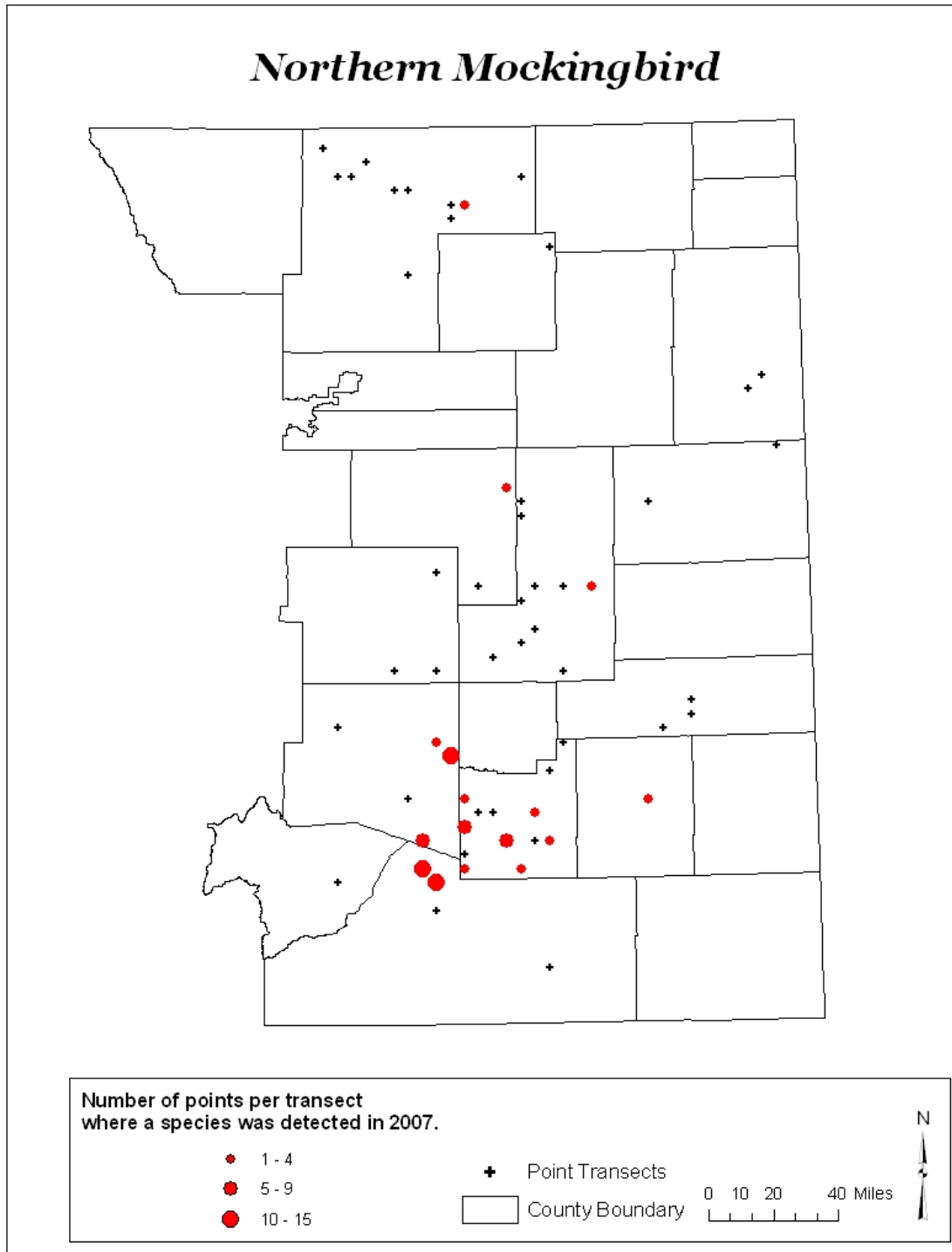


