Playa Lakes Joint Venture
Landbird Team Report

(a working document)

Version 2.0
November 2007

A Regional contribution to the
Partners in Flight
North American Landbird Conservation Plan
and the
Playa Lakes Joint Venture Implementation Plan

by the Playa Lakes Joint Venture
Landbird Team

PLJV Landbird Team

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Monitoring, Evaluation, and Research Team

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Background, Purpose, and Intended Audience

Partners in Flight

The vision for Partners in Flight is that "populations of native birds will occur in their natural numbers, natural habitats, and natural geographic ranges, through coordinated efforts by scientists, government, and private citizens" (Rich et al. 2004). Partners in Flight, formed in 1990, developed regional working groups which produced plans for several Physiographic Regions or states that intersect the current boundaries of the Playa Lakes Joint Venture. They include published plans for Colorado, New Mexico, Osage Plains and interim plans for the Pecos and Staked Plains and the Rolling Red Plains. After most regional plans had been developed the North American Landbird Conservation Plan (C-plan) pulled regional status and trends together on a continental level and developed a vision for continental landbird health.

Partners in Flight encourages implementation and planning integration with Joint Ventures and notes that where Joint Ventures have undertaken landbird planning and implementation that this is an effective mechanism for implementing objectives. In fact, Joint Venture plans, among others, should be the basis for "accomplishing site-specific conservation actions".

Playa Lakes Joint Venture

The Playa Lakes Joint Venture (PLJV) was formed in 1989 to implement the North American Waterfowl Management Plan in the Playa Lakes Region (PLR). The original PLR included northwestern Texas and portions of southeastern Colorado, southwestern Kansas, eastern New Mexico, and western Oklahoma. The PLJV has expanded geographically to include most of the Short-grass and Mixed-grass Bird Conservation Regions (BCRs) (Fig. 1, 2), and has expanded its focus to include all birds. The PLJV has accepted the challenge of Partners in Flight to develop explicit conservation objectives for landbirds. The PLJV updated its Implementation Plan in 2006 (PLJV 2006a); the adaptive approach to planning used by the PLJV requires maintaining up-to-date landbird population and habitat objectives.

PLJV Landbird Team

The PLJV Monitoring, Evaluation, and Research Team (MERT) formed an Upland and Riparian bird Team in 2003 to develop landbird population and habitat objectives. After only a few months it became obvious that the two teams, composed of primarily the same members, should be merged into one group, becoming the Landbird Team. This team has undergone several changes in membership since its formation and now includes the entire Nebraska Partnership for All-bird Conservation's Science Advisory Workgroup in addition to other members. The 22-member landbird team is comprised of volunteer landbird experts from around the PLJV region and 2 PLJV staff members. One co-chair (A. Cariveau) and two additional members are also members of the PLJV's MERT.

Goal, Purpose, and Intended Audience

Our goal was to create a biological foundation for PLJV landbird conservation actions by developing landbird objectives in a manner consistent with the guidance and needs of the C-Plan and the PLJV. Specifically, we developed (1) a list of landbirds for which habitat planning was important, (2) a habitat-based methodology for determining estimated regional populations, (3) a methodology for

determining population objectives consistent with the guidance of the C-plan, and (4) regional landbird habitat objectives that are linked with the best possible science to population objectives. The primary purpose of this report is to document the steps taken to guide PLJV landbird planning. The intended audience is biologists with technical orientation that are interested in the scientific underpinnings of PLJV landbird conservation objectives.

Relationship of this Report to other PLJV Biological Planning Reports and Products

This report serves as a technical companion document to the PLJV's Implementation Planning Guide (PLJV 2006a), which describes the PLJV's overall approach to integrated bird biological planning. Herein we describe the processes for establishing priority landbird species, habitats, and conditions of habitats for each species, biological relationships between priority species and their habitats (including bird density, habitat suitability, etc.), and population and habitat objectives. Some users may want to consult other sources of additional information relevant to PLJV landbird conservation planning:

- *Planning Guide* (PLJV 2006a). This document describes the PLJV's approach to biological planning, and describes in detail the *Hierarchical All Bird Strategy* (HABS) database. This database stores the biological data used to model the current carrying capacity of the PLJV for landbirds, and to design a landscape that supports desired numbers of all priority bird species, including landbirds. Users interested in the current carrying capacity of the PLJV for landbirds (relative to population goals) should consult this database.
- *Habitat Assessment Procedures* (PLJV 2006b). This document describes the PLJV's habitat classification system and procedures for estimating acreages of important landbird habitats as described in this document. These acreages were determined from the PLJV's GIS database and additional non-spatial data.
- *Area Implementation Plans (*AIPs*)*. The PLJV maintains an AIP for each of 9 areas (Bird Conservation Region portions of states). These plans give recommendations for changing or maintaining the landscape so it will support desired numbers of priority bird species, including landbirds. Current habitat acreage estimates also are found in these plans.

The PLJV in the Context of North American Landbirds

The PLJV region largely corresponds to BCRs 18 (Shortgrass Prairie) and 19 (Mixed-grass Prairie) in the Southern Great Plains region of the continent (Fig. 1,2) and contains expansive areas of cropland and rangeland. The region is bisected by several major riparian corridors and is dotted with natural and man-made lakes, ponds, and wetlands (often highly ephemeral). Landbirds in the PLJV use a wide range of wetland and upland habitats for nesting, foraging, and roosting. Important habitats for priority landbird species are identified in this report.

There have been a number of research studies of landbirds in the region, but monitoring data are generally sparse. However, the Rocky Mountain Bird Observatory had developed a section-based monitoring program (Sparks and Hanni, 2006) which has covered most portions of BCR 18 from 2002-2006, though not all portions of the BCR have been monitored equally (i.e. New Mexico). These data formed that backbone of the biological foundation for most of BCR 18. Consistent area-wide monitoring data does not exist for BCR 19 or the BCR 18 portion of Texas. Research on bird densities is complicated by the lack of consistent methodology, appropriate habitat descriptions, and/or descriptions of habitat condition. These factors complicate landbird conservation planning by reducing the quantity and quality of biological data.

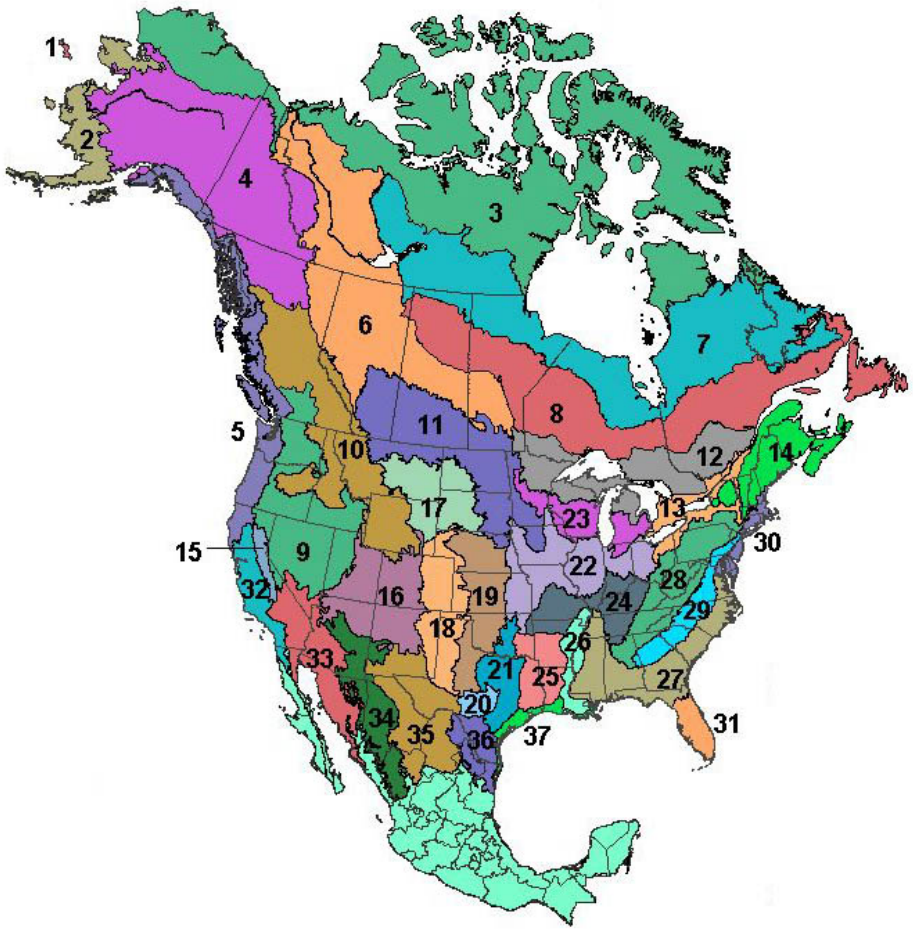

Fig. 1. NABCI delineated Bird Conservation Region boundaries in North America.

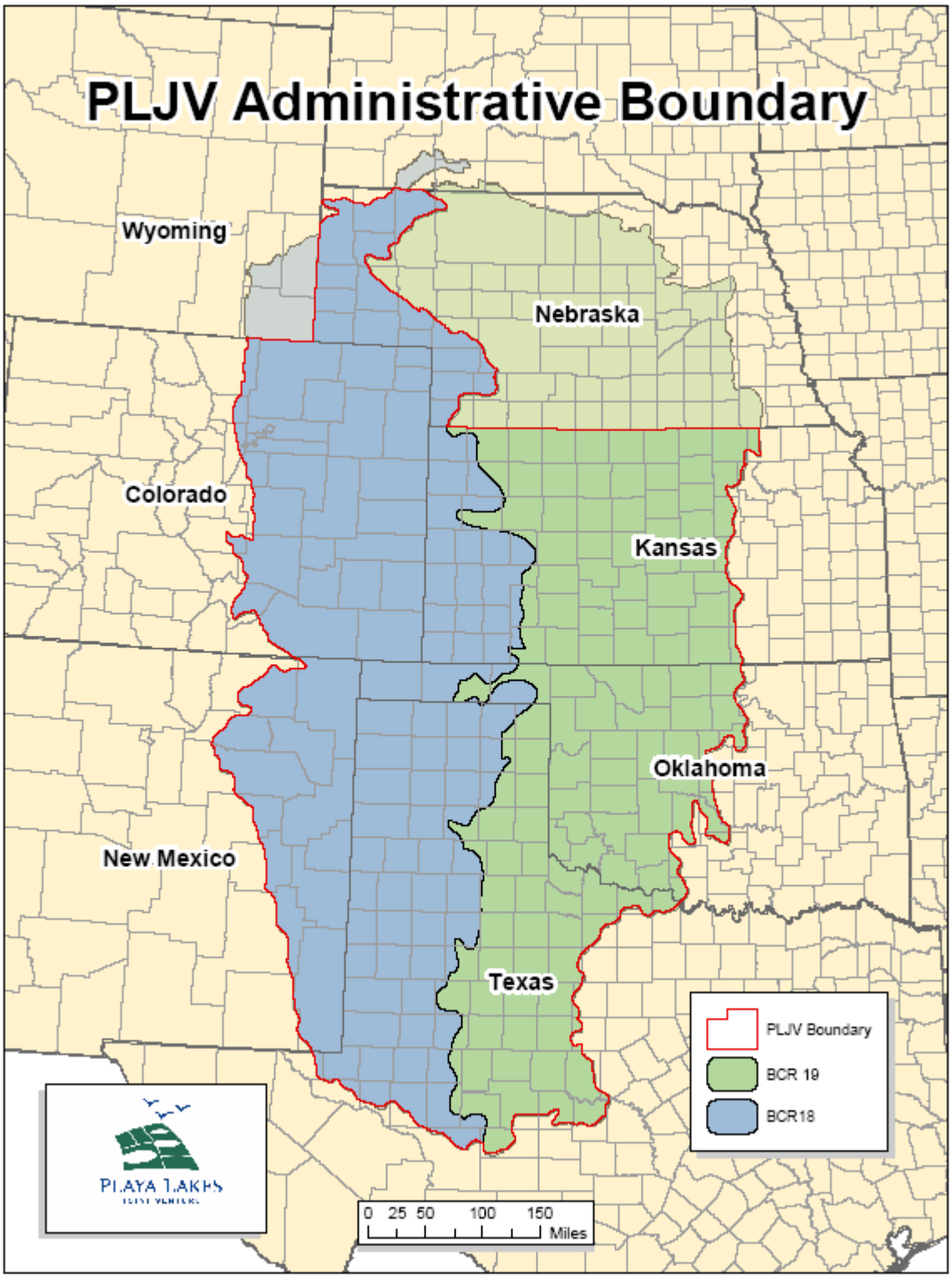

Figure 2. PLJV administrative boundary.

Approach for Developing Habitat Objectives

We used the following approach to develop landbird habitat conservation objectives:

1. Determine planning scale (geographic areas).
2. Determine priority species and seasons.
3. Develop carrying capacity estimates.
    a) determine important habitats/conditions and carrying capacity per acre (i.e., define relationships between abundance/vital rates and habitat characteristics)
    b) measure habitats to determine current quantity and quality
    c) model current landscape carrying capacity for landbirds and determine if current habitat can support the abundance/vital rate objectives
4. Develop abundance objectives.
5. Develop vital rate (i.e., population performance) objectives.
6. Determine limiting factors for #4-5.
7. Develop habitat objectives:
    a) analyze habitat trends to determine if current habitat quantity/quality is likely to change
    b) based on results of Steps 3 and 4, develop conservation strategy to increase or maintain landscape carrying capacity for landbirds
    c) evaluating results within the context of state desired restoration potential.

Step 1: Determine planning scale (geographic areas)

Geographic planning areas for this strategy are the BCR portions of states (e.g., BCR 18-Texas) (n = 9; see Fig. 2). Planning and implementation for landbirds at this scale ensures (1) that the desired distribution of landbirds and their habitats throughout the states and BCRs within the PLJV is achieved; and (2) that planning boundaries are consistent with other bird conservation initiatives.

Step 2: Determine priority species and seasons

The landbird team felt that several regional and continental concern lists were appropriate for consideration as priority species. Therefore species lists and threat assessments were pulled from four different sources:

1) The Partners in Flight concern and stewardship species list for BCRs 18 and 19 (which incorporates both continental and regional species of importance,
2) High priority birds from the shorebird plan which are best dealt with under riparian or grassland planning,
3) Species from the USFWS Birds of Conservation Concern (BCC) BCR 18 and 19 list, and
4) Species for which habitat work is targeted within the region (e.g. upland game birds).

