Bird Conservancy of the Rockies Best Management Practices for Grassland Birds

(Prepared September, 2016)

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Bird Conservancy of the Rockies

Bird Conservancy of the Rockies is a nonprofit organization founded in 1988. Our mission is the conservation of birds and their habitats through science, education and land stewardship. Our scientific research and monitoring programs focus on better understanding native bird populations, the roles they play in healthy ecosystems, and what factors influence survival across their full life cycle. Our stewardship goals are achieved by engaging with children, parents, teachers, natural resource managers and others, and through on-the-ground conservation of bird habitat through voluntary partnerships with private landowners, government agencies and other conservation organizations.

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History and Status of the Shortgrass Prairie

Native grasslands are among the most altered ecosystems in North America. This is reflected by the steep population declines documented in roughly 2/3 of grassland bird species over the last 50 years. Colorado is fortunate to still have extensive native grasslands, particularly in the eastern plains, and these areas play an important role in sustaining many grassland bird and wildlife species that are of high conservation interest to state and federal governments, conservation groups and the public. The Colorado State Land Board manages roughly 2 million acres of shortgrass prairie in eastern Colorado and can play a significant role in helping to conserve these species through informed management of its trust lands.

The shortgrass prairie stretches from New Mexico to Alberta, in the rain shadow of the Rocky Mountains, and is the most intact native grassland ecosystem in North America today. Historically, this region was shaped by fire, grazing and the arid climate. This created a mosaic of grasslands in various conditions, from short, sparse grasslands, to areas of denser and taller grass and diverse shrub lands. This variety of conditions has allowed different grassland bird species to flourish and adapt to specialized habitat niches within the shortgrass prairie ecosystem. Maintaining the full array of grassland bird habitats is one of the primary strategies for grassland bird conservation, especially through grazing management and maintenance of keystone species such as prairie dogs.

Grassland birds are potentially sensitive to land use and management practices such as grazing, energy development, as well as habitat fragmentation and direct mortality from roads, fences, power lines and other sources. The purpose of this manual is to inform land managers about the potential impacts of land use and management decisions on grassland birds, and provide broad guidance based on the best available science on how to minimize negative impacts to birds.
The recommendations in the following sections are suggestions only; land managers should choose to implement those practices that are compatible with other uses of their land. Management recommendations are aimed at the full suite of grassland birds, while the distribution maps are intended to provide spatial guidance on which bird species are likely to occur on trust lands in various parts of the state, based on the best data available.

Roads

The construction and presence of roads disrupts and fragments grassland bird habitat and creates the hazard of vehicle collisions (Thompson et al. 2015). Roads provide corridors for invasive plants and predators that can negatively impact bird populations and create what is known as an "edge effect" (Ingelfinger and Anderson 2004). Fragmentation from roads can lead to lower reproductive success and higher mortality in grassland bird populations, through increased predation and collisions with vehicles and fences. Roads also result in displacement (Hovick et al. 2014); many songbirds avoid habitat within 150m of road edges (Thompson et al. 2015). Thus, any 1km of secondary road can detrimentally affect up to 50 acres of habitat (Thompson et al. 2015). The avoidance behavior from roads can also have harmful impacts on reproduction causing higher energy outputs as birds move away from preferred habitat. Disturbance from roads can also alter site fidelity behavior and disrupt breeding cycles for Lesser Prairie Chickens and other species of grouse that breed on communal display sites known as leks, and exhibit strong site fidelity. The construction of a road through such an area may negatively affect the persistence of such a population over time (Hovick et al. 2014).

Management Recommendations:

- Whenever possible, avoid constructing new roads through known grassland bird breeding and nesting habitat to avoid increased predation and collision risk.
- Avoid construction within ½ mile of identified aggregation areas.
- Speed limits should be posted at 25 mph on dirt surface resource roads, and 35 mph on local county dirt surface roads during the breeding and brood rearing period of April 1 to Aug 31.
- Traffic related to oil and gas activity should be minimized by car-pooling and organizing work activities to minimize trips on surfaced roads. If possible, work schedules and shift changes should be set to avoid the periods from ½ hour before sunrise to 9:00am and from 5:00pm to ½ hour after sunset when birds and other wildlife are most active (Wyoming BLM, 2005).
- Always plant native grasses and forbs in roadside reseeding and restoration projects.

These suggestions are especially important for Mountain Plovers and Burrowing Owls, as those species are the most vulnerable to vehicle collisions.

Photos of heavy traffic from oil and gas development in Colorado. (courtesy: thefencepost.com)

Oil & Gas:

Construction of oil & natural gas infrastructure and ancillary facilities (e.g. pump jacks, storage tanks, compressor stations, processing plants, roads, etc.) directly removes viable habitat and can also affect habitat and populations beyond the immediate footprint through increased noise, disturbance, collisions, invasive species and contamination. The average size of a well pad is approximately 5 acres (2.2 ha). With a known habitat avoidance distance for many grassland birds of at least 150m (Thompson et al. 2015), the total area affected by the well pad can increase by nearly 10-fold from 5 acres to 50 acres.

Fig 1 demonstrates different scenarios for well pad and road placement (Thompson et al. 2015). The sites utilizing multi-bore well pads vs. single-bore well pads and their avoidance zones visibly reduce the overall footprint of oil development. Minimizing unnecessary roads also reduces disturbance and fragmenting the habitat.

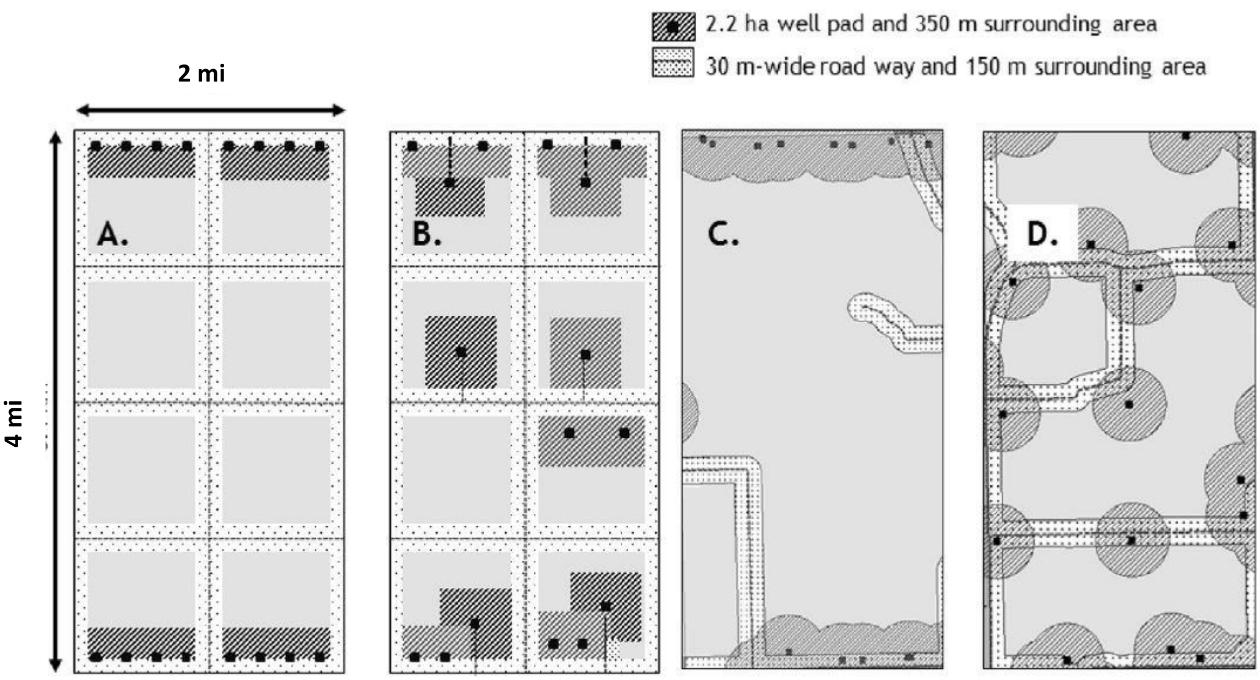

Fig 1: Adapted from Thompson et al. 2015. Scenario (A.) places well pads at the perimeters of a 2 x 4 mile site, and with roads evenly bisecting the area, 60% of the habitat remains intact outside the avoidance zones. Scenario (B.) has the same number of well pads and roads as A., but only 40% of the habitat is outside of the avoidance zones. Scenario (C.) shows another perimeter placement option where multi-bore wells and few unnecessary roads leave up to 75% of the landscape available outside the avoidance zone, whereas (D.) has the same number of wells, but unplanned roads and single-bore well pads leave only 54% of the highly fragmented landscape available.

Management Recommendations:

Well-pad siting:

- For Mountain Plover (Wyo BLM, 2005) and Burrowing Owl (California Burrowing Owl Consortium, 1993), the recommended buffer distance is 350m to ½ mi radius if possible from known nest sites (upwards of 89 acres around each well pad) for these sensitive species. Chestnut-collared & McCown's Longspurs, Sprague's Pipits, and Savannah Sparrows all avoided well activity out to 300m at a research site in Saskatchewan, Canada (Linnen, C. 2008).

- *Noise:* We recommend reducing noise levels to 49dBa (decibel level average) or less between April 1 and June 30 to minimize the effects of continuous noise on songbird species that rely on aural cues (i.e. singing and calling) for successful breeding (Inglefinger, 2001). *Reduce noise levels from Feb 1 – Aug 31 for Burrowing Owl (California Burrowing Owl Consortium, 1993) and from April 10 – July 10 for Mountain Plover (Wyo BLM, 2005).*

- *Reclamation:* Upon creation of a well pad and ancillary facilities, all efforts should focus on reclamation of the area with native grasses and vegetation. A large majority of the grassland bird species are ground foragers, relying on a heterogeneous vegetation structure and a diversity of arthropods and seeds for their diet. Studies have found that arthropod abundance is 60% higher in native grass habitat than non-native vegetation (Flanders et al. 2006). Invasions of exotic grasses can have a compounding effect on ecosystems as they displace native vegetation communities and simplify the plant community and structure, resulting in simplification of the invertebrate and vertebrate communities as well.