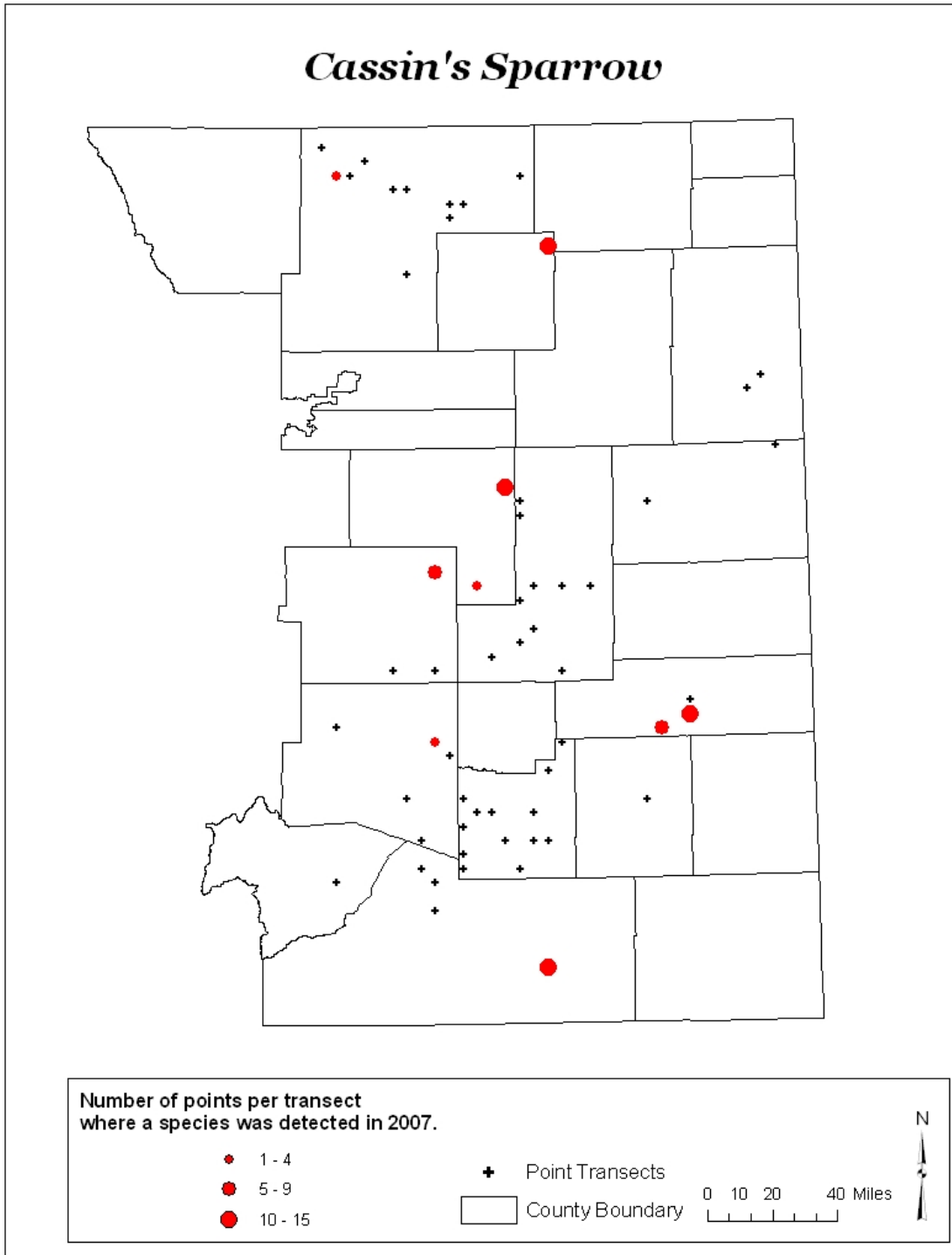


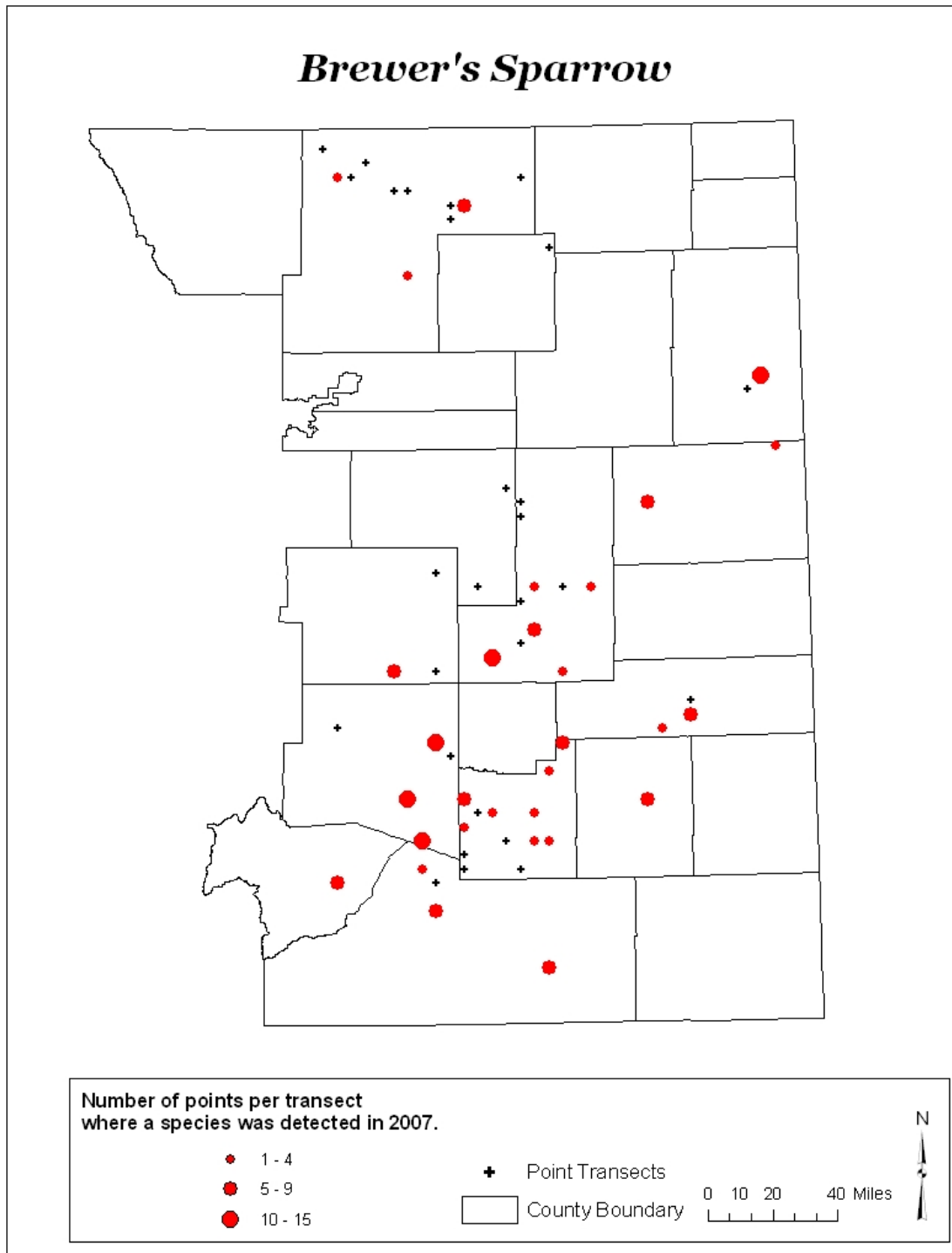