This initial list formed the Species for Management Action (SMA) list.

PIF concern and stewardship species are based on certain rule sets. If these rule sets change, species may be added or dropped to the list. Likewise birds from other plans and the FWS BCC list may change in the future. By using a rule-based system for adding species to the SMA list, rather than

adopting specific species, the landbird team is allowing for future changes to those lists based on changing, or newly understood threats to grassland birds.

The SMA list will contain species for which education, monitoring or other activities are needed. One of those activities is planning for habitat work. In order to determine which species on the SMA list were appropriate for habitat work (SMA-H list), the landbird team applied another set of rules. The rule-set is:

1) Any species with a Continental concern ranking and a Regional PIF determined Action code that was needing management action (MA), immediate action (IM) or critical action (CR). (PIF has a rule-based system for determining action codes outlined in the PIF Species Assessment handbook 2005).

2) Any species on the SMA list which had a 10% combined BCR 18/19 population and a population trend (PT) that was decreasing (this was translated using the PIF threat assessment as PT>3 in either BCR.

3) Any species that is a Continental or Regional stewardship species (CS or RS) that occupies a habitat not occupied by any species fitting criteria 1 or 2 above.

We assumed species federally listed as a candidate species, threatened or endangered have declining trends over the long term.

The current rule set is different than that established for the 2004 Implementation Plan. This incorporates the new PIF BCR lists developed in 2005, which incorporate information about "manageable populations" within their prioritization schematic. The new rules added three species to the SMA-H list: Common Nighthawk, Eastern Kingbird and Western Meadowlark. These three species have not yet been added to the HABS database however.

For birds during the winter season, PIF threat assessments have been developed but not revised using the rules in the PIF Handbook (2005), nor extensively reviewed. The landbird team developed a list of priority species using the winter threat assessments utilizing the similar criteria, although neither the PIF continental and regional concern categories nor action categories are part of the winter threat assessment currently . Current winter species which are not already breeding priority species, are also listed in Table 1, the current SMA-H list.

Table 1. PLJV landbird priority species and seasons.

Species Name	Species Code	Season
Ring-necked Pheasant	RINP	Breeding
Greater Prairie-Chicken	GRPC	Breeding
Lesser Prairie-Chicken	LEPC	Breeding
Scaled Quail	SCQU	Breeding
Mississippi Kite	MIKI	Breeding
Swainson's Hawk	SWHA	Breeding
Snowy Plover	SNPL	Breeding
Mountain Plover	MOUP	Breeding
Upland Sandpiper	UPSA	Breeding
Long-billed Curlew	LBCU	Breeding
Burrowing Owl	BUOW	Breeding

Common Nighthawk	CONI	Breeding
Lewis's Woodpecker	LEWO	Breeding
Red-headed Woodpecker	RHWO	Breeding
Eastern Kingbird	EAKI	Breeding
Scissor-tailed Flycatcher	STFL	Breeding
Loggerhead Shrike	LOSH	Breeding
Bell's Vireo	BEVI	Breeding
Black-capped Vireo	BCVI	Breeding
Sprague's Pipit	SPPI	Winter
Cassin's Sparrow	CASP	Breeding
Brewer's Sparrow	BRSP	Breeding
Lark Sparrow	LASP	Breeding
Lark Bunting	LARB	Breeding
Grasshopper Sparrow	GRSP	Breeding
Henslow's Sparrow	HESP	Breeding
McCown's Longspur	MCLO	Winter
Smith's Longspur	SMLO	Winter
Lapland Longspur	LALO	Winter
Chestnut-collared Longspur	CCLO	Winter
Painted Bunting	PABU	Breeding
Dickcissel	DICK	Breeding
Eastern Meadowlark	EAME	Breeding
Western Meadowlark	WEME	Breeding
Rusty Blackbird	RUBL	Winter
Baltimore Oriole	BAOR	Breeding
Bullock's Oriole	BUOR	Breeding

Step 3: Develop carrying capacity estimates

Step 3a: Determine important habitats and carrying capacity per acre (i.e., define relationships between abundance and habitat characteristics)

The landbird team took the priority species and assigned them to habitats and habitat conditions utilized by these birds within the region (Appendix A). We conducted a literature review of landbird densities (Dobbs 2007, Appendix F) from pertinent studies (including work conducted outside the PLJV when enough information was unavailable within the region). We used this information along with our own expert opinion to assign densities in each habitat and condition utilized by each priority species. In most cases the density that was closest to the area and habitat type were chosen. Where density data were not available for a species in an area, those that were most similar in location and habitat condition were assigned. Density can differ between areas. If needed, chosen densities were then adjusted using Breeding Bird Survey (BBS) relative abundance maps. When differences by condition, were determined through work by the Rocky Mountain Bird Observatory in BCR 18, densities were also adjusted using this information and/or expert opinion. Appendix F contains the Dobbs 2007 and lists the choices of densities (units) by habitat (and conditions if found) for each priority species, and the reference. For the densities chosen by habitat and condition and any

reasoning behind any density adjustment for each area consult information under Unit Notes in the HABS database.

Step 3b: Measure habitats to determine current quantity and quality

We obtained the available spatial and nonspatial data to develop a GIS and to estimate current acreage of important landbird habitats in the PLJV (see PLJV 2006b for the PLJV's habitat classification system and habitat assessment procedures). Habitat acreage estimates for all habitats for all priority species are found in the PLJV's *Area Implementation Plans*. In some cases habitat may have been available but we know that not all the habitat is occupied or suitable. Adjustment factors for *availability* and *suitability* were developed for each species in each area, as appropriate, and applied to the occupied habitats within an area. For availability we assumed that each habitat was spread equally across the landscape. For suitability we assumed that all habitats were equally suitable in an area.

In some cases, ranges of some species did not include an entire area. A factor for describing the amount of habitat available because of range considerations was developed. These factors were determined by using the most recent bird information sources available which described range. For each state the sources utilized are listed below:

Colorado – Kingery et al. 1998 or Andrews and Righter 1992.
Kansas – Busby and Zimmerman, 2001
Nebraska – Mollhoff 2001 and/or Sharpe et al. 2001
New Mexico – Hubbard 1978, Hanni and McLachlan 2004 and/or expert opinion
Oklahoma – Reinking 2004 or expert opinion
Texas – Benson and Arnold 2001

Appendix B details the basic range factor used for each bird in each area where required. Not all birds require a range factor because they are widespread throughout the Joint Venture such as Western Kingbird. Others have an overall factor used for widespread habitat types and separate range factors for habitats which occupy only a small portion of the landscape. For example, the range factor for Lark Bunting in BCR 19-KS overall is .25, this is applied towards mixed-grass prairie and cropland. However, Sand Sage and Shortgrass habitat occupy areas in only the western third of the BCR and all falls completely within the range of Lark Bunting in Kansas, therefore the range factor for these habitats is 1.0. Specifics for each range factor are found within the HABS database.

Many grassland species require a minimum patch size for breeding (Johnson and Igl 2000). An initial analysis of the landscape using the PLJV developed GIS, showed that less than 0.1% of all grassland areas were patches less than 40 acres, regardless of county size or dominant agricultural use. We decided that accounting for minimum patch size requirements less than 40 acres was not necessary. Species that have large patch size and landscape context needs required building models to evaluate potential habitat within an area. One of the products of these models is a "large block factor" that produces the percentage of any particular habitat type within an area that is suitable for this species, as determined by the model. For four species; Greater Prairie-Chicken, Lesser Prairie-Chicken, Long-billed Curlew, Henslow's Sparrow, these additional large block factors were determined and utilized to adjust habitat currently available for each species.

The factors for availability (range) , suitability and large blocks for each condition and association are included in the Area Implementation Plans in Table 2. Consult the Area Implementation Plan for the area of interest.

The models to describe each of the species requiring a look at landscape context within BCRs 18 and 19 are:

Greater Prairie-Chicken in Mixed Grass/Sandhills Grass/Tall Grass/Sand Sage –
Associations: CRP, Mixed grass, Sandhills Grassland, tall grass, shortgrass, sand sage, wet meadow and moist soil units (Min. 2,000 ac).
Associations with limits: Woodland (includes riparian shrub and canopy and mesquite) - ≤**50** ac.
Cropland - ≤ 3,000 ac of Cropland.
All water associations: < 100ac (playas, river channel, floodplain marsh, warmwater slough, sandhills wetland
Road Acreage: Other roads: Max. **50** ac.
No Tolerance: 4-lane roads, urban/suburban
Window Size – **5,000** ac
Documentation: Randy Rogers, KDWP, pers. comm.
Apply: - Apply model through range of Greater Prairie-Chicken with a 10-mile buffer.

Lesser Prairie-Chicken in Sand Sage –
Associations: sand sage (Min. **1,000** ac)
Associations with limits: Woodland (includes riparian shrub and canopy and mesquite) – Max. **50** ac.
Cropland – Max. **3,000** ac of Cropland and CRP combined.
Road Acreage: Other roads: Max. **50** ac.
No Tolerance: 4-lane roads, urban/suburban
Window Size – **5,000** ac.
Documentation: Began with GBCA proposed model and KDWP data. Final revision by LPCIWG 7/24/06.
Apply: - Apply model in BCR 18-CO within current mapped Prairie-Chicken range with a 10-mile buffer.

Lesser Prairie-Chicken in Sand sage/Shinnery –
Associations: sand sage and/or shinnery (Min. **1,000** ac)
Associations with limits: Woodland (includes riparian shrub and canopy) – Max. **50** ac.
Cropland – Max. **2,000** ac of Cropland
Mesquite – Max. **125** ac.
Road Acreage: Other roads: Max. **50** ac.
No Tolerance: 4-lane roads, urban/suburban
Window Size – **5,000** ac.
Documentation: Crawford and Bolen 1976, Effects of landuse on Lesser Prairie Chicken in Texas. J. Wildlife Mgmt. 40: 96-104). Revision by LPCIWG 7/24/06. Revised again 5/31/07 by staff based on the assumption that CRP is neutral (assuming that it is mostly still non-native)
Apply: - Apply model in BCR 18-NM, OK and TX and in BCR 19-TX and OK within current mapped Prairie-Chicken range with a 10-mile buffer.

Lesser Prairie-Chicken in Grass -
Associations: Mixed grass, Sandhills Grassland, tall grass, shortgrass, CRP, sand sage, wet meadow and moist soil units (Min. 2,000 ac)
Associations with limits: Woodland (includes riparian shrub and canopy and mesquite) – Max. **50** ac.
Cropland – Max. 3,000 ac of Cropland only
Road Acreage: Other roads: Max. **50** ac.
No Tolerance: 4-lane roads, urban/suburban
Window Size – **5,000** ac
Documentation: KDWP data; final revision by LPCIWG 7/24/06.
Apply: - Apply model in BCR 18/19-KS within current mapped Lesser Prairie-Chicken range plus 10 mile buffer.

Long-billed Curlew –

Associations: Shortgrass, Mixed Grass, Sandhills Grassland, and wet meadow Min. **1,310** ac
Associations with limits: Sand Sage, Shinnery - Max **200** ac
Woodland (includes mesquite, ponderosa pine, pinyon-juniper) - Max **20** ac
Road Acreage: Max **50** ac.
No Tolerance: 4-lane roads, urban/suburban
Window Size – **1,650** ac
Apply : in LBCU range of BCR 18 and 19. Result will be clipped to 1 mile + 1 window from water sources (river channel, lakes, ponds, reservoirs, wet meadows, moist soil unit, saline lakes, playas).

Documentation: There is no data for the Southern Great Plains. We will use 1,650 acres - about average of Saskatchewan data, (Sadler and Maher 1976): 6-7 km2/pair (1482.6-1729.7 acres/pair). Water source information from CO (McCallum et al. 1997) and Lew Oring (pers.comm.).

Henslow's Sparrow in Tallgrass – 200 ac (must be contiguous grass - for Henslow's Sparrow)
Other Associations: Tall Grass, Mixed grass, Sandhills Grassland, and CRP in BCR 19 – KS only
Associations with limits: No tolerance of other types
Road Acreage: No tolerance of roads, urban/suburban
Window Size – 200 ac
Documentation: Minimum acreage for HESP is 140 acres (Johnson and Igl, 1999) and J. Fitzgerald, (pers. comm.)

Apply: in BCR 19-KS, Result will be clipped to current Henslow's Sparrow range.)

Step c: Model current landscape carrying capacity for landbirds and determine if current habitat can support the abundance and/or vital rate objectives

We used the following model to estimate the current carrying capacity of each habitat for most priority landbird species in each planning area:

Current Estimated Carrying Capacity =
*Bird Units (Density) * Acres of habitat * Percentage of habitat in a condition *Habitat adjustment factors (availability, suitability, and large block)*

Carrying capacities for all habitats were summed, resulting in total current carrying capacity of each planning area for each priority species (expressed as numbers of breeding birds). The results of these models are in Appendix C. These model inputs are not static and are expected to change during periodic reviews from the landbird team.

Step 4: Develop abundance objectives

In the last iteration of PLJV planning the landbird team used the C-plan objectives, for each priority species. This has several distinct advantages. The objectives, based on continental BBS trends are simple (maintain, increase by 50%, or double the population), and they have already been developed. However there are several disadvantages when using this approach on a regional scale. Often continental trends may mask what is occurring regionally, either showing a need for increasing populations when those populations are stable regionally, or alternatively, showing no need for increased populations when regional populations are declining. Stewardship species only have maintenance goals. Furthermore no objectives have been developed for species that are not of continental importance, i.e. Watch List or Stewardship species. Therefore, in order to support continental population objectives, different objectives for the region depending upon regional trends, may be more appropriate. For example, there is a continental objective of population maintenance for Grasshopper Sparrow, however, because the BBS trend for BCR 19 is a -1.4% /yr and -3.3%/yr in BCR 18 (Sauer et al. 2005), increasing the populations in these two BCRs may be appropriate for continental population maintenance. The C-plan does state that the "maintenance of Stewardship Species, … may in some instances require actions and immediacy similar to those for Watch List Species." However, no further guidance is given toward the development of regional objectives for any species.