- *Waste water ponds:* Oil production and operations produce waste fluids that are stored in pits, open tanks, or other exposed sites pose hazards to wildlife. Any pits that contain oily waste should be netted or covered to exclude their use as a water source by songbirds (Esmoil & Anderson 1995). The best permanent solution is to replace pits with closed tanks or other containment systems (Trail, 2006).

Fences

The physical structures and fences present on a landscape naturally void of taller structures creates artificial perches for avian predators such as Golden Eagles, Red-tailed hawks, Kestrels, Loggerhead Shrikes, and Prairie Falcons which can increase the risk of predation to grassland songbird species. Fences can also create a collision hazard for many species. Bird species most likely to collide with fences are any low-flying raptor (such as Northern Harriers, Short-eared Owls, Long-eared Owls, Great-Horned Owls and Burrowing Owls), birds that make low, short-distance flights (like Gunnison and Greater Sage-Grouse, Sharp-tailed Grouse, and Lesser and Greater Prairie -Chicken), and potentially any other bird that cannot easily see the obstacle, including various songbirds.

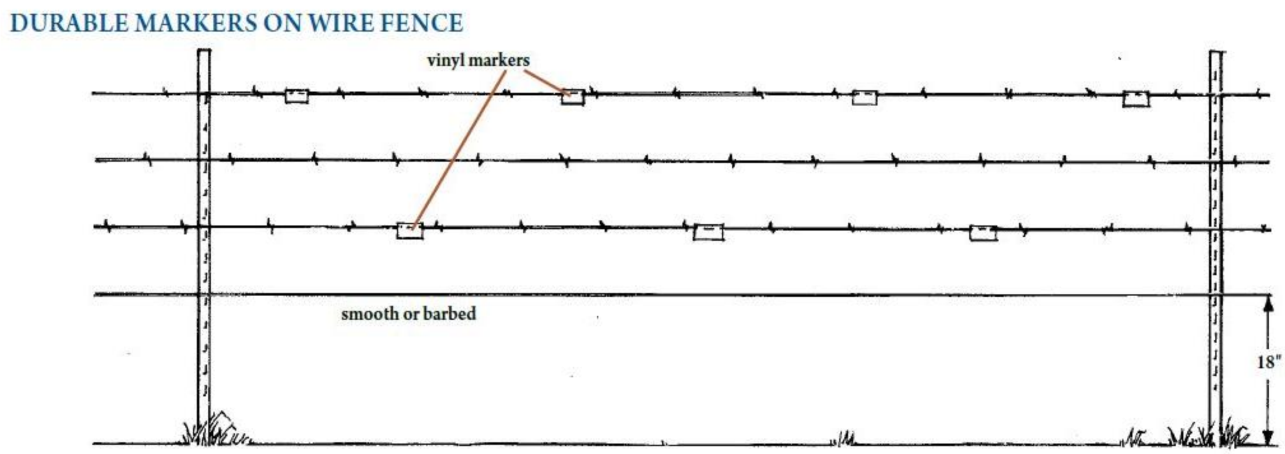

Fig 2. Wildlife friendly fence options are available in Paige, C. 2015. A Wyoming Landowners Handbook to Fences and Wildlife.

There are several wildlife-friendly fencing options, and for grasslands the recommended fence is a 4-wire fence with smooth wire on the bottom for Pronghorn and other wildlife to safely crawl under, and flagging or reflective fence markers to increase visibility to mitigate bird collisions (Fig 2). Research on sage grouse in Wyoming has shown that fence markers can decrease grouse collisions by up to 80% (Paige, C. 2015). If a barbed wire on top is not necessary, a smooth wire is recommended by Colorado Parks and Wildlife to reduce entanglement of raptors and ungulates like deer and elk that prefer to jump over fences.

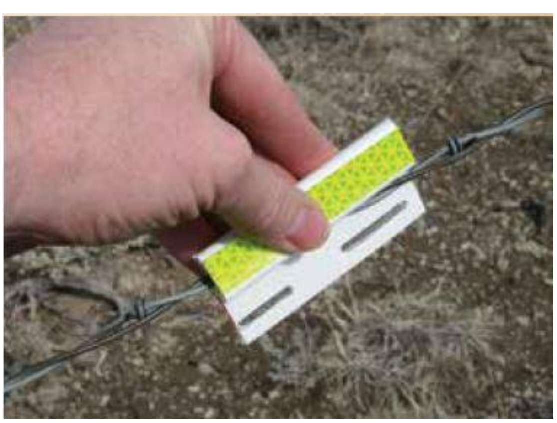

Fig 3. Vinyl fence marker (photo by Tom Christiansen)

The recommendation for areas within Sage Grouse or Prairie Chicken habitat is to place a minimum of two flags or markers per rod of fence on the top wire, or up to 4 on the top wire and three on the middle or bottom wire. Fence marking is most important in areas with a high density of birds, not every mile needs to be marked. A fairly inexpensive and durable option for fence markers is cutting 3" sections of vinyl "undersill" trim siding strips and then affixing a strip of reflective tape on the wide part of the siding. The siding then has a lip that can be snapped onto the wire of the fence (Figs 2 & 3). Seasonal "lay-down" fences, temporary wire fences with flagging, or moveable electric fences are encouraged if the goal is to keep livestock out of sensitive habitats or for short-term grazing where permanent fencing isn't necessary (Paige, C. 2015).

Wind Energy

The risk posed to birds by the recent increase in wind turbines worldwide is receiving considerable attention and it is important to understand the implications of erecting tall structures in areas where they don't naturally exist on the landscape. Drewitt and Langston (2008) give a thorough review of collision effects of wind-power generators on birds and found that apart from size, one of the most important factors relating to collisions (with any structure) is the use of lighting. Birds can be attracted to and disoriented by lights, especially during migration. Birds attracted to lights are not only at risk of death due to collision, but also exhaustion, starvation or predation as the energy expended while "trapped" circling a lit structure can have negative consequences on their ability to complete their migration. Minimal use of lighting will reduce attraction of potential insect prey, and is likely to reduce chances of disorientation of birds. A recommendation by Gehring et al (2009) is to remove non-flashing lights and replace them with strobe or flashing lights. Night migrants did not appear to be distracted or disoriented by flashing strobe-like lights in a study done in Michigan. Light bulb color (red vs white incandescent) was not as important as the flashing of the light itself.

The location of the wind turbine structure is a very important factor in minimizing the likelihood of collision mortality. The areas of greatest risk of collision are in places regularly used by larger numbers of feeding, breeding, or roosting birds, or on migratory or local flyways. Spacing turbines close together may encourage flocks of birds to fly around turbine clusters rather than among them. Conversely, if the wind farm is of considerable size, providing flight corridors between turbine clusters may be helpful. Siting of wind farms should be placed in or adjacent to existing disturbed areas to minimize habitat fragmentation and displacement. Positioning wind turbines back from cliff edges and on prevailing leeward sides of ridges is recommended to reduce the hazard posed to soaring raptors using rising winds (Drewitt & Langston, 2008).

Rock piles at turbine bases can attract small mammals and provide a food source for raptors, putting those birds at risk if they fly in low to capture prey. Cattle also tend to congregate around turbine bases, and their dung can attract insect prey species for birds like American Kestrels and Burrowing Owls. Anchoring the turbine bases with materials like cement and creating exclusions for livestock from the surroundings of turbines can help to prevent these scenarios.

More information about tower siting, construction and regulations is available from the American Bird Conservancy:

https://abcbirds.org/program/wind-energy/learn-more/
https://abcbirds.org/toolkit-tower-operators-engineers/

Grazing Management

Livestock production is perhaps the most widespread form of land use on Colorado state trust lands. Traditionally grazing livestock tends to spread disturbance evenly, so that the landscape varies little from one area to another, leaving shortgrass prairie birds without access to the variety of habitats they had historically and can make it increasingly difficult for some species to find the particular habitat conditions that meet their needs. Careful stewardship and short-grass prairie grazing management should strive to duplicate the timing, intensity and landscape distribution of large herbivores like bison, deer, elk and proghorn that helped to create the prairie ecosystem. Planned grazing management can be designed to improve forage harvest and quality, achieve desired changes in structure and composition of plant communities, and sustain a diverse array of grassland bird species by creating structural heterogeneity (i.e., patchiness in grass/forb types, heights and cover) within an area (VerCauteren & Gillihan 2004). Certain strategies can improve grassland bird habitat while maintaining livestock productivity (Toombs et al. 2010). A forage inventory is recommended by Briske et al. (2011) in order to assess the stocking rate of a given area/ pasture and help reach desired vegetation structure results and manage for short and long-term drought periods. Monitoring protocols should be set in order to plan grazing strategies to meet forage production and conservation goals. Those strategies may involve different pasture treatments to include deliberate "overgrazing" in some areas to create and maintain near-bare ground conditions that serve as important habitat for some species, such as the Mountain Plover and McCown's Longspur, while leaving other sections "undergrazed" to create the taller grassland structure preferred by Grasshopper and Cassin's sparrows (Fig 4). These practices should be targeted in areas where these species are known or likely to occur (see species maps in Appendix).