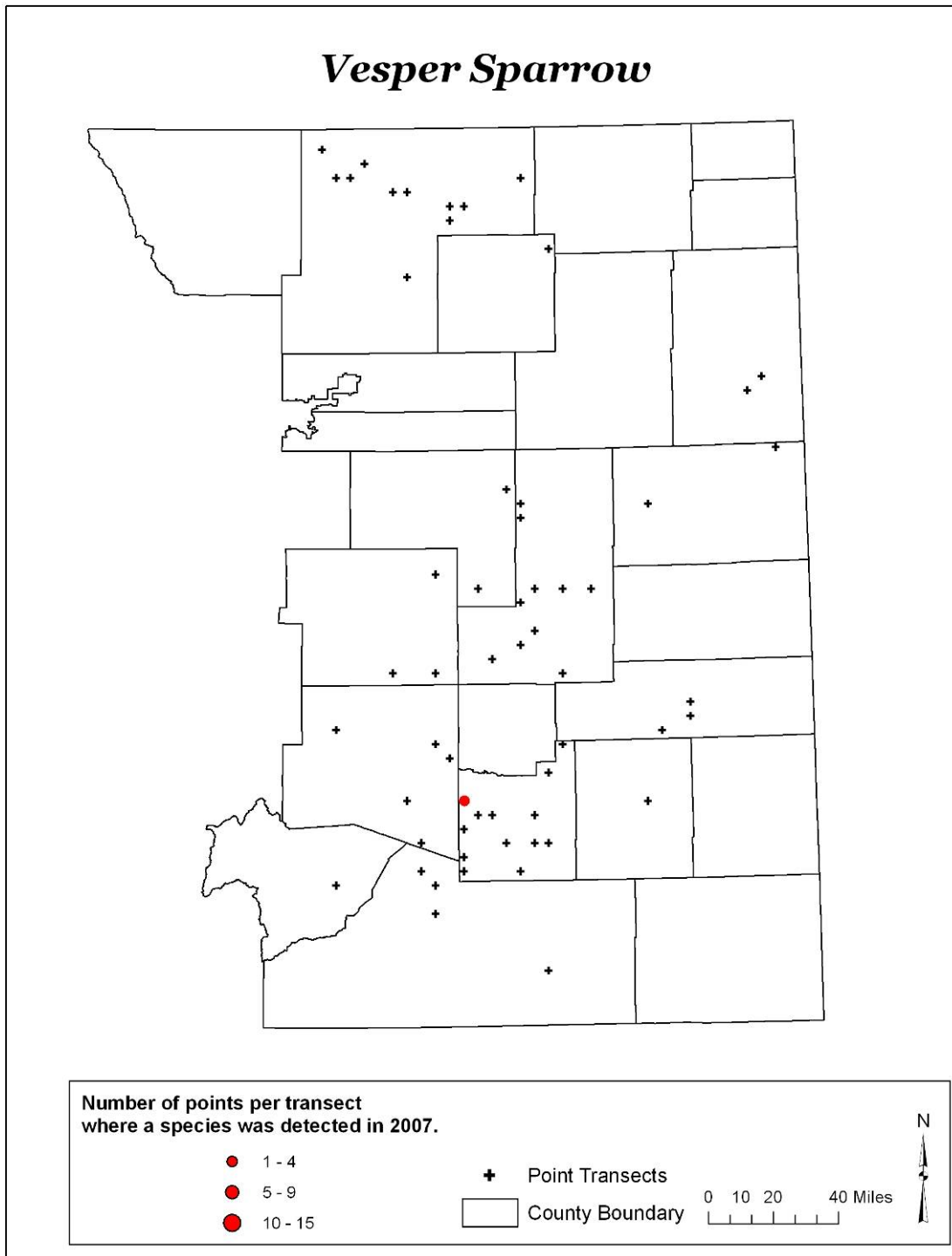