Taking this into consideration, the landbird team decided to utilize BBS trends to determine population objectives. BBS trends from 2005 were used (Sauer et al. 2005) for the period 1966-2005. This process first analyzed BBS trends by BCR for their ability to satisfy these criteria for significance: 1) p value ≤ 0.1, and 2) number of routes within the BCR on which the bird was detected was greater than 13. This generally follows those guidelines adopted by the Partners in Flight Plan. In general, the data from each BCR was sufficient for determining regional trend significance. In some cases when there was no regional data, going to survey-wide trend was most appropriate. For Black-capped Vireo data from Recovery Plans were used, for Piping and Snowy Plover a trend supporting the goals of the USSCP was used, and for the Lesser Prairie-Chicken objectives were determined by state members of the Lesser Prairie-Chicken Interstate Working Group. When trends did not meet data requirements it was assumed that the population was stable and an objective of maintaining the currently estimated population was utilized. Appendix D contains trends used in the HABS database for each species by BCR.

Next, we determined abundance objectives by scaling to 1970's levels for each BCR. If the population trend was ≥ 0, the abundance objective equaled the current population estimate (a goal of maintaining the population). If the population trend was < 0, we applied the following formula to determine a population goal:

$$\frac{\textit{Current Estimated Carrying Capacity}}{\textit{(1-Absolute Value [Trend])}^{29}}$$

Utilizing BBS trends to determine population objectives however, may result in abundance objectives that are greater than the ability of the current landscape to deliver. This could happen for several reasons including: 1) current habitat acreages have changed over the last thirty years because of habitat

conversion which does not allow restoration, i.e. urbanization, 2) current GIS information is old while habitat conversion is still taking place, which affects current bird trends used in developing abundance objectives, 3) factors outside of the breeding range may be affecting trend, etc. Nevertheless, the team felt that this process was better able to develop appropriate objectives for the region than using PIF continental objectives. That is, for species with significant negative trends that are different than the three basic PIF recommended objectives (maintain, increase by 50%, double) it allows for developing abundance objectives more finely tuned to the region, and for species whose regional trends differ from national trends, regional trends allow for more appropriate regional responses.

For those species where a Trend-developed abundance goal required a greater than doubling of the current estimated carrying capacity the abundance goal was capped at doubling, which is the equivalent of the Partners in Flight goal if that continental system of objective determination was utilized. This was done in response to partners concerns about the ability to produce habitat sufficient to make habitat goals for species with a greater than doubled population objective. Appendix E contains breeding season goals.

There are no current population estimates for landbirds by BCR during the winter season. There currently is no methodology for determining winter population objectives or population estimates, although recently completed work with Christmas Bird Count data may help with some of these. Until more explicit planning for wintering landbird species can be conducted, the landbird team has assumed that wintering species (none of which utilize habitats not already utilized by breeding landbirds) will have enough habitat provided for them if breeding riparian and grassland birds, are at objective levels.

Step 5: Develop vital rate (i.e., population performance) objectives

To address the question of how landbird populations should "perform" or "be influenced" while in the PLJV, we believe abundance objectives should be complemented by vital rate objectives (nest success, recruitment, survival, etc.). For example, it would not be prudent for managers to attract large numbers of birds to the PLJV region if recruitment or survival rates are below levels needed to sustain continental population objectives.

Ideally, BCR vital rate objectives for landbirds in the PLJV would be developed within the context of a regional prairie bird strategy, but we are unaware of such strategies for any species. Indeed, demographics for many priority landbird species have not been determined anywhere, let alone within the region. Therefore, we defer developing recruitment and survival objectives.

Step 6: Determine limiting factors

Given the lack of information on vital rates for most landbirds the landbird has opted to assume that habitat is a limiting factor for all breeding birds within the landbird team's purview. For wintering species, we have assumed that providing enough habitat for breeding landbirds will also provide enough for wintering landbirds using the same landscapes and habitats.

Step 7: Develop habitat objectives

Step 7a: Analyze habitat trends to determine whether current habitat quantity and/or quality is likely to change

Wilkins et al. 2003 has analyzed some habitat trends for Texas, and other habitat trend analyses exists for various habitat types for other portions of the Joint Venture. We believe the quantity and quality of some important landbird habitats is declining, or has declined within the last 30 years, in the PLJV region, due primarily to a variety of direct and indirect anthropogenic actions (urban expansion, agricultural intensification, water diversions, reduced fire intervals, etc.). For example, land uses such as improved pasture, irrigated cropland and non-agricultural uses all increased over the period 1992 – 2001 in the High Plains region of Texas (Wilkins et al., 2003). Each of these uses reduce the value of the landscape to most priority landbirds. The PLJV conducted an initial assessment of habitat trends (Melcher 2006). Preliminary data in several counties in central-western Oklahoma, covering over 4.5 million acres and 25% of BCR 19 in the state, based on imagery analysis separated by twelve years, suggests that eastern redcedar (ERC) has invaded some habitat types in the BCR to a significant degree. Eastern redcedar while providing habitat for some shrub and woodland birds reduces or eliminates the ability of grasslands to support most priority grassland species. Table 2 below lists some habitats measured, the percent converted to Eastern redcedar, the average loss per year, and total acres involved.

Table 2. Amount of Eastern Redcedar gains over 12 years in selected Oklahoma counties.

Association	% converted to ERC	Avg. Loss per year	Total Acres of Association	Total Acres invaded by ERC
Pasture	9.17%	0.764%	199,183	18,259
Mixed Grass	15.71%	1.309%	1,216,130	191,081
Native riparian shrubland	18.40%	1.533%	188	34
Tallgrass	12.29%	1.024%	373,404	45,885
Wet meadow	20.38%	1.698%	107,238	21,858
Riparian canopy	20.46%	1.705%	40,871	8,363
Sand Sage	24.50%	2.042%	10,591	2,594
Riverine Systems	26.47%	2.205%	8,595	2,275
Shinnery	37.19%	3.099%	71	26
Cropland	2.60%	0,216%	2,265,161	58,924

However, quantitative trend information is lacking for most habitats in most areas. For future landbird conservation planning, we believe carrying capacity models should be based on projected future habitat conditions, rather than current conditions. This will require a concerted effort by the PLJV to develop new programs for monitoring trends in habitat quantity and quality.

Step 7b: Based on results of Steps 3 and 4, develop a conservation strategy to increase or maintain landscape carrying capacity for landbirds

Current carrying capacity was compared to the population objective to determine whether an area meets the population objective. These calculations are performed within the PLJV's HABS database (PLJV 2006a); interested readers should consult this database for the current PLJV landbird carrying capacities relative to population goals.

Based on estimated landbird carrying capacities relative to population goals, we made specific landbird habitat conservation recommendations for each planning area. For species below goal, we calculated the amount of "added" (e.g., restored) specific habitat types needed to support enough additional birds to alleviate the deficit and allow the population to reach desired levels (see HABS database). For species at or above goal, we made more general recommendations to protect or maintain important habitats so that populations do not fall below desired levels in the future. Please see the PLJV's *Area Implementation Plans* for landbird habitat conservation recommendations.

Step 7c: Evaluating results within the context of state determined desired restoration potential

Habitat objectives, once determined, must be measured against implementers and the general populations ability and desire to achieve those objectives. While it is never easy to say that we cannot attain independently produced habitat objectives to maintain birds at desired levels, it is equally distasteful to simply leave goals unfulfilled. Once the process of determining habitat objectives is reached there must be some level of understanding of how these objectives will be received by implementers and the general public. Restoration of millions of acres of grassland will inevitably mean that some acres of cropland must be turned back into grass. There are currently programs which will pay for this to occur, most notably the Conservation Reserve Program, but determining how much can the public handle, rather than simply how much is needed to restore bird populations must be asked. When this dialogue takes place, and if new objectives are desired by the region, an active give and take with the bird initiatives on the national level should occur. This back and forth on the number of birds that the region is willing to deliver even if over several decades is what must ultimately affect what is actually achievable on a continental level and cause partners in Flight on a national level to reevaluate its on objectives. While this may not bring all birds up to original desired levels this kind of dialogue can only be healthy in order to determine the level of bird numbers that the public is willing to allow given other societal pressures currently in play.

Measuring Success

We believe the follow statement describes when success at landbird conservation has been achieved in the PLJV:

"When habitat in the PLJV is not limiting landbirds from reaching population objectives, and is not expected to be limiting in the future, because conservation actions in the PLJV are sufficient to offset any negative trends in important habitats."

More specifically, the current carrying capacity of each PLJV planning area should be maintained at $\geq$100% of the goal for each priority species. We recommend using *current carrying capacity* as the performance measure for landbird conservation in the PLJV until vital rate objectives can be determined and evaluated for priority species in each association and condition.

Monitoring and Evaluation

Numerous information gaps and uncertainties arose during this planning process, which required us to make assumptions and subjective decisions in developing landbird conservation objectives. Hopefully

some of these information gaps will be addressed through future research, which will allow improvements in PLJV landbird conservation planning. Specifically, we encourage work to:

1. *Assess accuracy of estimates for current landbird habitat quantity and quality.* Current habitat estimates represent a compilation of data and assumptions from many sources. Accuracy of acreage, availability, and suitability estimates should be tested for important landbird habitats. This will improve accuracy of carrying capacity models and will lead to better habitat conservation recommendations.
2. *Develop quantitative trend estimates for important landbird habitats.* Habitat trend information is needed to develop appropriate landbird habitat conservation actions that will maintain populations at desired levels over the long term. In a few habitats, there may be existing data that could be analyzed (e.g., agricultural statistics). For most habitats, this will require development of new, long-term periodic habitat surveys.
3. *Improve understanding of the relationship between priority landbirds and their habitats in the PLJV.* To model landbird carrying capacity, we often had to borrow this information from studies outside the PLJV or make assumptions. Better information would improve estimation of carrying capacities. Studies should address densities of breeding birds in important habitats. Determining appropriate habitat goals suffers when methodologies for determining densities are not consistent across all habitat types within an area. For non-breeding birds, almost no information exists on the ability of the landscape to support priority birds in non-breeding seasons in important habitats. Models for determining large blocks of habitat should be further refined to more accurately assess the landscapes potential to support those species where landscape context is crucial.

Report Updates

The PLJV's biological planning is an ongoing initiative (see PLJV 2006a, c). This report represents the PLJV's second attempt to develop appropriate landbird population objectives using information from the C-Plan and continental objectives, and its second attempt to develop habitat objectives that are linked biologically to population objectives. Landbird conservation objectives should be updated and revised as new information becomes available, and as desired by partners. Also, further critical thinking and discussion about habitat conservation strategies will create a desire to revise these objectives.

We encourage critical review of this landbird planning initiative, and we welcome suggestions for improvement. Please send comments to:

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Acknowledgements

We thank the entire landbird team for reviewing this manuscript, for reviewing landbird information and sharing density information respective to their states in addition to their continuing review and comments on information and process.

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Appendix A. Important habitats for PLJV priority landbird species.

PLJV Association Classification for BCRs 18 and 19.

"DIVISION"	"TYPE"	ASSOCIATION	CONDITION
Aquatic	Open Water	Reservoirs Lakes Ponds	Freshwater lake
			Lagoon
			Pit
			Reservoir
			Stock pond
	Wetlands	Playas	Wet
			Wet pit only
			Dry
		Sandhills Wetlands[1]	NA
		Other Wetlands	Moist-soil unit
			Emergent marsh
			Saline
	Riverine Systems	Riverine Systems	Riparian canopy (early successional w/o understory)
			Riparian canopy (early successional with understory)
			Riparian canopy (late successional w/o understory)
			Riparian canopy (late successional with understory)
			Exotic Riparian shrubland
			Native Riparian shrubland
			River channel
			Unvegetated sandbar
			Warmwater slough
			Wet meadow
			Floodplain marsh
		Arroyo/Ravine [2]	NA
Anthropogenic	Agricultural	Cropland	Alfalfa
			Corn
			Fallow
			Hay
			Millet
			Sorghum
			Soybeans
			Sunflowers
			Wheat
			Peanuts
			Pasture
			Other
			Sod Farm
		CRP	Native grasses
			Non-native grasses
Other	Other	Other	Urban/Suburban
			4 – lane roads
			Other roads
			All other types not important to SMA-Hs
Terrestrial	Sparsely Vegetated	Badlands/Cliffs/Outcrops	NA
	Forests/Woodlands	Forest/Woodland (upland)	Shelterbelts
			Eastern Red Cedar
		Pinyon/Juniper	NA
		Ponderosa Pine	Few trees, grassy understory
			Many trees, little grassy understory
		Crosstimbers Woodland	NA
		Hillside Woodland	NA
		Juniper	NA
		Juniper/Mesquite	NA
	Grasslands	Mixed Grass	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass

"DIVISION"	"TYPE"	ASSOCIATION	CONDITION
			Many shrubs/High grass
			Prairie Dog Colony[3]
		Sandhills Grasslands[1]	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
		Shortgrass	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
			Prairie Dog Colony[3]
		Tallgrass	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
	Shrublands	Mesquite Savannah	Savannah
			Shrubland
		Shinnery	Few shrubs/Low grass
			Many shrubs/ Low grass
			Few shrubs/High grass
			Many shrubs/High grass
		Sand Sage	Low grass
			High grass

[1] Nebraska only
[2] NM, OK and TX only
[3] Although prairie dogs are listed under both mixed grass and shortgrass, acres of prairie dog towns are allocated in HABS to the dominant type in each BCR (e.g. shortgrass in BCR 18 and mixed grass in BCR 19) due to difficulty in obtaining specific mapping of prairie dogs.

Appendix B. Range factors for priority species in BCRs 18/19.

Species Name	BCR 18 - CO	BCR 18 - KS	BCR 18 - NE	BCR 18 - NM	BCR 18 - OK	BCR 18 - TX	BCR 19 - KS	BCR 19 - OK	BCR 19 - TX
Baltimore Oriole	0.1		0.8				0.2		
Bell's Vireo	0.05						0.1		
Brewer's Sparrow	0.3	0.05	0.2	0.04	0.3337				
Bullock's Oriole		0.1125			0.25				
Cassin's Sparrow	0.9	0.246	0.5						
Chestnut-collared Longspur	0.02		0.6						
Chihuahuan Raven	0.15	0.05				0.7		0.25	0.7
Dickcissel				0.6					
Eastern Meadowlark							0.6		
Grasshopper Sparrow	0.7			0.4		0.6			
Greater Prairie-Chicken							0.5		
Lark Bunting				0.05		0.4	0.254	0.02	0.1
Lark Sparrow		0.737							
Lewis's Woodpecker	0.5			0.3					
Loggerhead Shrike		0.497							
McCown's Longspur	0.1		0.5						
Mississippi Kite	0.05	0.05		0.1		0.8	0.376		0.9
Mountain Plover	0.3	0.017	0.08	0.1	0.3	0.05			
Northern Bobwhite		0.369	0.2	0.5					
Painted Bunting				0.1			0.1		0.8
Pinyon Jay				0.5					
Piping Plover	0.1								
Red-headed Woodpecker						0.3			
Ring-necked Pheasant			0.5	0.1		0.6		0.3	0.5
Scaled Quail	0.5	0.075		0.3			0.01	0.05	
Scissor-tailed Flycatcher							0.4172		
Short-eared Owl	0.05	0.5	0.5				0.5		
Snowy Plover	0.2								
Swainson's Hawk							0.5		
Upland Sandpiper	0.2	0.106			0.1		0.3	0.5	

Appendix C. Current modeled Carrying Capacity for landbirds by area.