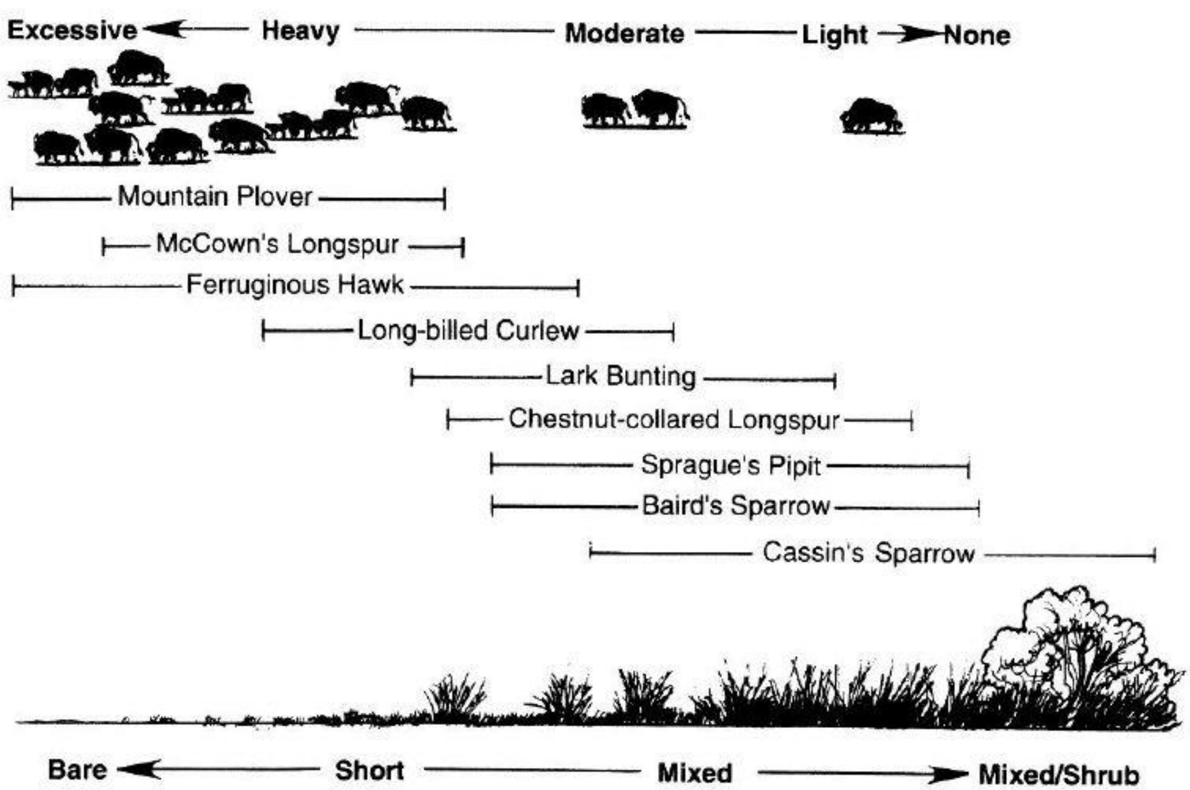

Fig 4. Grazing intensity effects on vegetation structure for grassland birds. Adapted from Knopf et al. (1996)

Allowing some areas to maintain shrubs can attract Lark Buntings, Loggerhead Shrikes, and Brewer's, Cassin's and Vesper sparrows that prefer mid-level mixed grasslands with a sparse salt-bush, rabbit brush, greasewood or sagebrush (*Artemesia spp.*) component.

Grazing effects can be measured at various scales, ranging from the pasture level to the landscape level. The landscape level is most relevant to wildlife and grazing management strategies should focus on managing the landscape for a mosaic of vegetative characteristics. This can be done using multiple pastures which allows for varying stocking rates and flexibility during the grazing season (Fig 5). Grasslands with more heterogeneity support a greater number and diversity of plant and animal species (Toombs et al. 2010). Grassland birds are an excellent example of the ecological value and result of a heterogeneous landscape (McFarland 2009).

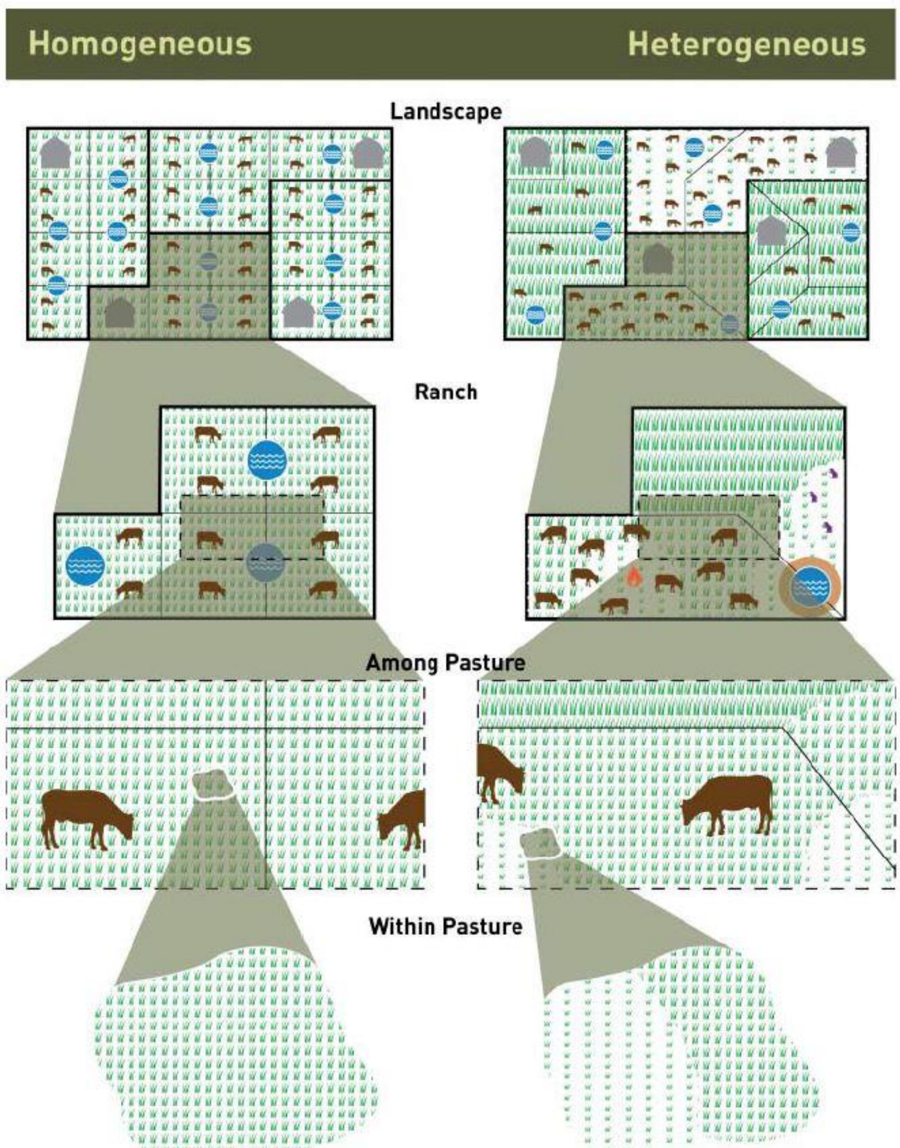

Fig 5. Comparison of vegetation heterogeneity at various scales (Toombs et al. 2010)

Prairie Dogs: Black-tailed prairie dogs were historically the most abundant species throughout the short- and mixed-grass prairies. Managers should consider maintenance of prairie dog colonies when evaluating strategies for vegetation heterogeneity because black-tailed prairie dogs create intensely disturbed patches, often with vegetation structure and composition that differ from areas of intensive livestock grazing (Toombs et al. 2010). Disturbance from prairie dogs increases total plant diversity with a greater live-to-dead biomass ratio, forage that's higher in crude protein (nitrogen) concentration, and greater digestibility for other animal species, especially cattle (Whicker and Detling, 1988). Previous studies have confirmed that bison, elk and pronghorn preferentially select prairie dog colonies over uncolonized grassland (Whicker and Detling, 1988). Prairie dogs also create preferred habitat for Burrowing Owls that rely on existing burrows to nest in, and the bare soil habitat preferred by Mountain Plover for foraging and nesting.

Stock Tank Ladders: Many species of wildlife perish in water facilities when they fall in and with no escape and swim until exhausted, eventually drowning. Research from the Bird Conservancy, universities and others shows that wildlife escape ladders are an effective way to reduce the threat of birds drowning in stock tanks. Providing a ramp or ladder with holes makes it much easier for a trapped bird or animal to find the ramp. The Bird Conservancy has developed a ladder that meets the requirements for NRCS Standard 614 Watering Facility, which requires installation of a wildlife escape ladder in these facilities. It can be attached to the top of a stock tank, resting on the bottom with no drilling required. You can download the stock tank ladder design here:
http://www.birdconservancy.org/wp-content/uploads/2015/03/Stock_Tank_Ladder_Design.pdf

Properly installed stock tank ladder
(photo courtesy of the Colorado Prairie Initiative)

Open Pipes: Exposed vertical pipes between 1 – 10 inches in diameter pose a potentially large source of mortality for birds. Many cavity-nesting species such as bluebirds, wrens and owls often will enter open pipes in search of suitable nesting and roosting sites. However, because of the smooth interior surface of pipes, many birds can become trapped inside and die. It has recently been discovered that a single open pipe can potentially kill dozens of bird over time, and collectively open pipes can create a significant source of mortality that can easily be prevented. Vertical pipes can be made of metal or PVC and may occur as: sign posts, fences (especially the larger posts used for gates), survey markers, mining claim markers, vents on top of buildings, irrigation systems and unused chimneys. It is important to identify any and all open pipes and cap, close, fill, screen or remove them to prevent birds – and other wildlife – from becoming trapped. More information and how to manage open pipes on your property can be found at the link(s) below:

https://abcbirds.org/article/agency-targets-open-pipes-and-mining-claim-markers-to-reduce-bird-deaths/
https://www.fws.gov/cno/conservation/MigratoryBirds/DeathByPipes-final.pdf
http://ca.audubon.org/conservation/protect-birds-danger-open-pipes
https://efotg.sc.egov.usda.gov/references/public/UT/Open-Topped-Pipes_TechNote_June2014.pdf
http://www.blm.gov/style/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTION_/mining_law.Par.58643.File.dat/RequestToMiningClaimants.pdf

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Appendix: Maps of grassland bird species in Eastern Colorado (Bird Conservation Region 18):

The following maps were developed using data from Bird Conservancy of the Rockies' *Integrated Monitoring in Bird Conservation Regions* (IMBCR) program and the USGS North American Breeding Bird Survey (BBS).