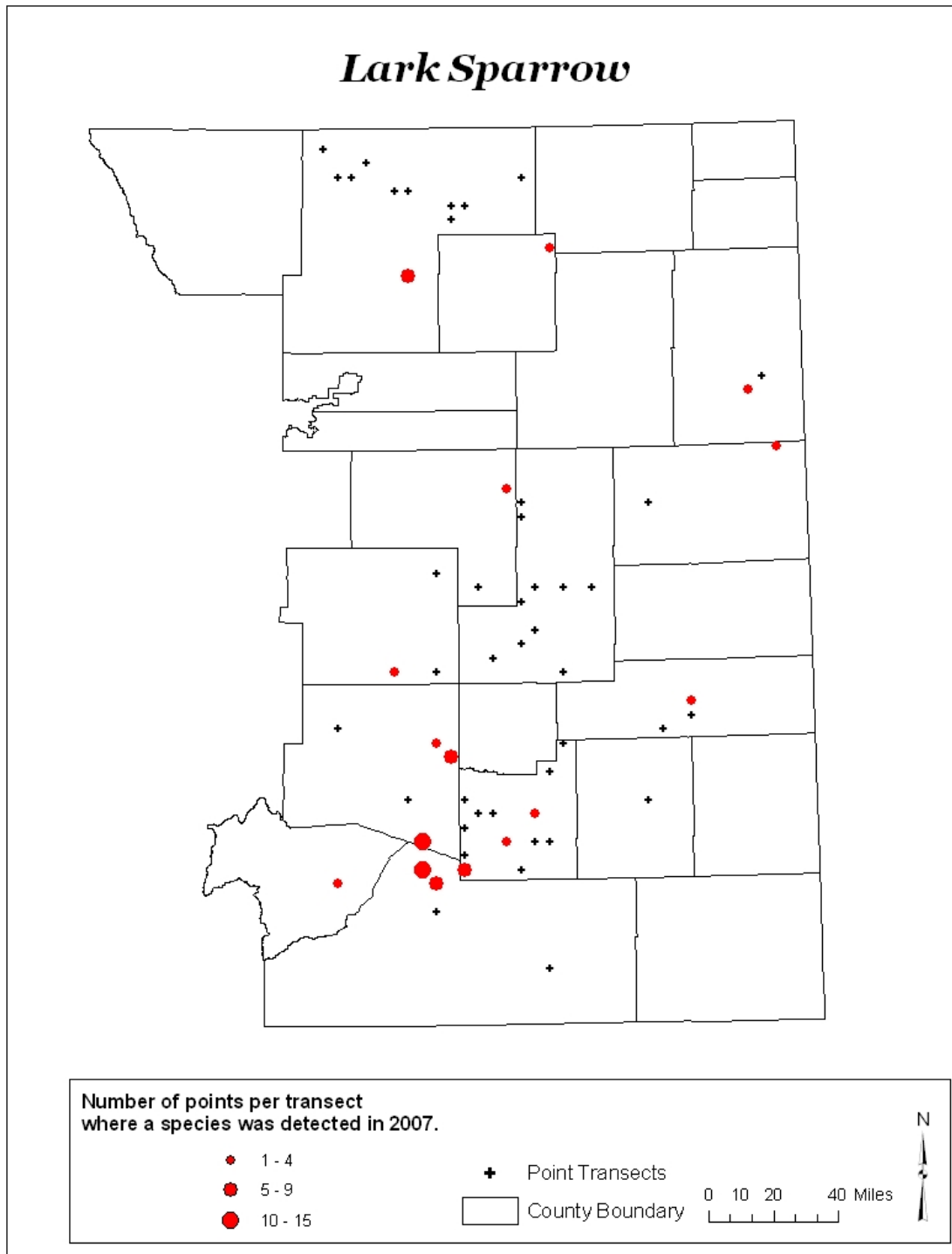