Species Name	BCR 18 - CO	BCR 18 - KS	BCR 18 - NE	BCR 18 - NM	BCR 18 - OK	BCR 18 - TX	BCR 19 - KS	BCR 19 - OK	BCR 19 - TX
Baltimore Oriole	187	214	168				100,415	49,951	747
Bell's Vireo	884	142	340	16			57,102	79,894	9,563
Black-capped Vireo								2,168	
Brewer's Sparrow	46,673	64	1,235	27	108				
Bullock's Oriole	115,084	4,420	3,708	27,468	1,451	38,572	1,535	1,195	51,396
Burrowing Owl	50,220	7,210	8,410	24,949	7,792	8,437	849	0	1,249
Cassin's Sparrow	859,982	29,683	876	2,045,847	176,306	2,816,414	11,795	141,247	747,861
Chestnut-collared Longspur	13,501		46,812						
Chihuahuan Raven	3,784	42		91,318	511	59,563		368	2,789
Dickcissel	23,950	298,687	25,524	2,416	49,240	33,819	5,691,979	1,298,825	265,340
Eastern Meadowlark		264		33,320	126	12,382	223,430	428,815	325,547
Grasshopper Sparrow	653,268	1,039,483	956,312	56,323	616,692	353,203	1,716,036	1,046,671	237,642
Greater Prairie-Chicken	3,057	1,203	708				78,086	0	
Henslow's Sparrow							3,808		
Lark Bunting	3,381,926	737,091	1,147,240	12,368	340,630	108,515	9,454	4,187	8,353
Lark Sparrow	1,691,658	113,593	575,729	1,192,157	140,408	1,484,439	294,345	741,604	542,314
Lesser Prairie-Chicken	682	7,621		5,218	896	279	20,693	8,615	68
Lewis's Woodpecker	2,793		123	214	8				
Loggerhead Shrike	114,594	6,191	18,778	367,392	2,867	111,878	24,643	59,043	45,812
Long-billed Curlew	1,450	62	1,887	5,360	356	1,991			
McCown's Longspur	8,086		3,393						
Mississippi Kite	166	543		1,528	418	53,388	13,176	31,776	42,883
Mountain Plover	4,779	300	2,024	1,754	495	127			
Northern Bobwhite	8,897	9,979	3,225	10,041	9,424	60,026	675,607	729,039	378,591
Painted Bunting				106		5,444	41	136,522	616,040
Pinyon Jay	7,271		195	2,652	16				
Piping Plover	22				0				
Red-headed Woodpecker	842	395	160	2	98	1,332	37,368	23,995	10,542
Ring-necked Pheasant	60,167	78,436	52,362	786	7,110	31,175	77,210	15,459	11,541
Scaled Quail	134,623	185		220,265	17,547	226,995	2	599	19,000
Scissor-tailed Flycatcher				48,232	20	141,688	8,390	87,716	139,180
Sharp-tailed Grouse			37,040						
Short-eared Owl	167	266	401				682		
Snowy Plover	102			222	0	1,209	802	660	23
Swainson's Hawk	89,083	8,307	11,094	30,661	3,239	47,323	10,777	7,021	16,636
Upland Sandpiper	517	346	17,928		8		70,940	12,194	
Western Kingbird	880,074	228,887	173,565	540,405	266,851	2,131,319	501,610	166,299	465,393

Appendix D. Trend used to determine landbird abundance goals by BCR. Columns are species, trend used in HABS (expressed as a proportion), the BBS trend (% lost-gained/yr., 1966–2005), *p*-value of that trend, and the number of routes on which the bird was detected. When trend data requirements were not met, we assumed a stable trend (0.001). If trends would require a greater than doubling of a population over 30 years, it was capped at a doubling rate (-0.023). Significant declining trends are highlighted.

Species Name	18 Trend Used	BCR 18 Trend	*p*	N	19 Trend Used	BCR 19 Trend	*p*	N
Ring-necked Pheasant	**-0.018**	-1.8	0.06	81	0.001	0.01	0.87	73
Sharp-tailed Grouse	0.001	-9.5	0.33	2	†	1	0.86	5
Greater Prairie-Chicken	0.001	51.1	0.15	2	0.001	-15	0.18	23
Scaled Quail	0.001	-0.2	0.95	22	0.001	-6.3	0.01	12
Northern Bobwhite	0.001	-0.3	0.76	56	0.001	-0.1	0.74	98
Mississippi Kite	0.001	0.0	1.00	7	**-0.023**	-2.9	0.02	41
Swainson's Hawk	0.001	-0.3	0.81	110	**-0.023**	-4.0	0.00	75
Piping Plover	**-0.02***				†			
Snowy Plover	0.001*				0.001*			
Mountain Plover	**-0.023***	-2.9	0.25	30	†			
Upland Sandpiper	0.001	-4.5	0.25	25	0.021	2.1	0.02	57
Long-billed Curlew	**-0.023**	-4.3	0.03	42	†	-5.5	0.39	10
Burrowing Owl	0.001	-4.6	0.29	92	0.001	2.3	0.83	27
Short-eared Owl	**-0.023**	-4.6**	0.01	171	**-0.023**	-0.046	0.01	171
Lewis's Woodpecker	0.001	-14.4	0.03	6	†			
Red-headed Woodpecker	0.001	-2.2	0.25	34	0.001	-0.3	0.63	85
Western Kingbird	0.018	1.8	0.00	118	**-0.023**	-2.4	0.00	101
Scissor-tailed Flycatcher	0.017	1.7	0.10	32	**-0.023**	-2.3	0.00	63
Loggerhead Shrike	0.001	0.1	0.94	90	**-0.023**	-3.9	0.00	93
Bell's Vireo	0.001	-11.0	0.57	3	**-0.023**	-3.9	0.01	59
Black-capped Vireo	†				**-0.017***			
Pinyon Jay	0.001	-0.3	0.97	7	†			
Cassin's Sparrow	**-0.009**	-0.9	0.02	96	**-0.023**	-3.6	0.02	46
Brewer's Sparrow	**-0.023**	-5.5	0.02	32	†			
Lark Sparrow	0.001	-0.4	0.47	109	**-0.023**	-2.5	0.0	98
Lark Bunting	**-0.023**	-2.3	0.0	93	**-0.023**	-5.7	0.01	42
Grasshopper Sparrow	**-0.023**	-3.3	0.0	96	**-0.014**	-1.4	0.02	98
Henslow's Sparrow	†				**-0.023**	-0.079**	0.0	179
McCown's Longspur	0.020	6.0	0.0	10	†			
Chestnut-collared Longspur	0.001	0.0	1.0	9	†			
Painted Bunting	0.001	3.7	0.26	5	0.015	1.5	0.1	47
Dickcissel	0.035	3.5	0.03	46	0.001	0.4	0.47	102
Eastern Meadowlark	0.001	-0.6	0.81	26	**-0.011**	-1.1	0.02	82
Baltimore Oriole	0.001	-0.2	0.83	15	**-0.011**	-1.1	0.1	78
Bullock's Oriole	0.008	0.8	0.36	91	**-0.023**	-3.8	0.06	38

*denotes trend used in HABS not determined via BBS (see page 14).

** denotes Survey-wide rather than BCR trend

†insignificant breeding within the PLJV planning portion of this BCR and no planning done.

††Lesser Prairie-Chicken Goals determined by state representatives to the Lesser Prairie-Chicken Interstate Working Group.

Colorado	Increase by 50%
Kansas	Double
New Mexico	Triple
Oklahoma	Triple
Texas	Triple

Appendix E. Current goals based on BBS trend for landbirds by area.

Species Name	BCR 18 - CO	BCR 18 - KS	BCR 18 - NE	BCR 18 - NM	BCR 18 - OK	BCR 18 - TX	BCR 19 - KS	BCR 19 - OK	BCR 19 - TX
Baltimore Oriole	187	214	168				138390	68842	1030
Bell's Vireo	884	142	340	16			112127	156882	18778
Black-capped Vireo								3263	
Brewer's Sparrow	91648	126	2425	53	212				
Bullock's Oriole	115084	4420	3708	27468	1451	38572	3014	2347	100922
Burrowing Owl	50220	7210	8410	24949	7792	8437	849	0	1249
Cassin's Sparrow	1117772	38525	1139	2659115	229185	3660669	23161	277356	1468516
Chestnut-collared Longspur	13501		46812						
Chihuahuan Raven	3784	42		91318	511	59563		368	2789
Dickcissel	23950	298687	25524	2416	49240	33819	5691979	1297472	319220
Eastern Meadowlark		264		33320	126	12382	307928	590986	448664
Grasshopper Sparrow	1282771	2041151	1877834	110597	1210949	704573	2582830	1575359	357678
Greater Prairie-Chicken	3057	1203	708				78086		
Henslow's Sparrow							7477		
Lark Bunting	6640821	1447367	2252342	24286	668868	213082	18564	8222	16402
Lark Sparrow	1693050	113055	575729	1192157	139706	1484439	577982	1456229	1064899
Lesser Prairie-Chicken	1026	14965		16048	2691	855	40633	26324	209
Lewis's Woodpecker	2793		123	214	8				
Loggerhead Shrike	114594	6191	18778	367392	2867	111878	48390	115938	89957
Long-billed Curlew	2847	122	3705	10525	699	3910			
McCown's Longspur	8086		3393						
Mississippi Kite	166	543		1528	418	53388	19090	62396	84206
Mountain Plover	9384	589	3974	3444	972	249			
Northern Bobwhite	8897	9979	3225	10041	9424	60026	675607	729039	378591
Painted Bunting				106		5444	41	136522	616040
Pinyon Jay	7271		195	2652	16				
Piping Plover	40								
Red-headed Woodpecker	842	14	160	2	56	1332	37368	23995	10542
Ring-necked Pheasant	101889	132826	88671	1331	12040	52793	77210	15459	11541
Scaled Quail	134623	184		220265	17560	226995	2	599	19000
Scissor-tailed Flycatcher				48232	20	141688	16475	172241	273297
Sharp-tailed Grouse			37040						
Short-eared Owl	328	522	787		22		1339		
Snowy Plover	102			222		1209	802	660	23
Swainson's Hawk	90441	8307	11094	30661	3239	47323	31214	13787	32667
Upland Sandpiper	517	345	17928		8		70940	12194	
Western Kingbird	880074	229539	173565	540405	266851	2131319	1035227	326548	913855

Appendix F.

A Review of Distribution, Habitat Use, and Population Density Data in the Hierarchical All Bird System (HABS) Database

Robert C. Dobbs
17 April 2006

Updated 25 May 2006
Updated 28 August 2007

The Hierarchical All Bird System (HABS) database is a tool developed by Playa Lakes Joint Venture (PLJV) to calculate the landscape's capacity to achieve population objectives for priority species, both currently, based on current habitat availability, and in the future, based on alternative scenarios of future habitat availability (e.g., through conservation and management work). The hierarchical levels on which HABS functions include Area (Bird Conservation Region (BCR) intersections of PLJV states; see Figure 1), Association (map-able habitats), Condition (management condition or a more specific, but not map-able, habitat), and Season/Period (e.g., breeding, non-breeding) (see PLJV 2006 for additional details).

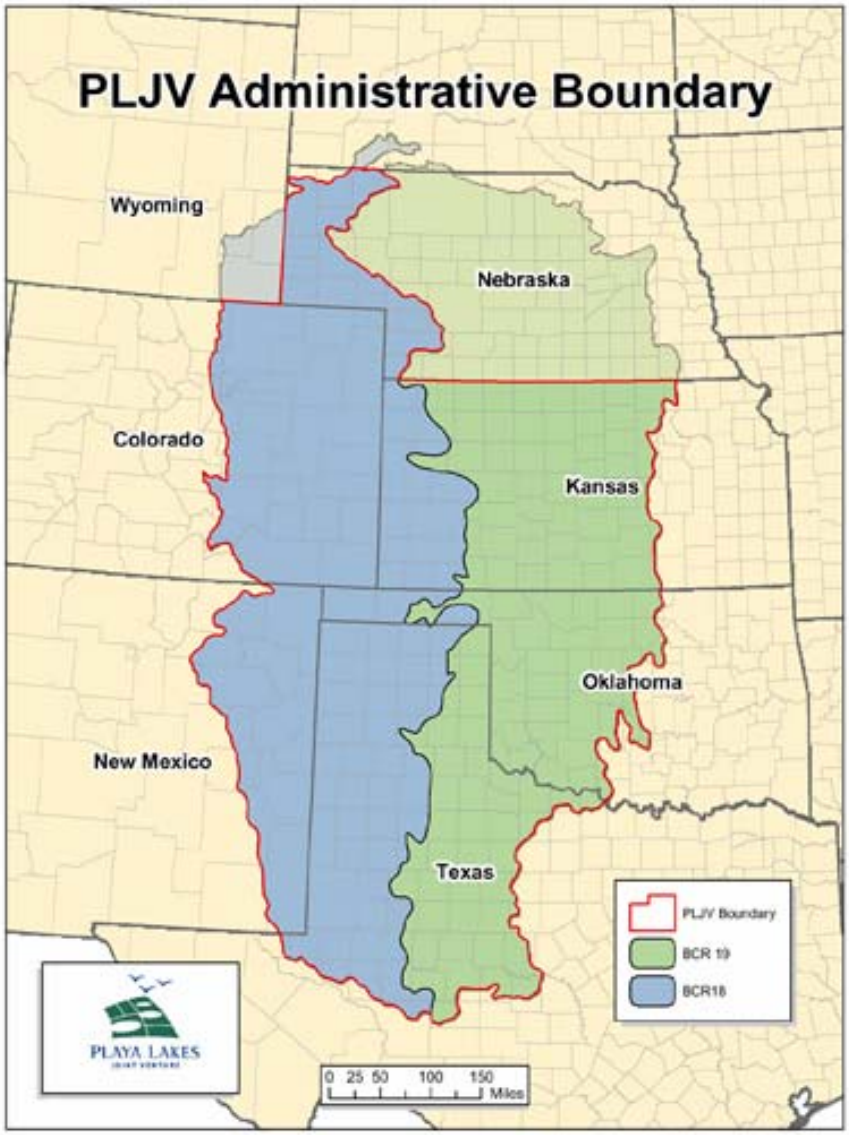
In HABS, priority species are placed in all appropriate combinations of Area, Association, Condition, and Season to reflect their full range of spatial-temporal distribution and habitat use within the PLJV region. Each species entry is associated with a Units figure, which represents quantitatively how that species uses the particular Association (and Condition if applicable), in a particular Area during a particular Season. Units are use-days for non-breeding populations of waterfowl and shorebirds, and population density (number of individuals per acre) for all other species. Waterfowl and shorebird use-day figures are based on extensive research, and thus reliably represent the numbers of individuals on the landscape. For most species, however, high-quality estimates of population density are scarce. In many cases, for example, available density estimates are of limited applicability because data were collected at few sites, over a limited time period, outside of the PLJV region, or in habitats that do not occur in the PLJV region, or because data were collected using a methodology lacking rigor.