Study Design:

According to the IMBCR sampling design (White et al. 2010), we defined the sampling frame by superimposing a 1 km X 1 km grid over the study area. The sampling units were defined by the 1 km^2 grid cells. We used a stratified design and selected sample units in each State/Bird Conservation Region (BCR) intersection within the study area using generalized random-tessellation stratification (Stevens and Olson 2004, package spsurvey, R Development Core Team 2014). Each 1 km^2 sampling unit contained 16 point count locations separated by 250 m, and each point count plot consisted of a 125 m-radius circular plot (4.9 ha). The point counts for each sampling unit were surveyed on a single day during the avian breeding season from end of May to June and from 2010 -2015. We sampled avian abundance and occurrence using 6-min point counts (Alldredge et al. 2007) between one-half hour before sunrise and 1100 h at each accessible point count location, and measured the distance to each bird detection using a laser rangefinder. We binned the six minute point count duration into three, two-minute time occasions (Alldredge et al. 2007).

Statistical Analysis and Model Justification:

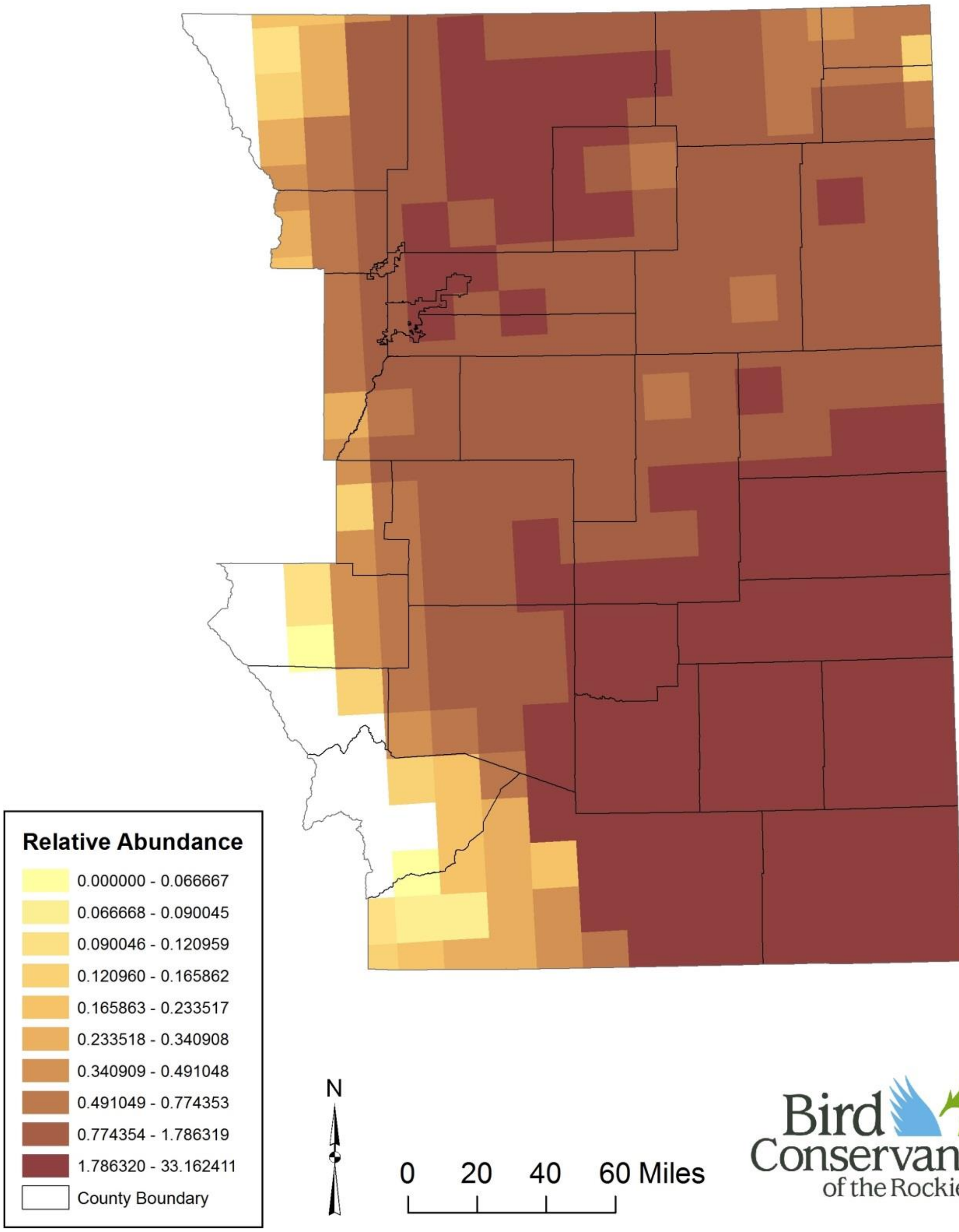
We extended an open population *N*-mixture model developed by Chandler et al. (2011) to estimate population density, and probabilities of availability and detection using five years of data (2010-2015) from the IMBCR program. We estimated density, availability and detection probability within the 1 km sampling grid. Density was modeled using the Poisson distribution. The availability parameter, the probability of being exposed to sampling within a sampling unit, was modeled with the Binomial distribution, which can also be interpreted as small scale occupancy. We ranked models by the Akaike Information Criterion (AIC) (Akaike 1973) and selected the top model when creating the predicted distribution maps. If the top model included the temporal covariate, year, we excluded it when predicting since we are interested in the species distribution across years. Predicted densities are displayed using raster images with cell sizes of 1 km^2, generated from USNG grid layers for the Colorado Shortgrass Prairie Bird Conservation Region (BCR 18).

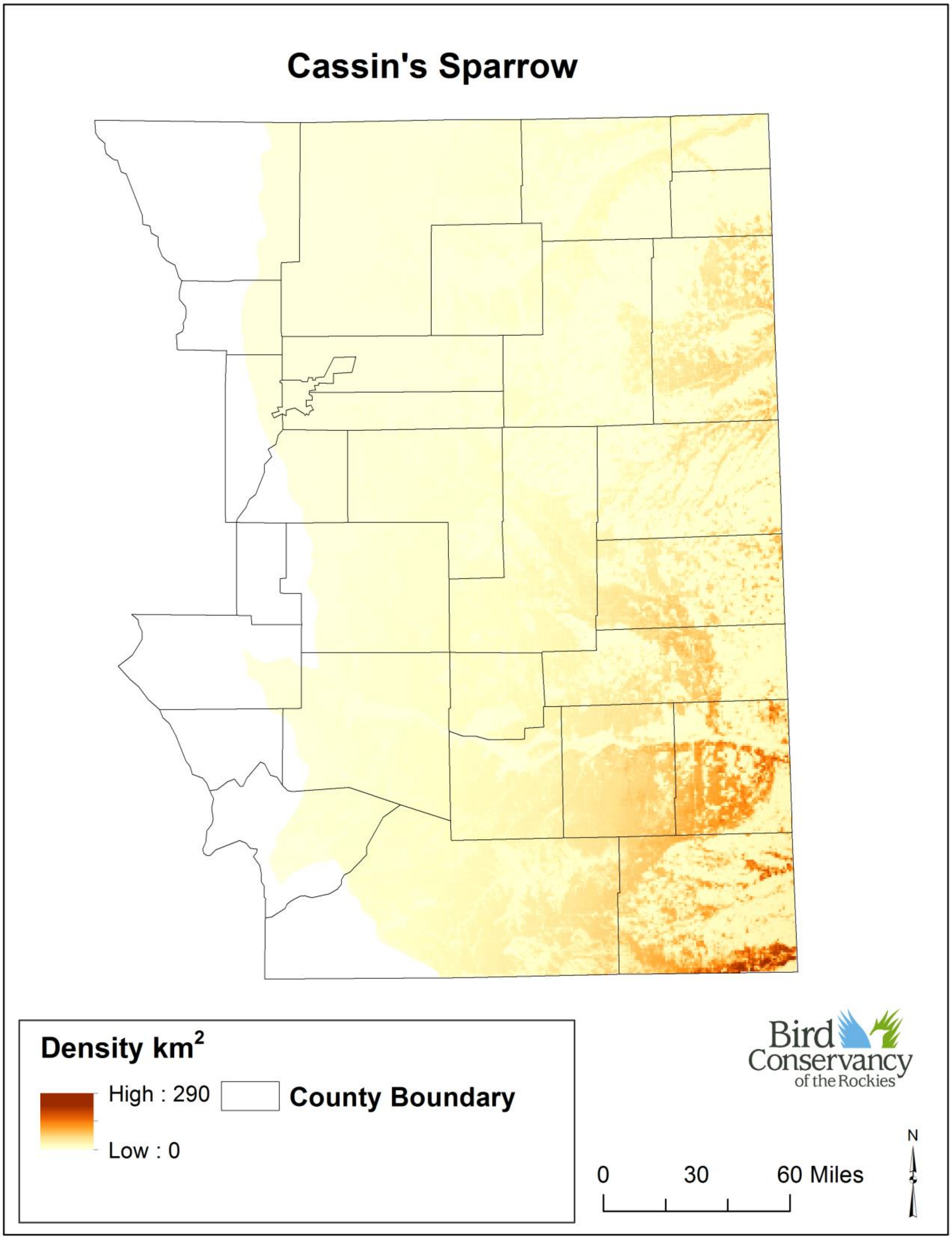
We then used the method of multiple working hypotheses (Chamberlin 1965) to develop alternate *a priori* hypotheses for the effects of covariates on detection, availability, and abundance of 7 focal grassland species (Cassin's Sparrow, Grasshopper Sparrow, Lark Bunting, Loggerhead Shrike, McCown's Longspur, Vesper Sparrow and Western Meadowlark). We evaluated spatial variation in detection by allowing detection probability to vary by grass height, shrub cover and year.