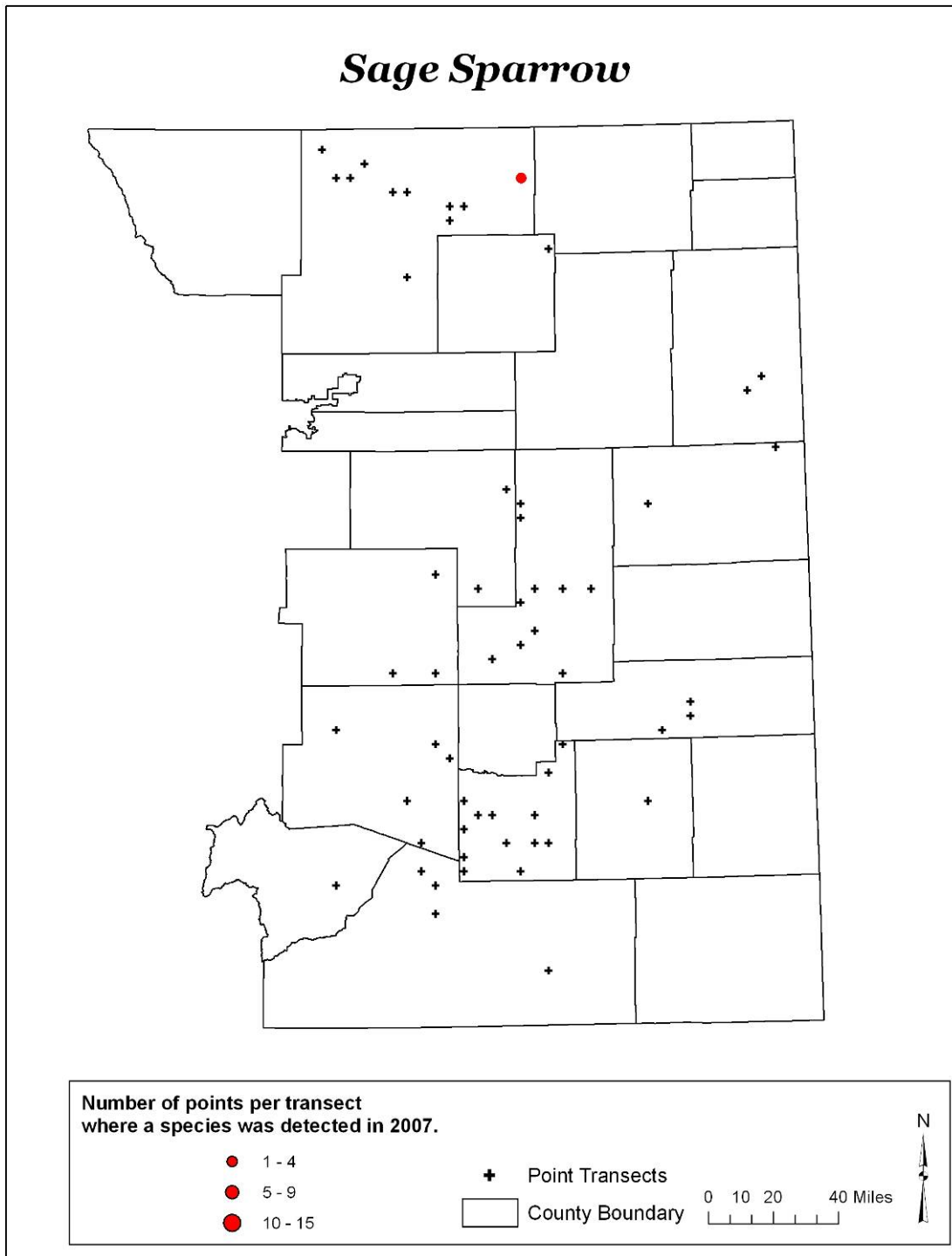


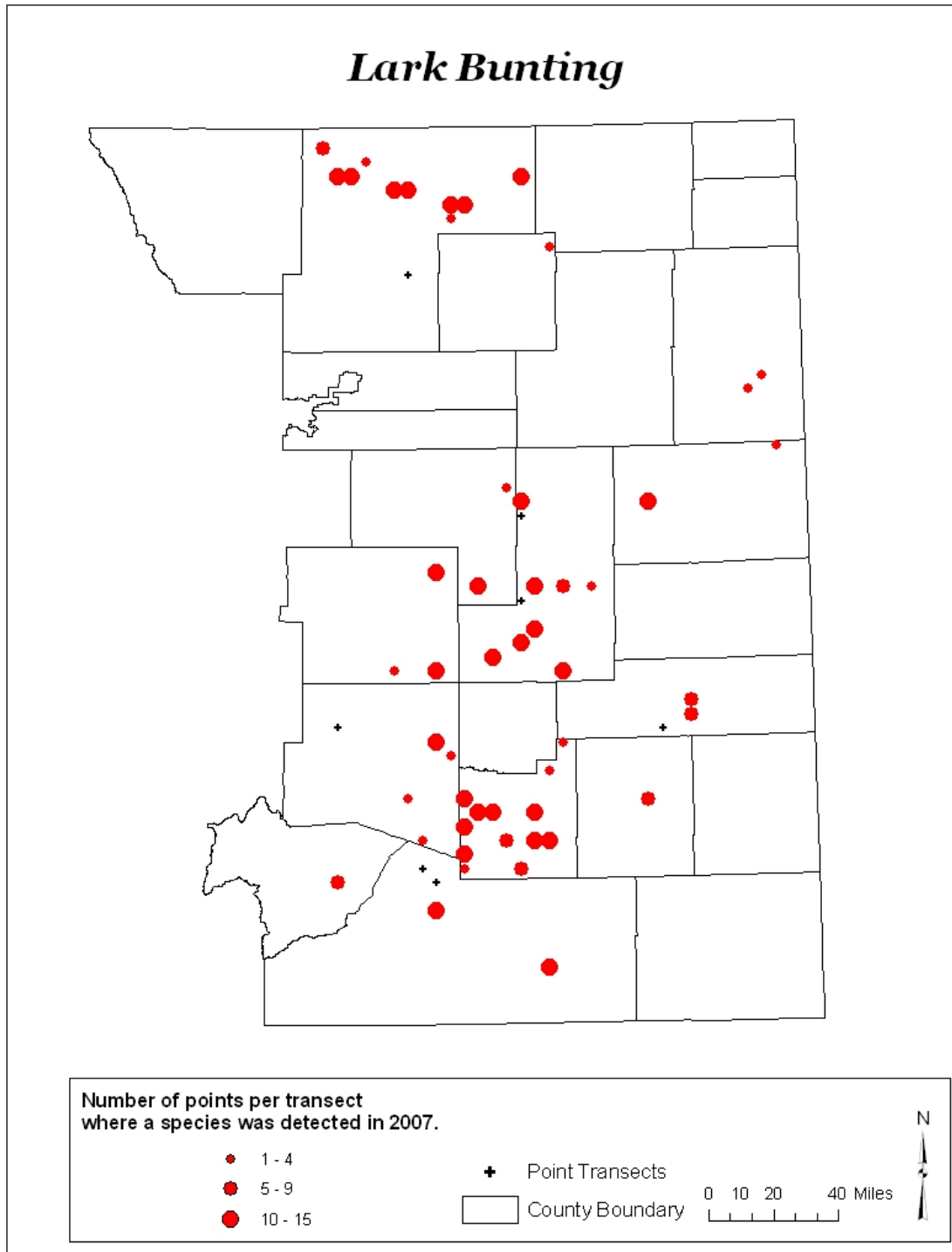