Here we synthesize information available on the breeding-season distribution, habitat use, and population density of species of interest to PLJV partners, including Species for Management Action (SMA), for which PLJV is developing habitat objectives (see PLJV 2007). We thus focus on distribution, habitat use, and population density of SMA in the PLJV region. Toward the goal of identifying the highest-quality data available for SMA, however, we also present density data collected outside of the PLJV region for species that are not well studied or in habitats not well studied within the PLJV. A major goal of this work is to present a range of density measurements that HABS users may pick from or adjust to estimate densities in different scenarios of Area, Association, and Condition in the PLJV region. Nevertheless, a compilation of all density data located during this process is available from PLJV upon request. To facilitate ease of use with HABS, we refer to BCR-state intersections throughout this document, including BCR18-WY and BCR19-NE, which are not technically part of the PLJV region (Figure 1).

METHODS

We searched peer-reviewed literature, theses and dissertations, government publications, unpublished reports, species accounts in the Birds of North America (BNA) series, state bird books and breeding bird atlases, published and unpublished (courtesy of Cornell Lab of Ornithology) Breeding Bird Census (BBC) data (1982-1996), and world wide web-publications (e.g., Johnson et al. 2004) for information on distribution, habitat use, and population density. In general, we summarized information for each species in the context of the PLJV region, although, due to a lack of density data available for many species, we often include density data collected outside the PLJV region. We examined Breeding Bird Survey (BBS; Sauer et al. 2005) maps to identify patterns of variation in species' abundances, a critical step in placing available density data in the context of the PLJV region and in adjusting density estimates among areas

Figure 1. PLJV region showing BCR-state Areas (e.g., BCR18-KS is the intersection of BCR 18 and the state of Kansas, represented by the blue portion of Kansas).



within the PLJV region. We converted density units reported in the literature to birds/ac, if necessary, and converted sex-biased densities (e.g., males/ac) to total birds/ac assuming an even sex ratio. We also summarized in general terms grassland species' response to management, where data were available, toward the goal of providing HABS users the information necessary to adjust density estimates according to habitat condition (i.e., with respect to shrub and grass cover in grasslands, and understory condition and age of riparian woodlands).

Rocky Mountain Bird Observatory (RMBO) survey work has, in general, produced the highest-quality and most consistent data available on breeding population density of priority bird species in the PLJV region. Two RMBO monitoring programs produce data that are particularly relevant to the PLJV region. First, surveys conducted throughout BCR18 areas of CO, OK, KS, and NE, with limited coverage in extreme northeastern NM and northwestern TX, provide valuable density data from native (primarily grassland) habitat, dryland agriculture, and CRP in the shortgrass prairie region (one year of data is also available for all of BCR 18-NM); these data are either unpublished (courtesy of RMBO) or included in publications (Hanni and McLachlan 2004, Sparks et al. (2005)) which are available from

the RMBO website (www.rmbo.org). Second, data from the Monitoring Colorado's Birds (MCB) program provides breeding density data from throughout Colorado; these data are found in Leukering et al. (2002), Leukering and Levad (2003), Leukering et al. (2004), and Beason et al. (2005). Note that data from MCB grassland surveys are limited to eastern Colorado (i.e., BCR18-CO), while data from other habitats, many of which are also present in the PLJV region (e.g., sage shrubland, semi-desert shrubland, pinyon-juniper woodland, low-elevation riparian), come from both east and west slope areas of Colorado.

SPECIES ACCOUNTS: BREEDING SEASON

1. Ring-necked Pheasant (*Phasianus colchicus*)

Distribution and abundance.—Resident throughout the PLJV region, except for southern BCR19-OK, southern BCR18/19-TX, northern BCR18-NM, and western BCR18-CO (Giudice and Ratti 2001). BBS data show patterns of abundance among areas of the PLJV region: (1) 30-100 birds/route throughout most of BCRs18/19-KS, (2) 10-30 birds/route throughout all of BCR18/19-NE and BCR18-OK, (3) 3-10 birds/route in BCR18-WY, and (4) on average, <3 birds/route in remaining areas of the PLJV (Sauer et al. 2005).

Habitat.—Uses wide range of habitats, but is most common in areas having a mix of cultivated cropland, grassland and/or CRP, with areas of heavy cover (e.g., roadside ditches, fencerows) (Giudice and Ratti 2001). Uses small-grain fields, fallow fields, and alfalfa (Mollhoff 2001), as well as hayfields and pasture (Thompson and Ely 1989). Among crop types, uses standing wheat and wheat stubble in CO (Snyder 1984), NE (Faanes and Lingle 1995), and TX (Whiteside and Guthery 1983), as well as sunflowers and sorghum in TX (Whiteside and Guthery 1983). Playa wetlands are also important in TX (Whiteside and Guthery 1983). Wetlands with emergent vegetation and wet meadows provide particularly important habitat during winter (Giudice and Ratti 2001, Dinan and Johnsgard 2004).

Population density.—Breeding population density estimates are available for the PLJV region, primarily from BCR18 (Tables 1.1, 1.2).

Table 1.1. Ring-necked Pheasant breeding density by habitat and geographic area.

Habitat Area	Birds/ac	Comments	Reference
Native (Prairie) habitat			
BCR18-wide	0.0013	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0012	2-yr avg	RMBO unpubl. data
BCR18-NE	0.0020	1 yr	RMBO unpubl. data
BCR18-KS	0.0044	2-yr avg	RMBO unpubl. data
Mixed grass prairie			
BCR19-NE	0.0016	Upland prairie	Faanes & Lingle 1995
BCR19-NE	0.1101	Prairie wetland	Faanes & Lingle 1995
BCR19-NE	0.0121	Wet prairie	Faanes & Lingle 1995
Riparian woodland			
BCR19-NE	0.0097		Faanes & Lingle 1995
CRP			
BCR18-wide	0.0094	1 yr	RMBO unpubl. data
Dryland agriculture			
BCR18-wide	0.0110	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0122	1 yr	RMBO unpubl. data
BCR18-KS	0.0113	2-yr avg	RMBO unpubl. data

BCR18-NE	0.0084	1 yr	RMBO unpubl. data
Other agriculture			
BCR19-NE	0.0016	Wheat	Faanes & Lingle 1995
BCR19-NE	0.0300	Alfalfa	Faanes & Lingle 1995
BCR19-NE	0.0121	Hay	Faanes & Lingle 1995

Table 1.2. Ring-necked Pheasant breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**Birds/ac**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0039	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	0.0026	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	NA	Sparks et al. 2005
Low (1-3%)	Managed	0.0005	Sparks et al. 2005
Moderate (3-10%)	Managed	NA	Sparks et al. 2005
High (>10%)	Not managed	NA	Sparks et al. 2005

2. (Plains) Sharp-tailed Grouse (*Tympanuchus phasianellus jamesi*)

Distribution and abundance.—Resident in isolated areas of BCR18-WY/CO/NE/KS and in BCR19-NE (Connelly et al. 1998, Gillihan and VerCauteren 2003). BBS map shows no clear pattern of variation in abundance among areas BCR18-WY, BCR18-NE, or BCR19-NE, except that abundance appears lower in occupied areas of BCR18-CO/KS, where map does not show the species as present (Sauer et al. 2005).

Habitat.—Primarily occurs in sand sage, shortgrass, and mixed grass prairie in NE (Sisson 1976, Dinan and Johnsgard 2004). In CO, uses medium-tall grasslands, including CRP plantings (Kingery 1998).

Population density.—Few density estimates are available for the PLJV or nearby regions. High-quality density estimates from NE range from 0.0016 birds/ac (11-year average) in upland prairie (presumably mixed grass) of the central Platte River valley (Faanes and Lingle 1995), to 0.0183 birds/ac (five-year average) in a single area (Sisson 1976) and 0.0243 using management including fire and bison grazing in sandhills prairie (Griebel et al. 1998)

Response to management.—Managing grasslands with fire to reduce invasion of woody shrubs benefits this species by facilitating increased nest density (Kirsch et al. 1973), but disturbance to shrub habitat should be avoided if shrubs constitute < 10% of the cover in an occupied area (Connelly et al. 1998). Sharp-tailed Grouse density is highest under light-moderate grazing regimes, and decreases as grazing intensity increases (Kantrud and Kologiski 1982). No grouse found in areas managed with cattle grazing and fire on the landscape (Griebel et al. 1998).

3. Greater Prairie-Chicken (*Tympanuchus cupido*)

Distribution and abundance.—Resident in northern BCR18-CO, southern BCR18-NE, much of BCR19-NE/KS, and portions of BCR18-KS and BCR19-OK (Schroeder and Robb 1993, Gillihan and VerCauteren 2003, Sauer et al. 2005). BBS map shows higher abundance (3-10 birds/route) in much of BCR19-NE/KS, and lower abundance (<1 bird/route) in other occupied areas of PLJV (i.e., BCR18-CO/NE/KS, BCR19-OK) (Sauer et al. 2005).

Habitat.—In CO, uses primarily sand sage, but also mid-grass, prairie (Andrews and Righter 1992, Schroeder and Braun 1991, Kingery 1998). In NE, uses sand sage, sandhills grasslands, and mixed grass prairie (Dinan and Johnsgard 2004). Most important habitat is sand sage with high-quality (i.e., not over-grazed) grass component (Schroeder and Braun 1991).

Population density.—Little high-quality density data available, as follows: 0.022 birds/ac (Van Sant and Braun 1990) and 0.0112 birds/ac (Schroeder et al. 1992) in sand sage prairie in northeastern CO, 0.0016 birds/ac in upland prairie (presumably mixed grass) in central NE (Faanes and Lingle 1995), 0.0031 birds/ac statewide in OK (Duck and Fletcher 1944, as cited by Baumgartner and Baumgartner 1992) and 0.0377 birds/ac (Ryan et al. 1998) in a variety of grassland situations including pasture in southwestern MO.

Response to management.—Greater Prairie-Chicken nest success decreases dramatically when woody shrub cover increases over 5 %. Prescribed fire may facilitate increased nest density, in part by reducing invasion of woody shrubs (Svedarsky et al. 2003). Overgrazing affects Greater Prairie-Chickens negatively; breeding density is highest where grazing pressure is relaxed by either limiting grazing to winter or idling pastures in some years (Svedarsky et al. 2003).

4. Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*)

Distribution and abundance.—Resident and patchily distributed in southeastern BCR18-CO, BCR18-KS, western BCR19-KS, western BCR19-OK, BCR19-TX, and BCR18-TX/NM (Gillihan and VerCauteren 2003, Hagan 2005). Most common in southwestern portion of BCR19-KS and area in southern BCR18-NM/TX (Price et al. 1995).

Habitat.—Habitat varies across range, but generally consists of dwarf shrub-mixed grass vegetation types associated with sandy soils, which may be interspersed with short grass or mixed grass prairie (Taylor and Guthery 1980; see Hagan 2005). Habitat is comprised primarily by sand sage prairie in CO and KS (Andrews and Righter 1992, Giesen 1994, Busby and Zimmerman 2001), and primarily shinnery oak prairie in OK, TX, and NM (Riley et al. 1992, Jackson and DeArment 1963; see Hagan 2005). Also uses CRP in some areas (e.g., KS; Fields 2004), as well as cropland, but needs > 63 % of landscape to be native (Crawford and Bolen 1976).

Population density.—Higher densities in shinnery oak than sand sage in OK (see Hagan 2005). Giesen (1994) showed that grass height and density at successful nests was higher than at unsuccessful nests, suggesting that overgrazing may negatively affect success.

Response to management.—Habitat preferences vary with season and stage of the breeding cycle. Lesser Prairie-Chickens use areas with very short vegetation as lek sites, and need areas with bare ground for foraging, but use areas with approximately 50 % cover from shrubs or >40-cm tall grasses for nesting, and areas with approximately 25 % cover from shrubs, forbs, or 25-30-cm tall grasses for brood-rearing (Jamison et al. 2002). Fire in shinnery oak habitats produces bare ground and thereby improves foraging habitat, but degrades nesting habitat in the short-term (Jamison et al. 2002). Heavy grazing may facilitate the conversion of native habitat to uniform shortgrass, and thereby reduce the vertical structure of the grass community that is a necessary component of nesting habitat (Jamison et al. 2002).

Overgrazing, especially during drought conditions, negatively affects the species' reproductive success (Merchant 1982). Prescribed burning may facilitate birds to use areas as lekking sites (Cannon and Knopf 1979). Prescribed burning of relatively mesic shinnery oak may increase forb growth and invertebrate biomass, thereby enhancing brood-rearing habitat, but may limit nesting cover for the first two years following the burn (Boyd and Bidwell 2001).

Table 4.1. Lesser Prairie-Chicken breeding density by habitat and geographic area.