Additional Maps from BBS

We made maps for 5 additional grassland bird species for which we did not have IMBCR data that occur only locally or in low density in Colorado, but are of high conservation interest (Burrowing Owl, Chestnut-collared Longspur, Ferruginous Hawk, Mountain Plover and Northern Harrier). BBS includes average counts on BBS survey routes in eastern Colorado from 2011-2015 and is an index to relative abundance. The legend on these maps indicates the range in abundance of birds per 162 km^2 (the size of each grid cell) and thus the difference in appearance of the resolution between map types.

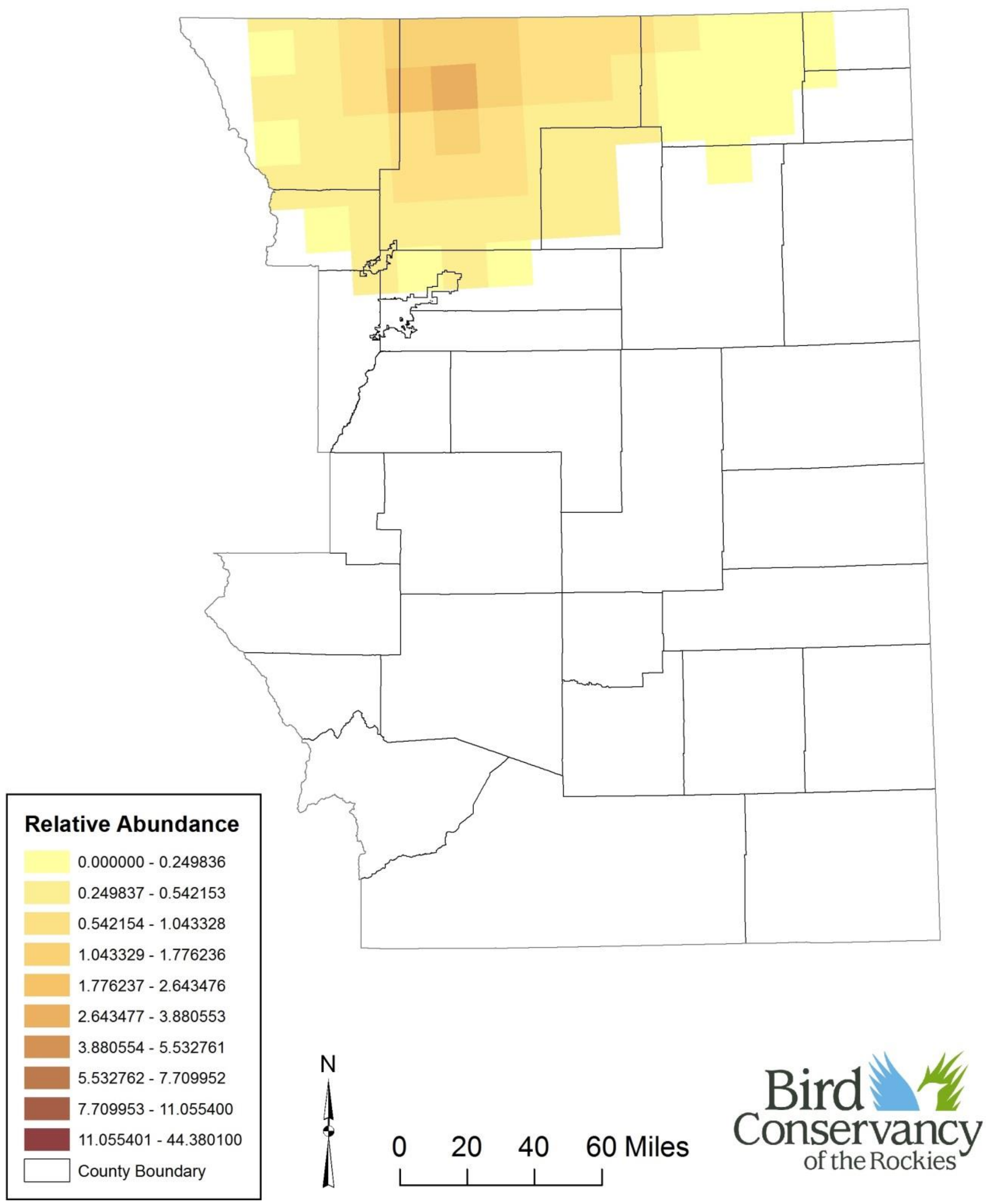
Burrowing Owl

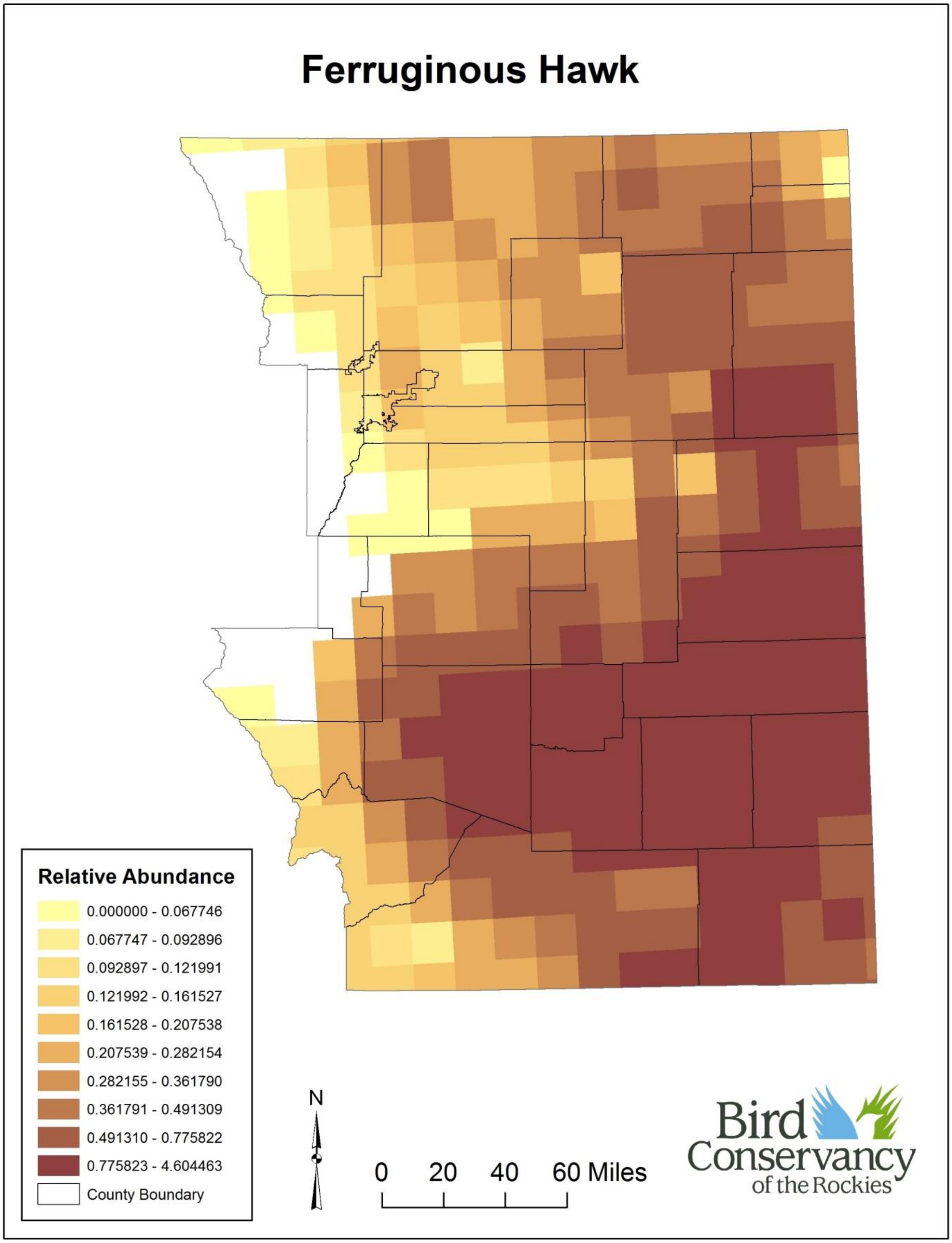




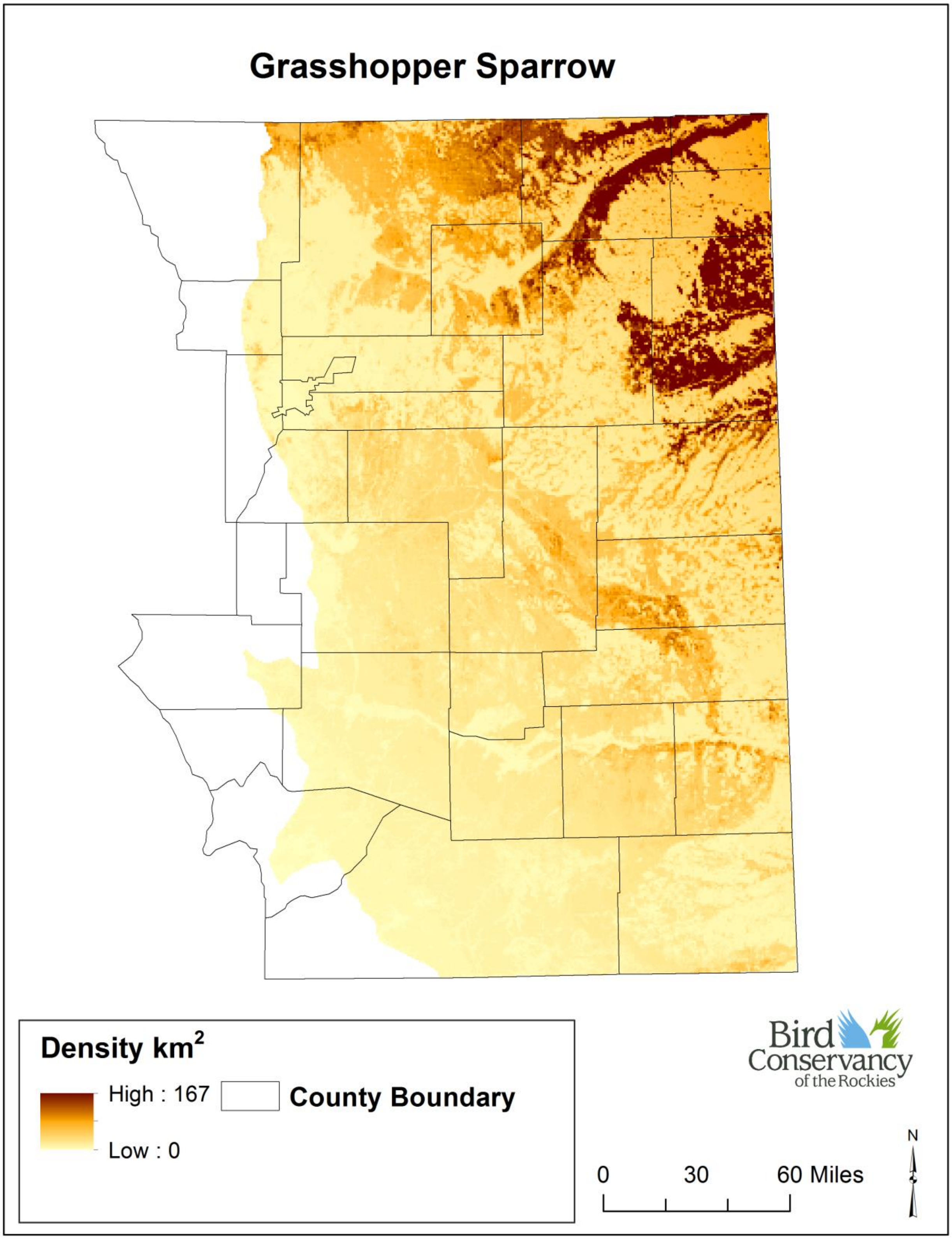
Cassin's Sparrow
Density km2
High : 290
Low : 0
County Boundary
Bird Conservancy of the Rockies
0
30
60 Miles
N