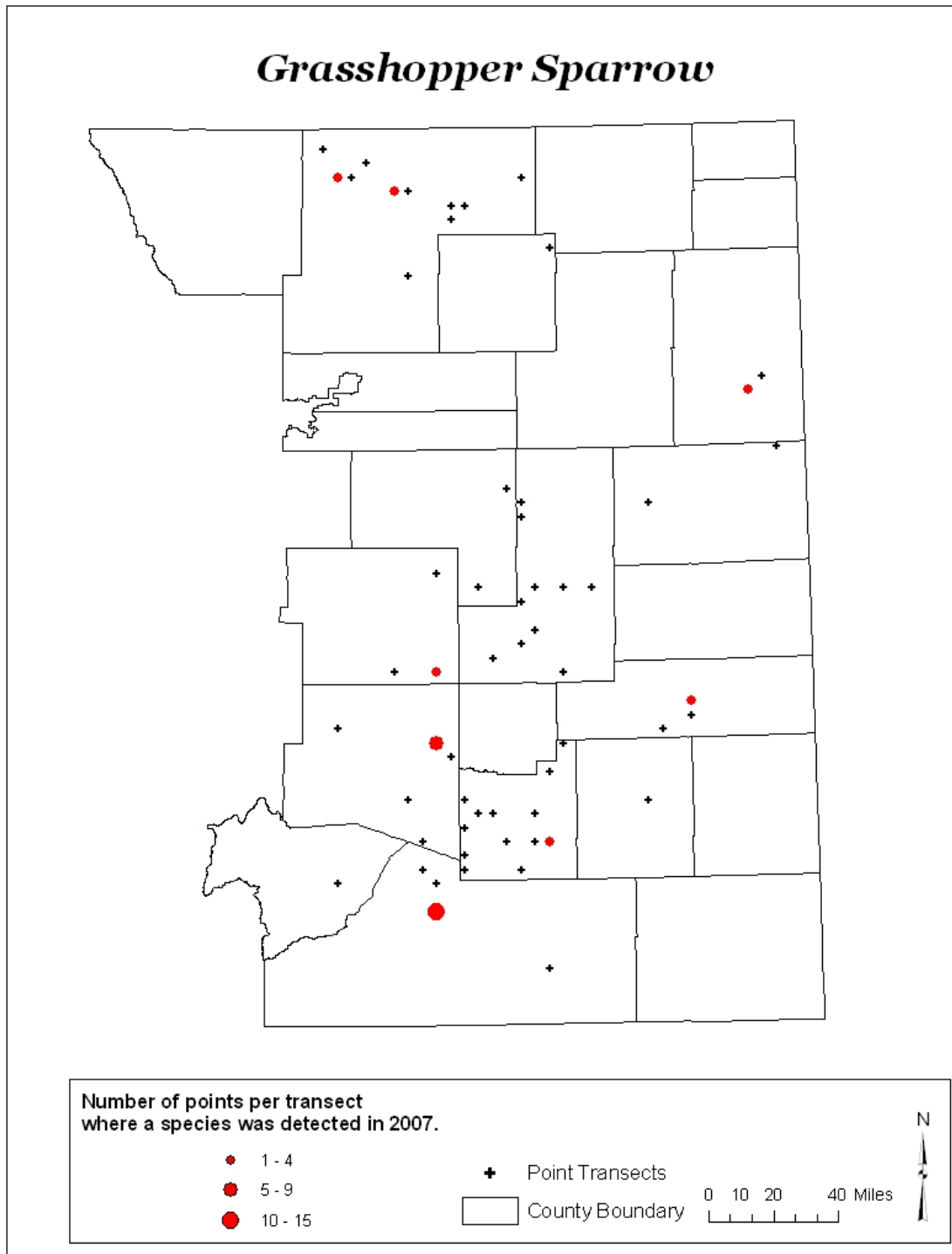