Habitat	Birds/ac	Comments	Reference

Area			
Native (unspecified) prairie			
BCR18-CO	0.0060		Schroeder et al. 1992
BCR18-CO	0.0149	5-yr avg	Giesen 1994
BCR18-CO	0.0099	4-yr avg	Hoffman 1963
BCR18-TX	0.014		Sell 1979†
BCR18-NM	0.015		Locke 1992†
BCR19-OK	0.0541	3-yr avg	Jones 1963‡
Sand sage			
BCR19-OK	0.0055		Copelin 1975‡
Shinnery oak			
BCR18-TX/NM	0.081		Olawski and Smith 1981
BCR19-OK	0.0225		Copelin 1975‡

† as cited by Brennan 1999
‡ as cited by Baumgartner and Baumgartner 1992

Table 4.2. Unpublished Lesser Prairie-Chicken breeding density by habitat, and area.

Vegetation	Birds/ac	Comments	Reference
Sandsage			
BCR19-TX	0.0135	High grass/few shrubs	Lionberger 2006
Shinnery			
BCR19-TX	0.0034	High grass/few shrubs	Lionberger 2006
BCR18-TX	0.0054	High grass/few shrubs	Lionberger 2006
Mixed grass			
BCR19-TX	0.0108	High grass/many shrubs	Lionberger 2006
BCR18-TX	0.0109	Low grass/many shrubs	Lionberger 2006
Mixed grass			
KS	0.0125		Rogers 2004
Sand Sage			
KS	0.0156		Rogers 2004

5. Scaled Quail (*Callipepla squamata*)

Distribution and abundance.—Resident throughout BCR18-NM/TX, southern BCR18-CO, western BCR18-KS/OK, most of BCR19-TX and portions of western BCR19-OK (Schemnitz 1994, Gillihan and VerCauteren 2003). BBS map shows variation in abundance among areas of PLJV region as follows: (1) 3-10 birds/route, on average, in BCR18-NM/TX, (2) 1-3 birds/route, on average, in BCR18-OK/CO, and (3) <1 birds/route elsewhere within species' range in the PLJV (i.e., BCR18-KS, BCR19-OK/TX) (Sauer et al. 2005).

Habitat.—Uses grasslands with scattered shrubs (Schemnitz 1994), primarily sand sage, but also shortgrass, prairie in se. CO (Andrews and Righter 1992) and in KS (Thompson and Ely 1989, Busby and Zimmerman 2001). Uses upland grass-shrub lands and savanna-like habitat with sagebrush, mesquite, yucca, juniper, and shinnery oak in OK (Schemnitz 1964, Sutton 1967), as well as TX (Seyffert 2001) and NM.

Population density.—Breeding population density data are available primarily from RMBO BCR18 surveys. Like BBS abundance data, data from RMBO BCR18 surveys show higher densities in BCR18-TX/NM than in areas farther north (e.g., BCR18-CO; Table 5.1). With respect to habitat, all available density estimates are for "native prairie," and were not further differentiated by habitat (e.g., sandsage, mixed grass, etc.). With respect to grazing/management condition, data suggest that density

may be higher where shorter grass is prevalent. Data show that density is much higher where at least some shrubs are present (i.e., density in low, moderate, and high shrub categories are higher than density in the very low shrub category; Table 5.2). In the Texas panhandle, density is higher in canyon-associated mesquite vegetation than on the plains (Seyffert 2001).

Response to management.—In BCR18, the species occurs at higher density where at least some shrubs are present (Table 5.2; Sparks et al. 2005).

Scaled Quail in south TX were more abundant on pastures grazed under high-intensity short-duration rotation, which had higher forb abundance and grass cover than pastures grazed year-round (Campbell-Kissock et al. 1984).

Table 5.1. Scaled Quail breeding density by habitat and geographic area.

Habitat	**D (birds/ac)**	**Comments**	**Reference**
Area			
Native prairie			
BCR18-wide	0.0067	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0022	3-yr avg	RMBO unpubl. data
BCR18-NM	0.0376	1 yr	RMBO unpubl. data

Table 5.2. Scaled Quail breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0058	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0036	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0019	Sparks et al. 2005
Low (1-3%)	Managed	0.0097	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0055	Sparks et al. 2005
High (>10%)	Not managed	0.0070	Sparks et al. 2005

6. Northern Bobwhite (*Colinus virginianus*)

Distribution and abundance.—Resident throughout much of the PLJV region, but occurs mainly south of the Platte River in BCR18/19-NE, and is limited to eastern portions of BCR18-NM/CO (but extends west well into BCR18-CO along South Platte River) (Brennan 1999). BBS map shows variation in abundance as follows: (1) >30 birds/route in BCR19-TX/OK/KS, (2) 10-30 birds/route in BCR18-TX, (3) 3-10 birds/route in BCR19-NE, BCR18-OK/KS and southern area of BCR18-NM, (4) <3 birds/route, on average in BCR18-CO and the northern part of BCR18-NM, and (5) <1 bird/route in BCR18-WY/NE (Sauer et al. 2005).

Habitat.—Uses a mix of cropland and native habitats with brushy areas (e.g., fencerows, woodlots). Primarily uses riparian woodland and riparian shrub associations in NE (Dinan and Johnsgard 2004), CO (Kingery 1998), western KS (Busby and Zimmerman 2001 **NC**), western OK (Schemnitz 1994, Sutton 1967), and northern TX (Seyffert 2001). Also uses wet meadow and hayfields in central NE (Faanes and Lingle 1995), and CRP in eastern NE (King and Savidge 1995) and elsewhere.

Population density.—Breeding population density estimates for the Great Plains are available in the published literature, BBC results, and, RMBO BCR18 survey results. RMBO survey data suggest that, throughout BCR18, density is similar in native habitat and dryland agriculture (Table 6.1). Note

that density is considerably higher farther east in the PLJV area (i.e., BCR19-KS), regardless of habitat, and that, within areas, density is higher in riparian woodland than in native prairie or agriculture (Table 6.1).

Response to management.—Low- to moderate-intensity grazing benefits the species in grasslands, especially during years of normal rainfall (Guthery 1986). Frequent disturbance from prescribed burning and/or mechanical means facilitates abundant populations (≥ 6.6 birds/ha) in wooded habitats (Landers and Mueller 1986).

RMBO survey data indicate that, in BCR18 native habitats, there is little relationship between density and grass height, but that the species occurs at higher density in high shrub cover than low or moderate shrub cover areas (Table 6.2).

Table 6.1. Northern Bobwhite breeding density by habitat and geographic area.

Habitat **Area**	**D (birds/ac)**	**Comments**	**Reference**
Native prairie			
BCR18-wide	0.0019	2-yr avg	RMBO unpubl. data
BCR18-KS	0.0110	2-yr avg	RMBO unpubl. data
BCR19-NE	0.0016	Upland prairie	Faanes & Lingle 1995
Juniper rangeland			
TX	0.2023	Avg of 2 plots	Lief and Smith 1993
Sand Sage			
BCR 18 - wide	0.002	3-yr avg	RMBO unpubl. data
Riparian woodland			
CO (statewide)	0.0096	2-yr avg	RMBO MCB data[1,2]
BCR19-NE	0.0980	11-yr avg	Faanes & Lingle 1995
BCR19-NE	0.4372	2-yr avg	Davis 2005
Dryland Agriculture			
BCR18-wide	0.0013	2-yr avg	RMBO unpubl. data
BCR18-KS	0.0028	1 yr	RMBO unpubl. data
Cropland			
East-central NE	0.14575	2-yr Sorghum	Fitzmaurice 1995
East-central NE	0.02024	2-yr Soybeans	Fitzmaurice 1995
CRP			
BCR-22 NE	0.032	s-e NE	Delisle and Savidge 1997

[1] Leukering et al. 2004; [2] Beason et al. 2005

Table 6.2. Northern Bobwhite breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0021	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	0.0022	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0010	Sparks et al. 2005
Low (1-3%)	Managed	NA	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0018	Sparks et al. 2005
High (>10%)	Not managed	0.0039	Sparks et al. 2005

7. Eared Grebe (*Podiceps nigricollis*)

Distribution and abundance.—Breeds throughout BCR18-WY/NE, the northern half of BCR18-CO, and northern portions of BCR19-NE (Cullen et al. 1999). BBS data show little variation in relative abundance in the PLJV region, as follows: 1-3 birds/route, on average, in BCR18-NE, and < 1 bird/route elsewhere in the species' PLJV range (Sauer et al. 2005).

Habitat.—Breeds on shallow lakes and ponds with emergent vegetation interspersed with open water (Faanes and Lingle 1995, Cullen et al. 1999). In the PLJV region, the species is associated with shallow ponds and lakes bordered by emergent vegetation in CO (Andrews and Righter 1992), and freshwater and saline marsh and playa wetlands in NE (Dinan and Johnsgard 2004).

Population density.—Very few estimates of breeding population density are available. In a three-year study in ND, density was highest (0.0316 birds/ac) on seasonal wetlands, followed by semipermanent (0.0154 birds/ac) and permanent (0.013 birds/ac) wetlands (Kantrud and Stewart 1984); note that the species is (at least) three times more abundant in ND than in occupied areas of the PLJV region (Sauer et al. 2005).

8. Western Grebe (*Aechmophorus occidentalis*)

Distribution and abundance.—Breeds throughout BCR18-WY/NE, the majority of BCR18-CO/NM/TX, and the northern half of BCR19-NE (Storer and Nuechterlein 1992). Although the species may be more abundant in western NE than elsewhere in the PLJV region, BBS data show no clear patterns of variation in abundance among occupied areas of the PLJV (Sauer et al. 2005).

Habitat.—Breeds on freshwater lakes and marshes with extensive open water and emergent vegetation (Storer and Nuechterlein 1992). In the PLJV region, the species is associated with large reservoirs and shallow lakes, often bordered by emergent vegetation, but not small ponds in CO (Andrews and Righter 1992), and freshwater and saline marsh and playa wetlands in NE (Dinan and Johnsgard 2004).

Population density.—Very few estimates of breeding population density are available. Density was 0.013 birds/ac on permanent wetlands, but only 0.0016 birds/ac on semipermanent wetlands, in a three-year study in ND (Kantrud and Stewart 1984); note that the species is (at least) three times more abundant in ND than it is in the PLJV area (Sauer et al. 2005).

9. American White Pelican (*Pelecanus erythrorhynchos*)

Distribution and abundance.—Relatively widespread breeder across BCR18-WY/NE and western BCR19-NE, but patchy elsewhere in the PLJV region, including BCR18-CO, BCR19-KS (Knopf 2004, Sauer et al. 2005). BBS data show that the species is more common in western NE sandhills than elsewhere in the PLJV region (Sauer et al. 2005).

Habitat.—Breeds on freshwater lakes and reservoirs (Andrews and Righter 1992), but forages in many types of wetlands during the breeding season (Knopf 2004).

Population density.—Is a colonial breeder; no data available.

10. American Bittern (*Botaurus lentiginosus*)

Distribution and abundance.—Breeds throughout much of BCR18-WY/NE and BCR19-NE/KS, and in the northern half of BCR18-CO (Gibbs et al. 1992; Sauer et al. 2005). BBS data show small area of relatively high abundance in western BCR19-NE, but no clear pattern of variation in abundance among areas in the species' range within the PLJV region (Sauer et al. 2005).

Habitat.—Breeds primarily in wet meadows with native vegetation, emergent marsh, less frequently in upland habitats (native prairie, hay, CRP), usually near wetlands; not in cultivated agricultural land (Duebbert and Lokemoen 1977, Gibbs et al. 1992, Johnson et al. 2004). In the PLJV region, breeding is associated with emergent marsh and adjacent wet meadows in CO (Andrews and Righter 1992), emergent marsh, wet areas in grassy meadows, and upland grasslands in KS (Thompson and Ely 1989), wet meadows, playas, saline wetlands in NE (Dinan and Johnsgard 2004).

Population density.—No data on breeding population density are available for the PLJV region. In ND, breeding density is lowest in permanent wetlands (0.0008 birds/ac), intermediate in temporary (0.047 birds/ac), semipermanent (0.047 birds/ac), and fen (alkaline groundwater; 0.068 birds/ac) wetlands, and highest in seasonal wetlands (0.0267 birds/ac) (Kantrud and Stewart 1984).

11. Snowy Egret (*Egretta thula*)

Distribution and abundance.—Limited breeding in BCR18-CO (Kingery 1998) and possibly NE (Dinan and Johnsgard 2004); widespread breeding in BCR19-KS/OK/TX and BCR18-TX (Parsons and Master 2000, Sauer et al. 2005). BBS maps show low-density breeding evenly distributed over all occupied areas of the PLJV region (Sauer et al. 2005).

Habitat.—Breeding is associated with marshes, ponds, reservoirs, rivers, and riparian woodland in CO (Kingery 1998), marshes, riparian habitats, and lakes in KS (Thompson and Ely 1989), and freshwater, saline, and playa wetlands in NE (Dinan and Johnsgard 2004).

Population density.—No data available.

12. Little Blue Heron (*Egretta caerulea*)

Distribution and abundance.—Breeds regularly only in BCR19-KS/OK/TX in the PLJV region (Rodgers and Smith 1995), within which the species shows no clear pattern of variation in relative abundance (Sauer et al. 2005).

Habitat.—The species uses various wetland habitats in occupied areas of the PLJV, including emergent marsh, streams and rivers, ponds, lakes and reservoirs (Thompson and Ely 1989, Baumgartner and Baumgartner 1992).

Population density.—The species does not breed on a landscape scale in the PLJV region, limiting the application of population density. Nevertheless, density data are not available.

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

Distribution and abundance.—Breeds throughout the PLJV region, except for southern areas of BCR18-TX and BCR19-TX (Davis 1993). BBS data shows variation in relative abundance in the PLJV area as follows: 1-3 birds/route in BCR19-KS and the northern half of BCR18/19-TX, and <1 bird/route, on average, elsewhere in species' range within the PLJV (Sauer et al. 2005).

Habitat.—Breeding habitat typically consists of large, semiopen wetlands with emergent vegetation interspersed with open water (Davis 1993, Faanes and Lingle 1995). Breeding is associated with reservoirs, ponds, marshes, and rivers in CO (Kingery 1998), playas and irrigation ditches in KS (Busby and Zimmerman 2001), and freshwater, saline, and playa wetlands in NE (Dinan and Johnsgard 2004).

Population density.—Estimates of breeding population density are not available for the PLJV region. A three-year study in ND found density to be highest on fen (alkaline groundwater; 0.1393 birds/ac) wetlands, followed by semipermanent (0.034 birds/ac), permanent (0.0081 birds/ac), and seasonal (0.0032 birds/ac) wetlands (Kantrud and Stewart 1984).