Chestnut-collared Longspur

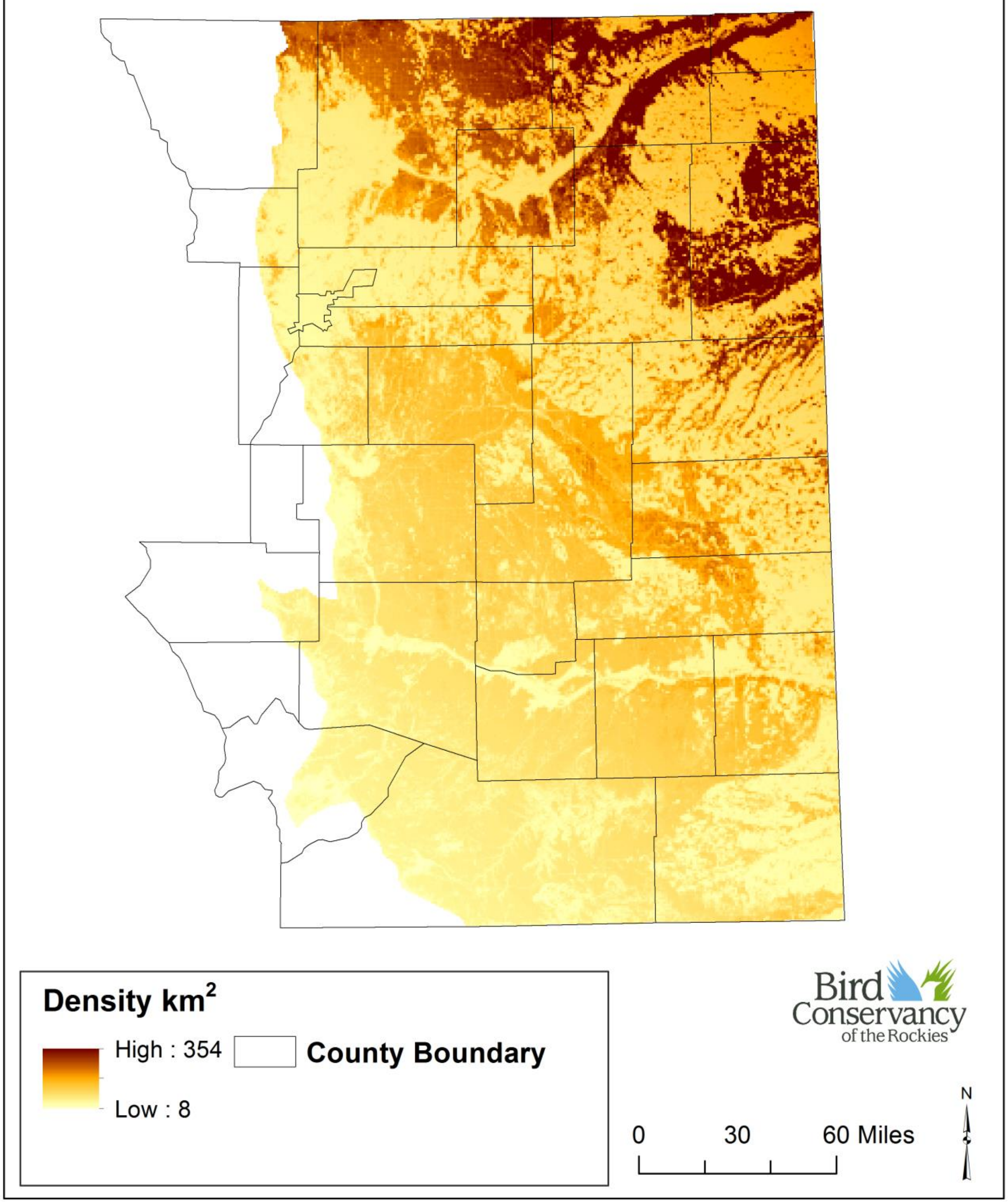


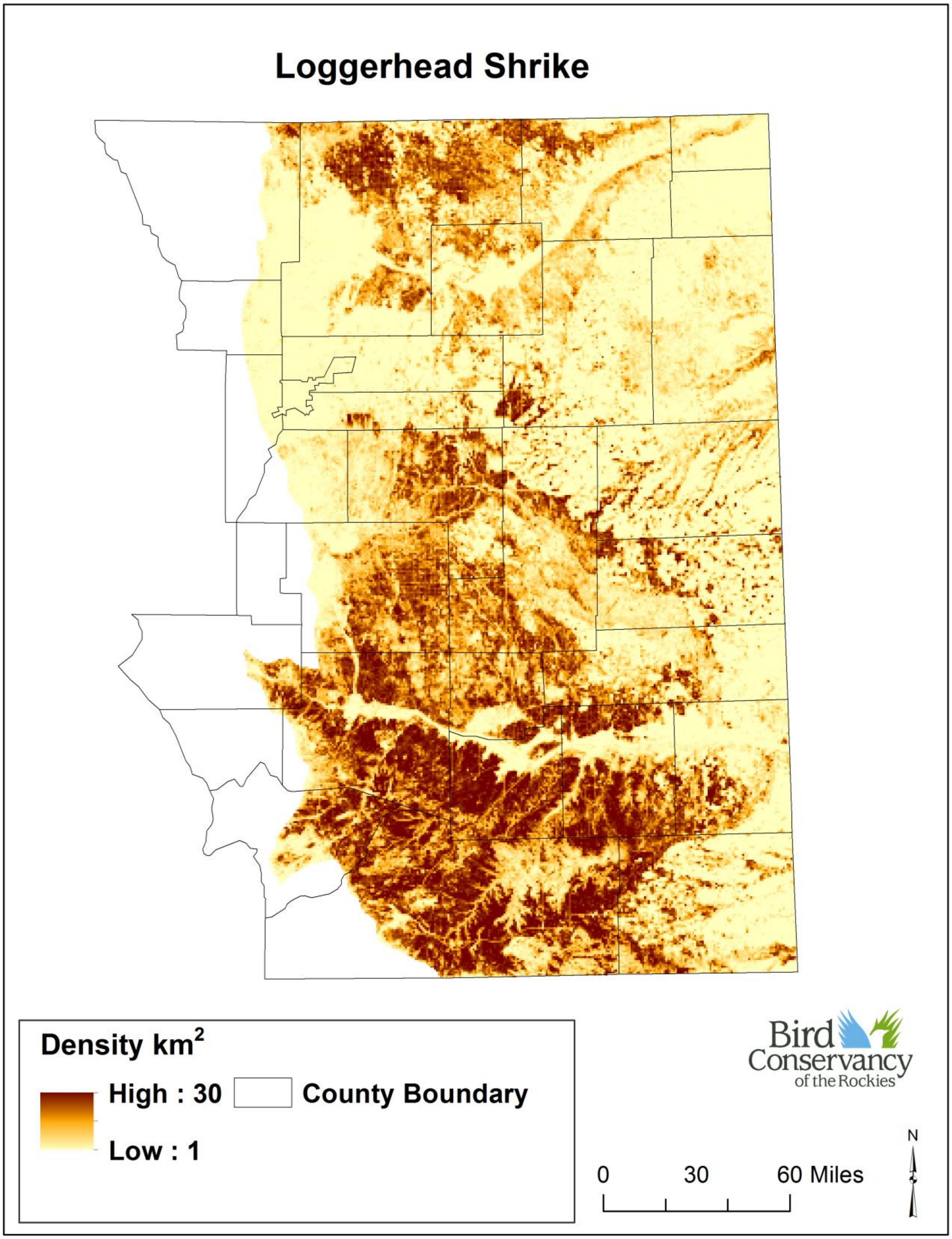


Ferruginous Hawk
Relative Abundance
0.000000 - 0.067746
0.067747 - 0.092896
0.092897 - 0.121991
0.121992 - 0.161527
0.161528 - 0.207538
0.207539 - 0.282154
0.282155 - 0.361790
0.361791 - 0.491309
0.491310 - 0.775822
0.775823 - 4.604463
County Boundary
N
0 20 40 60 Miles
Bird Conservancy of the Rockies