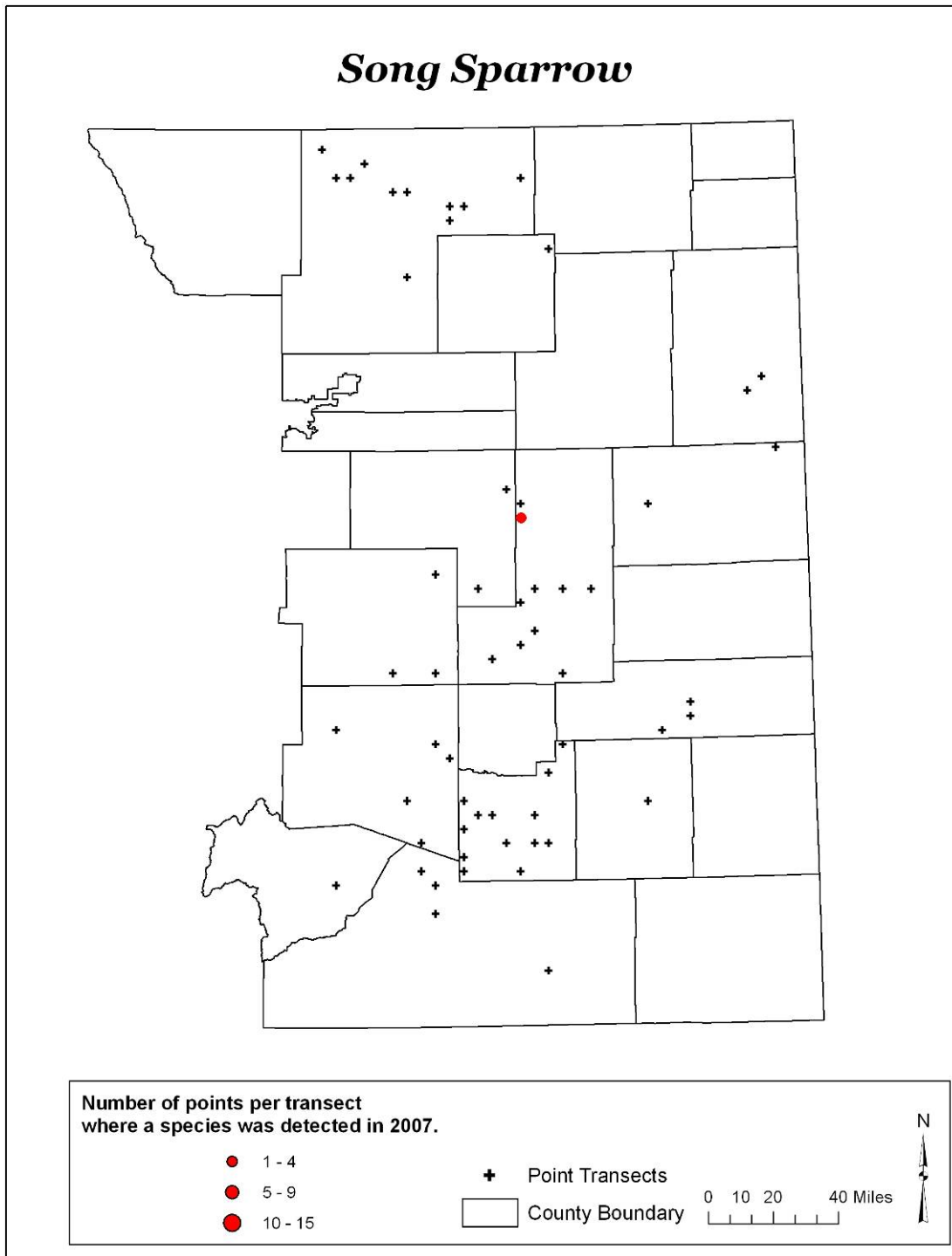