14. Mississippi Kite (*Ictinia mississippiensis*)

Distribution and abundance.—Widespread breeder in BCR19-OK/TX, southern BCR19-KS, BCR18-TX, and southern BCR18-OK; also patchily distributed in BCR18-CO/NM and BCR19-NE (Parker 1999, Gillihan and VerCauteren 2003). BBS data shows variation in relative abundance among occupied areas of the PLJV region as follows: (1) 1-3 birds/route, on average, in BCR18-TX and BCR19-TX/OK, and (2) <1 bird/route, on average, in BCR18-OK and where it occurs in BCR18-NM, BCR18-KS, and BCR19-KS (and where patchily distributed in BCR18-CO and BCR19-NE) (Sauer et al. 2005).

Habitat.—In the PLJV region, the species breeds in rural woodland in shortgrass and mixed grass prairie, intergrading with shinnery oak, mesquite, and shrub savanna, with lesser use of cottonwood-dominated riparian woodland (Parker 1999). Nevertheless, breeding records are associated with riparian woodland in CO (Kingery 1998) and KS, where the species is also associated with cedar hill prairie and shelterbelts (Busby and Zimmerman 2001). Seyffert (2001) notes that, while the species was formerly confined to riparian woodland and nearby shrub-grassland in the TX panhandle (Allan and Sime 1943), it is now more generally distributed and typically uses mesquite brushlands.

Population density.—Few density estimates are available. Density in western (BCR18) OK was 0.0543 birds/ac in shinnery oak savanna and 0.0999 birds/ac in mesquite-dominated habitats (Parker 1975). Density considerably higher in riparian woodland, with 0.6937 birds/ac recorded in Meade, KS (BCR 19) (Parker 1975). A roadside survey in the TX panhandle recorded 0.0031 birds/ac, but habitat-specific variation was not recorded (Allan and Sime 1943), a later examination of a small area near Canadian Texas (BCR 18) revealed 0.,05913 birds/ac (Allan 1947)

Response to management.—Management recommendations for the southern Great Plains emphasize the importance of cottonwood riparian woodlands, which provide nesting habitat. No data are available on how management (fire) or grazing affects rangeland as foraging habitat for Mississippi Kites.

15. Swainson's Hawk (*Buteo swainsoni*)

Distribution and abundance.—Breeds virtually throughout the PLJV region, except eastern-most areas of BCR19-NE/KS (England et al. 1997, Gillihan and VerCauteren 2003). BBS map shows variation in relative abundance in the PLJV region as follow: (1) 3-10 birds/route) in BCR18-CO, (2) 1-3 birds/route in BCR18-WY/NM/TX/OK/KS and BCR19-TX, and (3) <1 birds/route, on average, elsewhere (i.e., BCR18-NE and BCR19-NE/KS/OK) (Sauer et al. 2005).

Habitat.—Uses a wide range of native grassland and shrubland, hay, pasture, and cultivated land with scattered trees, and riparian woodland and shelterbelts (Thompson and Ely 1989, England et al. 1997, Busby and Zimmerman 2001, Johnson et al. 2004).

Population density.—RMBO surveys throughout BCR18 indicate that breeding population density does not differ between native habitat (0.0014 birds/ac; 2-yr average) and dryland agriculture (0.0013 birds/ac; 2-yr average) (RMBO unpubl. data). RMBO data reflect the species' higher density in BCR18-CO (0.0064 birds/ac, native habitat; 4-yr average) than elsewhere in the PLJV (see also Sauer et al. 2005). Other recent data from shortgrass prairie in eastern CO reflect lower density (0.0005 birds/ac; Leslie 1992) than RMBO BCR18 survey data. In central (BCR19) NE, Faanes and Lingle (1995) reported a density of 0.0016 birds/ac in upland, presumably mixed grass prairie.

Response to management.—Appears to prefer some cultivated cropland, and tolerates extensive areas of cultivated cropland, in territories (Dechant et al. 2001a). Requires sparsely available or aggregations (e.g., associated with riparian areas, homesteads) of trees for nest sites (Olendorff 1973). Little information is available on how burning or grazing of grasslands affects Swainson's Hawk habitat use or population density.

Among vegetation conditions evaluated during RMBO surveys, Swainson's Hawk density was substantially higher in the low shrub category than in the very low shrub, moderate, and high shrub categories (Table 15.1), suggesting that density may be higher on managed grasslands, where shrub density is low, than on unmanaged grasslands. Swainson's Hawk habitat was also characterized by having low-moderate grass height.

Table 15.1. Swainson's Hawk breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	Management	D (birds/ac)	Reference
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0024	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0019	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0018	Sparks et al. 2005
Low (1-3%)	Managed	0.0035	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0013	Sparks et al. 2005
High (>10%)	Not managed	0.0015	Sparks et al. 2005

16. King Rail (*Rallus elegans*)

Distribution and abundance.—Very rare and local breeder in eastern portions of BCR19-KS/OK/TX (Poole et al. 2005); may also breed irregularly in BCR19-NE (Dinan and Johnsgard 2004). BBS data show limited breeding at very low density only in BCR19-KS (Sauer et al. 2005).

Habitat.—Breeding birds are associated primarily with freshwater and saline marsh and wet meadow habitats (Busby and Zimmerman 2001, Dinan and Johnsgard 2004), and possibly (occasionally) playas in NE (Dinan and Johnsgard 2004).

Population density.—Few high-quality data are available. Based on detection rate of 22 birds on 6-mile long inland route (Meanly 1992), and assuming a 200-m radius detection limit, density is estimated at 0.0461 birds/ac. No data are available for the PLJV region, within which the species does not breed on a landscape scale.

17. Black Rail (*Laterallus jamaicensis*)

Distribution and abundance.—Very rare and local breeder in southern BCR18-CO, BCR18-OK/KS, and BCR19-OK/KS (Eddleman et al. 1994).

Habitat.—Breeding is associated with emergent marsh and wet meadow habitats with shallow water and dense vegetation in the PLJV region (Andrews and Righter 1992, Busby and Zimmerman 2001).

Population density.—Few data are available. Based on detection of 1-3 birds, assuming an average of two, in a 16-ha marsh in Colorado (Kingery 1998), resulting in an estimated density of 0.0506 birds/ac. Note, however, that this species does not breed on a landscape scale in the PLJV region.

18. Snowy Plover (*Charadrius alexandrinus*)

Distribution and abundance.—Breeds across large areas of BCR18-NM/TX and BCR19-TX/OK/KS, and is patchily distributed, primarily along the Arkansas River in BCR18-CO/OK/KS (Page et al. 1995). Irregular breeder in NE (Dinan and Johnsgard 2004).

Habitat.—Breeds on barren or sparsely vegetated river islands, alkali playas, and reservoir shorelines in CO (Kingery 1998), river sandbars and salt flats in KS (Busby and Zimmerman 2001), sand/gravel flats and open shorelines in NE (Dinan and Johnsgard 2004). In BCR18-TX, breeds primarily in association with saline lakes and, to a lesser degree, riparian wetlands, but apparently does not breed in association with playas (Conway et al. 2005).

Population density.—Only regional breeding density estimate is 0.0585 birds/ac on salt flats at Salt Plains NWR, OK (Grover and Knopf 1982). Given the species' extremely limited and patchy distribution in the PLJV region, breeding density is not applicable at a landscape level.

19. Piping Plover (*Charadrius melodus*)

Distribution and abundance.—Breeds in the Platte River drainage in NE, and patchily along the Arkansas River in BCR18-CO/KS (Haig and Elliot-Smith 2004).

Habitat.—Breeds on sparsely-vegetated sand and gravel flats, including river or lake beaches, sandpits associated with river channels, and river channel islands in NE (Sidle and Kirsch 1993, Faanes and Lingle 1995, Dinan and Johnsgard 2004).

Population density.—Breeding density on river channel islands of the Platte River in central NE is 0.0097 birds/ac (Faanes and Lingle 1995). Given the species' extremely limited and patchy distribution in the PLJV region, breeding density is not applicable at a landscape level.

20. Mountain Plover (*Charadrius montanus*)

Distribution and abundance.—Breeds virtually throughout BCR18-WY/CO, in extreme western BCR18-NE/KS/OK, and northern BCR18-NM/TX (Knopf 1996, Gillihan and VerCauteren 2003). Also breeds in extreme western BCR18-KS (Busby and Zimmerman 2001). Although BBS show higher abundance in southern BCR18-CO (1-3 birds/route) than other occupied areas of the PLJV region (<1 bird/route), there appears to be no significant variation among BCR-state areas of the PLJV region (Sauer et al. 2005).

Habitat.—Uses primarily shortgrass prairie in the PLJV region (Knopf 1996, Kingery 1998, Dinan and Johnsgard 2004), especially areas characterized by short, sparse grass, such as prairie dog towns; also uses cultivated cropland (Kingery 1996, Shackford et al. 1999, Busby and Zimmerman 2001).

Population density.—Estimates of breeding population density on shortgrass prairie with heavy summer grazing varied from 0.0135 (Buckland et al. 1993) to 0.019 birds/ac Wiens (1973) to 0.176 birds/ac (Giezentanner 1970) in northeastern CO. Density on prairie dog towns varies from 0.0256 birds/ac (Knopf 1996) to 0.175 birds/ac in MT (Olsen-Edge and Edge 1987).

Response to management.—Prefers areas heavily grazed areas and/or areas disturbed by prairie dog activity or fire (Kantrud and Kologiski 1982, Dechant et al. 2002b). In Giezentanner's (1970) two-year CO study, breeding density was much higher on shortgrass prairie that was heavily grazed during the summer than that which was grazed at less intense levels during the summer, or at any level of winter-grazing intensity.

21. Long-billed Curlew (*Numenius americanus*)

Distribution and abundance.—Breeds throughout BCR18-CO/WY/NE, western BCR18-KS/OK, northern BCR18-TX, and most of BCR18-NM, as well as western BCR19-NE (Dugger and Dugger 2002, Gillihan and VerCauteren 2003). BBS map shows clear pattern of relative abundance in the PLJV region as follows: (1) 3-10 birds/route in western part of BCR19-NE and area covering southeastern BCR18-CO, western BCR18-OK, and the northwestern portion of BCR18-TX, (2) <3

birds/route in BCR18-NE and much of BCR18-NM, and (3) <1 bird/route elsewhere in the species' PLJV range (Sauer et al. 2005).

Habitat.—Uses primarily sand sage and shortgrass prairie in CO and KS (Kingery 1998, Busby and Zimmerman 2001), and shortgrass, mixed grass, and sand hills prairie (Dinan and Johnsgard 2004) and wet prairie (Faanes and Lingle 1995) in NE. Also nests in cropland (Kingery 1998), fallow fields (Andrews and Righter 1992), or hay fields (Dugger and Dugger 2002), but use of these habitats is rare (Johnson et al. 2004). In southeastern CO, 68 % of nests were within 0.4 km of water (McCallum et al. 1977), showing that grassland habitat use is strongly influenced by the distribution of water. Playas may thus be particularly important to Long-billed Curlews, at least during some years.

Population density.—Breeding population density estimates are not available for the PLJV region, except from RMBO section surveys: BCR 18 – CO (0.0005 birds/ac averaged over 2 years). BCR 18 – NE (0.0021 birds/ac) and BCR 18 – NM (0.0046 birds/ac) each a one year only figure. In central (BCR19) NE, where the species is not abundant (Sauer et al. 2005), it occurs at much higher density in wet prairie (0.0081 birds/ac) than in upland prairie (0.0016; Faanes and Lingle 1995). Given the low abundance of this species in both central NE and the PLJV region (see Sauer et al. 2005), the Faanes and Lingle (1995) density estimates, which reflect the species' association with water, are likely applicable to the PLJV as a whole. Note that Long-billed Curlew is relatively abundant in southern BCR18-CO, BCR18-OK, and northern BCR18-TX (Sauer et al. 2005). In those areas, breeding density may be more similar to other areas where the species is relatively abundant, such as mixed grass prairie in western SD (0.064 birds/ac; Wiens 1973) and "shortgrass" grassland in ID (0.049 birds/ac; Redmond and Jenni 1986) (see Sauer et al. 2005).

Response to management.—Burning during the nonbreeding season can improve habitat for Long-billed Curlews by removing shrubs (Pampush and Anthony 1993). The species generally prefers grazed grasslands (Dechant et al. 2002g), but within areas having aridic soils, such as the PLJV area, density appears to be highest where grazing pressure is light (Kantrud and Kologiski 1982). Long-billed Curlews prefer grasslands with low grass height, and thus use mixed grass prairie that has been recently grazed (Dechant et al. 2002g).

Among different management conditions on OR grasslands, breeding density was lower on plots characterized by the presence of shrubs (i.e., bitterbrush [0.0101 birds/ac], open low shrub [0.0202 birds/ac] plots) than on plots characterized by grass cover (i.e., cheatgrass [0.0729 birds/ac], native bunchgrass [0.0283 birds/ac]) (Pampush and Anthony 1993).

22. Upland Sandpiper (*Bartramia longicauda*)

Distribution and abundance.—Breeds in BCR18-WY/NE/KS, northern BCR18-CO, virtually all of BCR19-NE/KS, and northern BCR19-OK (Houston and Bowen 2001, Gillihan and VerCauteren 2003). BBS map shows variation in abundance among areas of the PLJV: (1) 3-10 birds/route, on average, throughout BCR19-NE/KS and BCR18-NE, and (2) <1 bird/route, on average, elsewhere (BCR18-WY/CO/KS/OK) (Sauer et al. 2005).

Habitat.—Breeds in sand sage, shortgrass, and mixed grass prairie, and cropland, in CO (Kingery 1998); also uses sand hills prairie, wet meadow, hay, alfalfa, and cropland (e.g., wheat) in NE (Faanes and Lingle 1995, Dinan and Johnsgard 2004), as well as various types of pasture, fallow cropland, and CRP (Houston and Bowen 2001, Dechant et al. 2002a). In northeastern Colorado, birds foraged on heavily grazed pastures and cut alfalfa fields, as well as bare ground and cultivated crop fields (Bolster 1990). For nesting, however, Upland Sandpipers generally prefer grasslands with moderate grass cover, low woody cover, moderate-high litter cover, and little bare ground (Dechant et al. 2002a).

Population density.—Few density estimates are available for the PLJV region, but RMBO surveys found a BCR18-wide two-year average of 0.0004 birds/ac in native habitat. Data from BCR19-NE and the northern Great Plains are presented in Table 22.1.