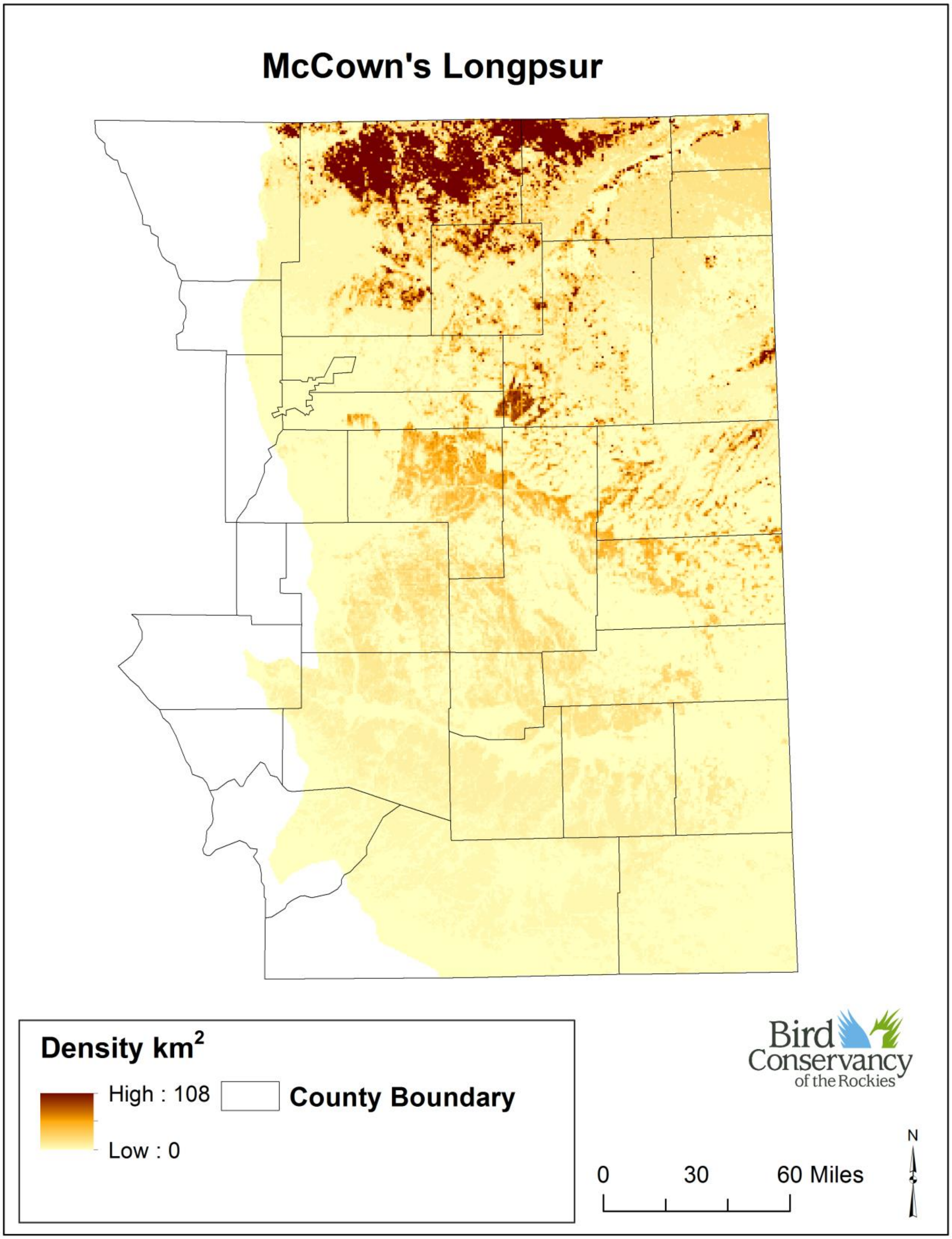

Grasshopper Sparrow
Density km2
High : 167
Low : 0
County Boundary
Bird Conservancy of the Rockies
0 30 60 Miles
N