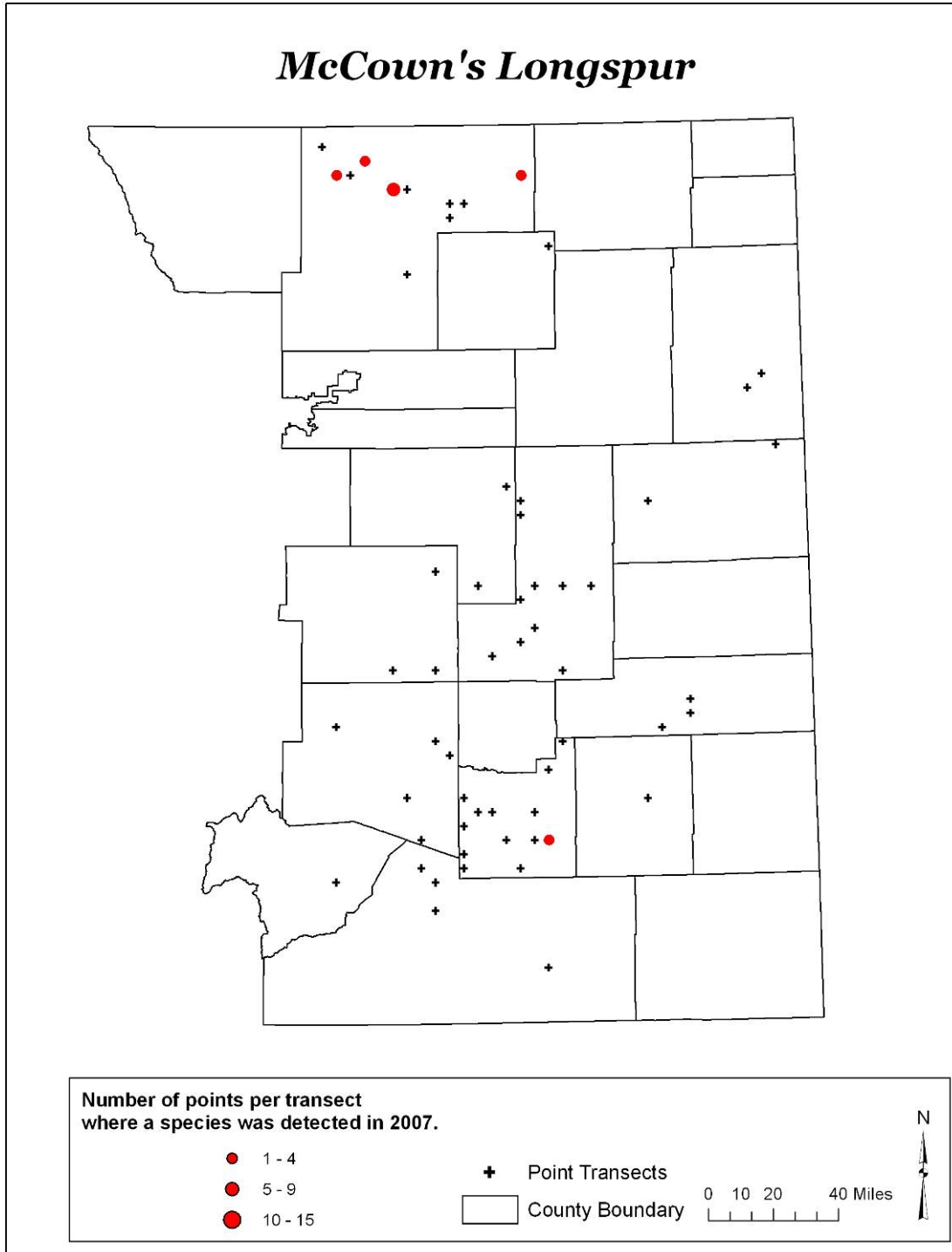












Lazuli Bunting