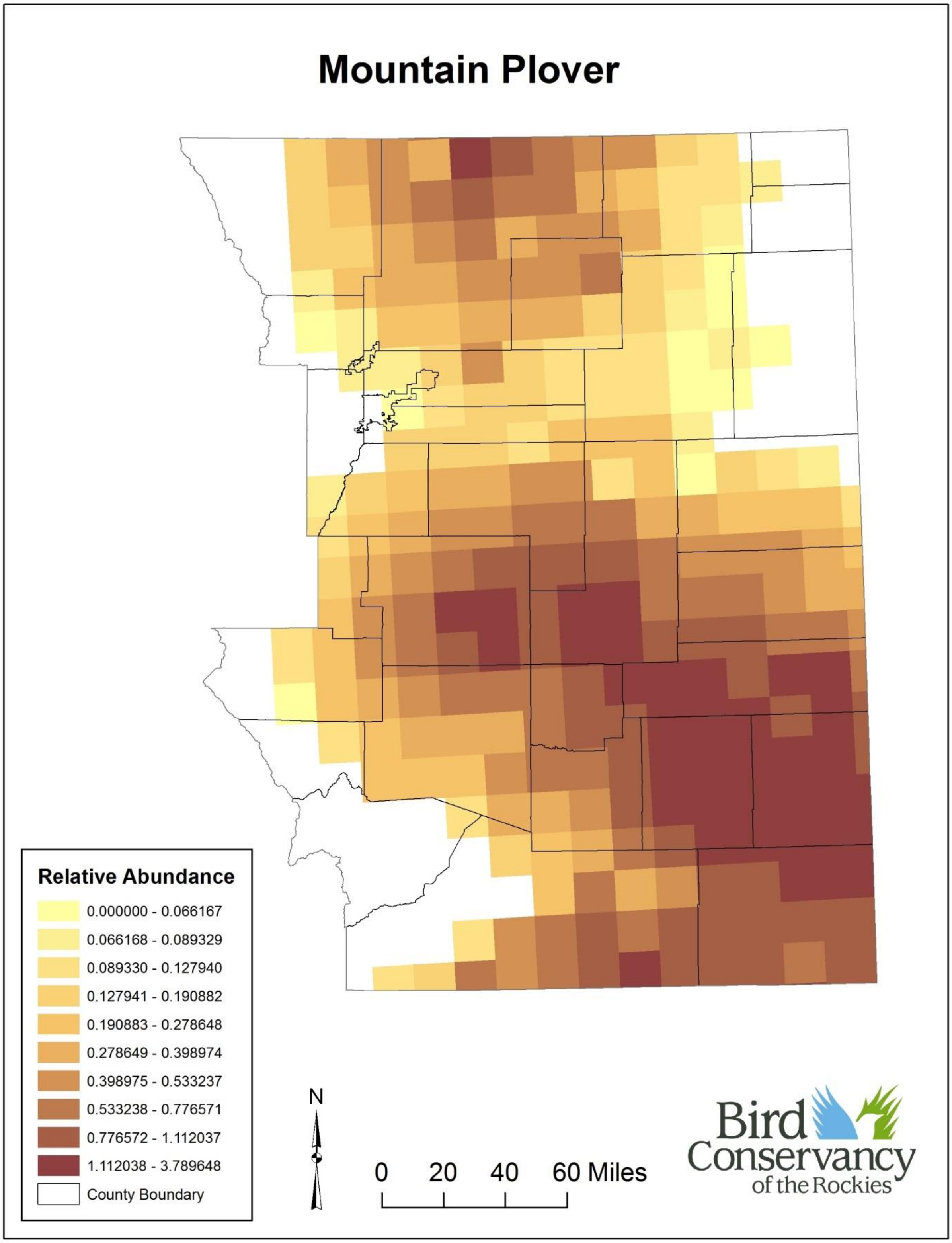
Lark Bunting



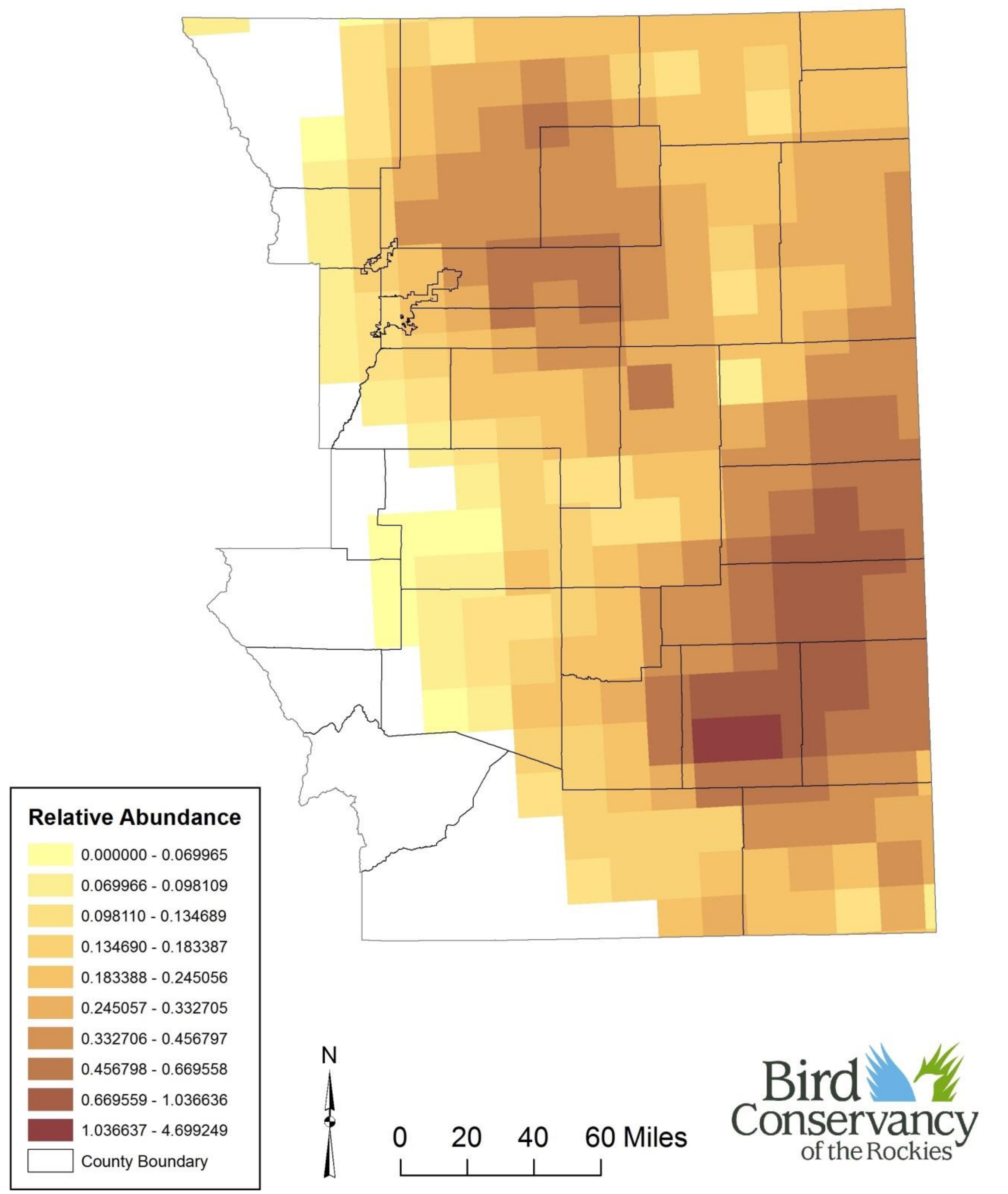


Loggerhead Shrike
Density km²
High : 30
Low : 1
County Boundary
0
30
60 Miles
N
Bird Conservancy of the Rockies

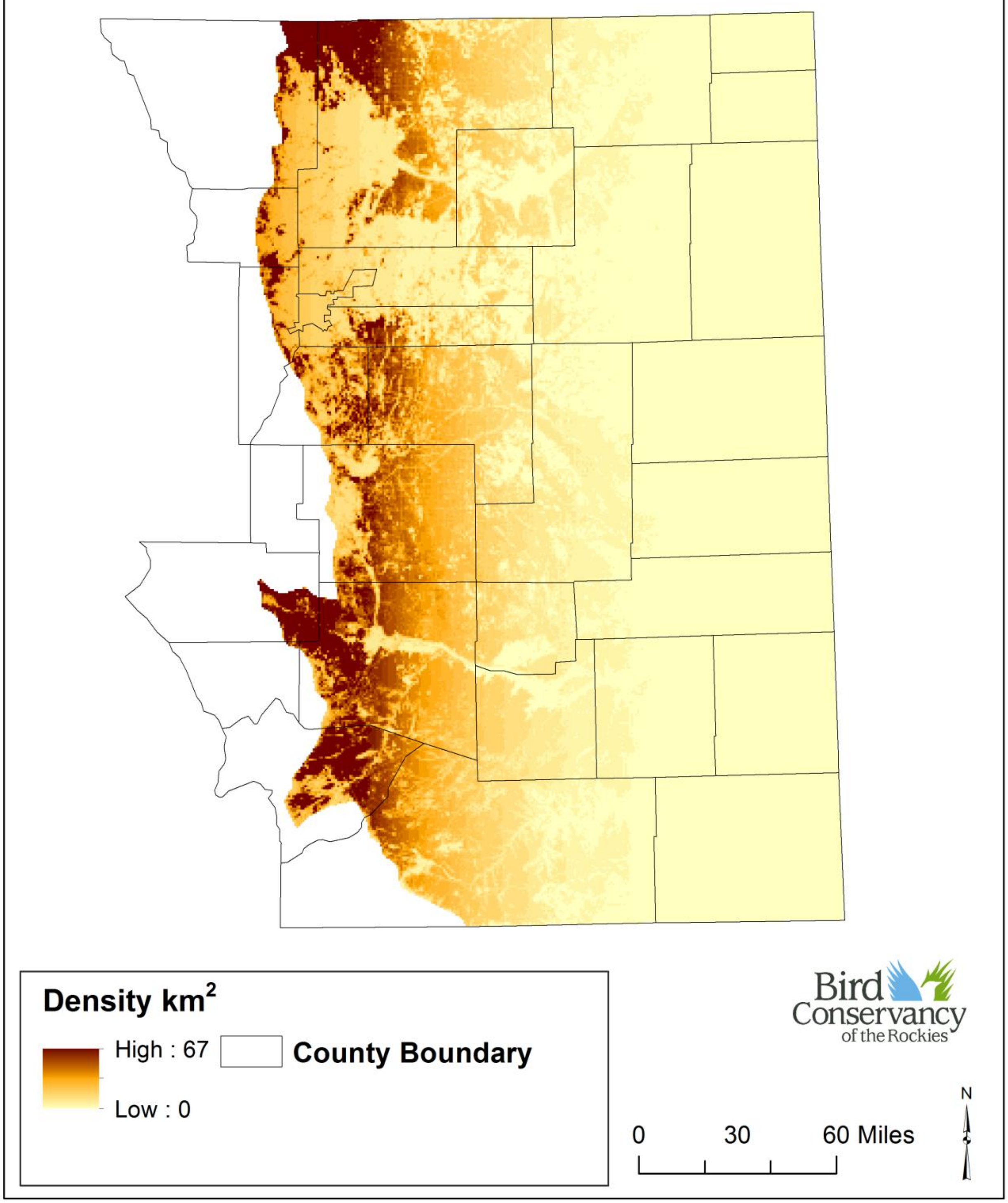

McCown's Longpsur
Density km2
High : 108
Low : 0
County Boundary
Bird Conservancy of the Rockies
0
30
60 Miles
N

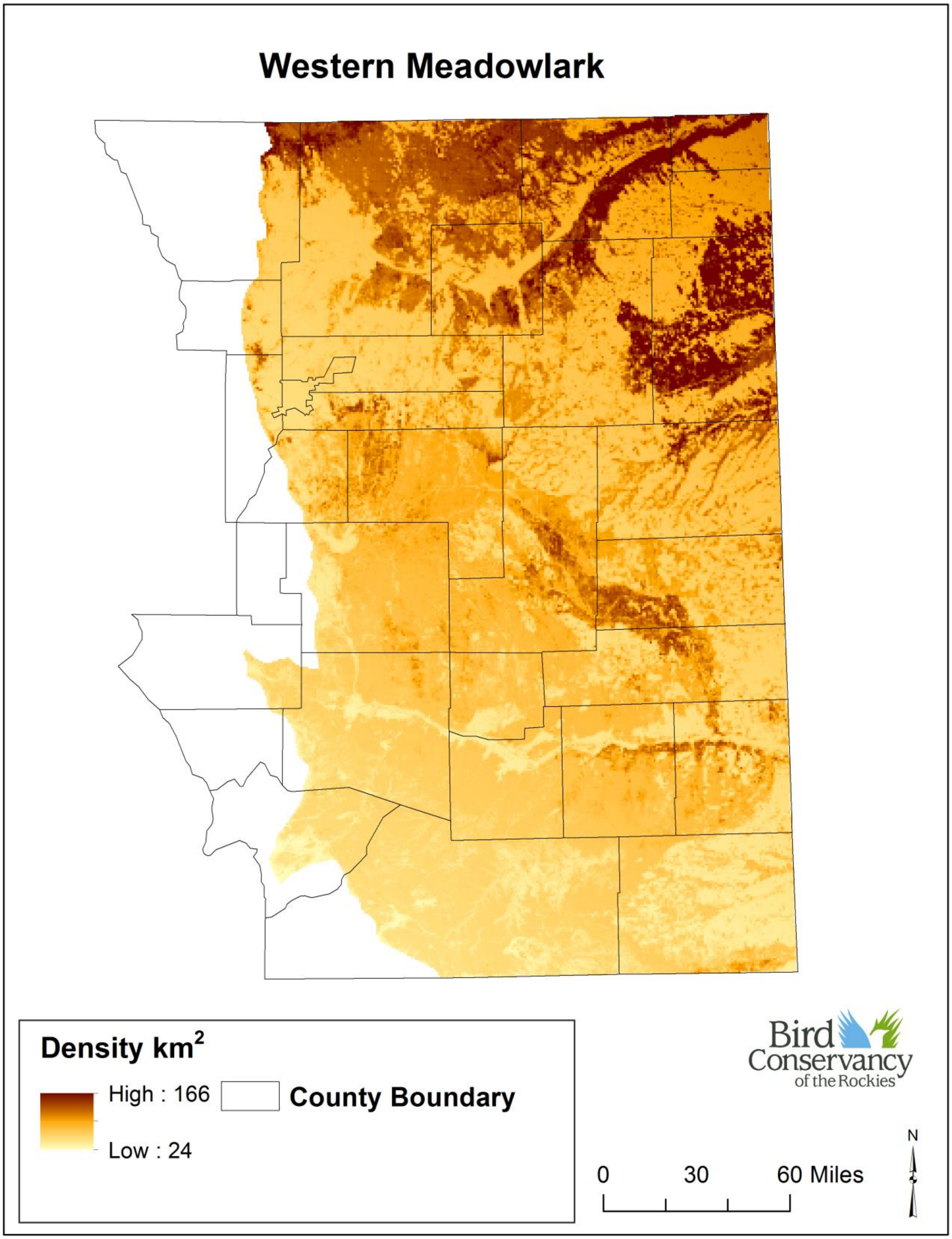

Mountain Plover
Relative Abundance
0.000000 - 0.066167
0.066168 - 0.089329
0.089330 - 0.127940
0.127941 - 0.190882
0.190883 - 0.278648
0.278649 - 0.398974
0.398975 - 0.533237
0.533238 - 0.776571
0.776572 - 1.112037
1.112038 - 3.789648
County Boundary
N
0 20 40 60 Miles
Bird Conservancy of the Rockies

Northern Harrier



Vesper Sparrow




Western Meadowlark
Density km2
High : 166
Low : 24
County Boundary
Bird Conservancy of the Rockies
0 30 60 Miles
N