Response to management.—Upland Sandpipers probably respond most positively to moderate levels of grazing and nonbreeding season burning (Kantrud and Kologiski 1982, Dechant et al. 2002a). Because of different habitat preferences for foraging and nesting, a mosaic of different management conditions is likely optimal for the species (Dechant et al. 2002a). The species prefers lightly grazed fields for nesting (Bolster 1990). In ND mixed grass and semi-permanent wetland basins, breeding density on spring- or season-long grazing plots was approximately half that on control and autumn-grazing plots (Bowen and Kruse 1993).

Table 22.1. Upland Sandpiper breeding density by habitat and geographic area.

Habitat	**D (birds/ac)**	**Comments**	**Reference**
Area			
Mixed grass prairie			
BCR19-NE	0.016	Upland prairie	Faanes and Lingle 1995
BCR19-NE	0.074	Wet prairie	Faanes and Lingle 1995
BCR19-NE	0.008	Upland prairie	Sporrong 2004
SD	0.040	Grazed	Lokemoen and Duebbert 1974
SD (western)	0.057	Ungrazed	Wiens 1973
ND	0.066	Managed w/ fire	Kirsch and Higgins 1976
ND (s-c.)	0.034	Grazed	Renken and Dinsmore 1987
ND (s-c.)	0.013	Ungrazed	Renken and Dinsmore 1987
ND (s-c.)	0.100	W/ wetland basins	Bowen and Kruse 1993
Agriculture			
BCR19-NE	0.046	Domestic hay	Faanes and Lingle 1995
BCR19-NE	0.004	Alfalfa	Faanes and Lingle 1995
NE	0.004	Alfalfa	Houston and Bowen 2001
NE (c.)	0.004	Wheat	Faanes and Lingle 1995
NE	0.040	Corn—organic	Beecher et al. 2002
NE	0.002	Corn—non-organic	Beecher et al. 2002
NE	0.113	Soybean	Fitzmaurice 1995
ND (s-c.)	0.004	Alfalfa-wheatgrass	Renken and Dinsmore 1987
ND	0.007	Rowcrop	Johnson and Igl 1995
IA	0.0004	Rowcrop	Patterson and Best 1996
CRP			
ND	0.0024		Johnson and Igl 1995
IA	0.004		Patterson and Best 1996

23. American Avocet (*Recurvirostra americana*)

Distribution and abundance.—Breeds throughout most of PLJV (Gillihan and VerCauteren 2003), but distribution is irregular and patchy in much of BCR18-KS and BCR19-KS/OK (Robinson et al. 1997). BBS maps shows some variation in abundance among areas in the PLJV region, as follows: (1) 1-3 birds/route, on average, in BCR18-TX and BCR19-TX, and in western BCR19-NE, and (2) <1 bird/route, on average, throughout most of the PLJV region (Sauer et al. 2005).

Habitat.—Breeds in freshwater, alkaline, and playa wetlands (Dinan and Johnsgard 2004), typically shallow, permanent wetlands with little herbaceous cover (Faanes and Lingle 1995) in NE. Breeds in both playas and saline lakes in BCR18-TX (Conway et al. 2005).

Population density.—Few regional breeding density estimates are available. In western OK, 0.0099 birds/ac occurred on the salt flats of Salt Plains NWR (Grover and Knopf 1982). Just west of the PLJV region, 0.057 birds/ac were found breeding in appropriate habitat in Colorado's San Luis Valley (Laubhan and Gammonley 2000). RMBO surveys throughout CO report a single-year density estimate of 0.1186 birds/ac (Leukering et al. 2004).

24. Wilson's Phalarope (*Phalaropus tricolor*)

Distribution and abundance.—Breeds through much of BCR18-WY/NE and northern BCR19-NE, and patchily in BCR18-CO/KS and BCR19-KS (Colwell and Jehl 1994, Gillihan and VerCauteren 2003, Sauer et al. 2005). BBS maps show no widespread variation in abundance among areas in the PLJV region, although abundance in western BCR19-NE is higher than other occupied areas in the PLJV (Sauer et al. 2005).

Habitat.—Breeds in freshwater and saline marsh/wet meadow and playa habitats in NE (Dinan and Johnsgard 2004); prefers wetlands with open water, emergent vegetation, and open shorelines (Johnson et al. 2004). Also breeds in low density in upland mixed grass prairie in ND (Renken and Dinsmore 1987).

Population density.—Estimates of breeding density are not available for the PLJV region. In central (BCR19) NE, Fannes and Lingle (1995) found 0.082 birds/ac in prairie wetland, and only 0.0016 birds/ac in wet prairie, indicating relatively low densities occur in more upland grasslands. A three-year study in ND, where the species is much more abundant than anywhere in the PLJV (Sauer et al. 2005), found density to be highest on tillage (0.506 birds/ac), temporary (0.368 birds/ac), and seasonal (0.234 birds/ac) wetlands, intermediate on semipermanent (0.093 birds/ac) and fen (alkaline groundwater; 0.041 birds/ac) wetlands, and lowest on permanent (0.0008 birds/ac) wetlands (Kantrud and Stewart 1984). In Colorado's San Luis Valley, breeding density was 0.057 birds/ac (Laubhan and Gammonley 2000). RMBO surveys throughout CO report a single-year density estimates of 0.0004 birds/ac (Leukering and Levad 2003) and 0.2097 birds/ac (Leukering et al. 2004), resulting in a two-year average density of 0.1051 birds/ac.

25. Least Tern (*Sterna antillarum*)

Distribution and abundance.—Breeds primarily in BCR19 portion of the PLJV region (i.e., BCR19-TX/OK/KS/NE), and sparingly into BCR18 (i.e., BCR18-NM/TX/CO/OK/KS/NE) (Thompson et al. 1997).

Habitat.—Breeds primarily in association with rivers, on sandy beaches, sandbars, and unvegetated islands, in the PLJV region (Thompson et al. 1997). Specifically, breeds on sand/gravel pits associated with major river channels in NE (Sidle and Kirsch 1993), river sandbars and salt flats near rivers in KS (Busby and Zimmerman 2001), and river islands and reservoir edges in eastern CO (Kingery 1998).

Population density.—In western OK, breeding density was 0.486 birds/ac on sand pits and 0.041 birds/ac on salt flats (Hill 1993). In north-central OK, breeding density was 0.486 birds/ac on salt flats (Schweitzer and Leslie 1999). Density in area units is not available for river-associated habitats (e.g., beaches, sandbars), but Hill (1993) reported 2.6 adults/linear km along the Cimarron River in northwestern OK.

26. Forster's Tern (*Sterna forsteri*)

Distribution and abundance.—Patchy breeding distribution in the PLJV region, in BCR18-WY/CO/NE and BCR19-NE/KS (McNicholl et al. 2001, Sauer et al. 2005). BBS data show very low

abundances (<1 bird/route) in PLJV region and no variation in abundance among occupied areas of the PLJV (Sauer et al. 2005).

Habitat.—Breeding is strongly associated with freshwater and saline marsh, including marshy borders or islands of lakes and rivers, in NE (Dinan and Johnsgard 2004) and throughout breeding range (McNicholl et al. 2001).

Population density.—No data available. The species does not breed at measurable densities on a landscape scale in the PLJV region.

27. Black Tern (*Chlidonias niger*)

Distribution and abundance.—Breeds patchily in BCR18-CO/WY/KS/NE and BCR19-KS/NE (Dunn and Agro 1995, Sauer et al. 2005). BBS data show species breeds at low densities (<1 birds/route, on average) in the PLJV region, within which there is no widespread variation in abundance among areas (Sauer et al. 2005).

Habitat.—Breeding habitat consists of shallow freshwater marsh, including marshy borders and islands of lakes and rivers (Dunn and Agro 1995). In NE, specifically noted breeding in association with freshwater and saline marshes and playa wetlands (Dinan and Johnsgard 2004).

Population density.— The species does not breed at measurable densities on a landscape scale in the PLJV region. In ND, where the species is much more abundant than anywhere in the PLJV region (Sauer et al. 2005), a three-year study found density to be highest on semipermanent (0.3635 birds/ac), followed by seasonal (0.1538 birds/ac) and fen (alkaline groundwater; 0.1393 birds/ac) wetlands, and lowest on permanent (0.0267 birds/ac) and temporary (0.047 birds/ac) wetlands (Kantrud and Stewart 1984).

28. Burrowing Owl (*Athene cunicularia*)

Distribution and abundance.—Breeds throughout the PLJV region, except in eastern BCR19-OK, and is resident year-round in southern BCR18-NM and southern BCR18/19-TX (Haug et al. 1993, Gillihan and VerCauteren 2003). BBS map shows pattern of variation in abundance in the PLJV region, as follows: (1) 3-10 birds/route in southern half of BCR18-CO and all of BCR18-OK, (2) 1-3 birds/route in northern half of BCR18-CO and throughout majority of BCR18-NM/TX/KS, and (3) <1 bird/route elsewhere in PLJV where species occurs (Sauer et al. 2005).

Habitat.—Predominantly uses shortgrass prairie in CO (Kingery 1998 **NC**), and in shortgrass and mixed grass in KS and NE (Busby and Zimmerman 2001, Dinan and Johnsgard 2004); shows strong association with prairie dog colonies throughout range (Haug et al. 1993), and also uses "badlands" in NE (Dinan and Johnsgard 2004).

Population density.—RMBO BCR18 surveys provide excellent breeding density data for the PLJV area (Table 28.1).

Response to management.—Burrowing Owls prefer heavily grazed grasslands, and apparently respond positively to fire, which reduces invasion of woody shrubs into grasslands (Kantrud and Kologiski 1982, Dechant et al. 2002f).

In BCR18, Burrowing Owls show strong preference for very short grass or barren ground with relatively few shrubs; uses areas with very short grass (0-10 % of grass > 15 cm tall) more than expected based on availability, and areas with > 10 % shrub cover less than expected based on availability (Sparks et al. 2005).

Table 28.1. Burrowing Owl breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference

Native prairie			
BCR18-wide	0.0033	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0024	4-yr avg	RMBO unpubl. data
BCR18-NE	0.0012	1 yr	RMBO unpubl. data
BCR18-OK	0.0200	1 yr	RMBO unpubl. data
BCR18-NM	0.0100	1 yr	RMBO unpubl. data
Prairie-dog colonies			
OK	0.213	panhandle	Butts 1973
Sagebrush grassland			
se WA	0.010	2 sites avg	Schuler et al. 1993

Table 28.2. Burrowing Owl breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0025	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0018	Sparks et al. 2005
Low (1-3%)	Managed	0.0038	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0021	Sparks et al. 2005
High (>10%)	Not managed	NA	Sparks et al. 2005

29. Short-eared Owl (*Asio flammeus*)

Distribution and abundance.—Resident in BCR18-WY/NE and western BCR19-NE, much of BCR18-CO/KS, and most of BCR19-KS (Holt and Leasure 1993, Gillihan and VerCauteren 2003). BBS data show that the species breeds in very low abundance (<1 bird/route) in the PLJV region, within which there is no clear pattern of variation in abundance (Sauer et al. 2005).

Habitat.—In CO, recorded breeding primarily in sand sage, shortgrass, and mixed grass grasslands, emergent marsh, pinyon-juniper woodland, and, less often, in shrublands (Kingery 1998). Breeds in shortgrass, mixed grass, and sand hills prairie in NE (Dinan and Johnsgard 2004). Documented breeding in wheat and other grain fields, fallow fields, alfalfa, and CRP in KS (Thompson and Ely 1989, Busby and Zimmerman 2001), and in hayfields and wet meadows elsewhere (Dechant et al. 2001b).

Population density.—No breeding population density data are available for the PLJV region. In Manitoba, where species is much more common than in the PLJV, density was 0.0057 birds/ac in prairie marsh (Clark 1975).

Response to management.—In general, Short-eared Owls respond negatively to grazing pressure, especially summer grazing (Kantrud and Higgins 1992), both generally (Dechant et al. 2001b) and particularly in the western Great Plains (Bock et al. 1993). Periodic habitat disturbance via burning or mowing likely benefits the species by increasing prey populations and stimulating plant growth (Dechant et al. 2001b).

30. Common Nighthawk (*Chordeiles minor*)

Distribution and Abundance.—Breeds throughout the PLJV region (Poulin et al. 1996, Gillihan and VerCauteren 2003). BBS data show variation in abundance in the PLJV as follows: (1) 3-10

birds/route throughout majority of BCR18-CO/NM/TX/OK and BCR19-TX/OK/KS, and (2) <3 birds/route elsewhere in the PLJV region (Sauer et al. 2005).

Habitat.—Common Nighthawks nest in a wide array of open habitats, most notably shortgrass and mixed grass prairie, sagebrush and other shrublands (Poulin et al. 1996, Kingery 1998). The species also breeds in open areas of woodlands (e.g., pinyon-juniper, ponderosa pine, riparian), as well as cropland in CO (Kingery 1998). In NE, recorded breeding in short grass, mixed grass, and sandhills prairie, including on prairie dog colonies (Dinan and Johnsgard 2004).

Population density.—RMBO surveys show a single-year density of 0.0056 birds/ac on native habitats throughout BCR18; additional data show variation in density by grass height and shrub cover categories (Table 30.1). Similarly, RMBO surveys in eastern CO (BCR18) grasslands report a single-year density estimate of 0.0059 birds/ac (Beason et al. 2005). Wiens (1973) reported a much higher density of 0.0267 birds/ac on heavily summer-grazed shortgrass prairie in BCR18-CO.

Response to management.—No data are available on how grassland condition or management affects habitat use or population density of this species.

Table 30.1. Common Nighthawk breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	Management	D (birds/ac)	Reference
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0056	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0061	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.003	Sparks et al. 2005
Low (1-3%)	Managed	0.0069	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0079	Sparks et al. 2005
High (>10%)	Not managed	0.0099	Sparks et al. 2005

31. Lewis's Woodpecker (*Melanerpes lewis*)

Distribution and abundance.—In northern portions of the PLJV region, breeds in BCR18-WY and northwestern BCR18-NE; farther south, resident in southern BCR18-CO, northern BCR18-NM, and, rarely, to western BCR18-OK (Tobalske 1997).

Habitat.—Breeds in lowland and foothill riparian deciduous woodland, and pinyon-juniper and ponderosa pine woodland in CO (Kingery 1998), and in northwestern BCR18-NE (Dinan and Johnsgard 2004). Preferred lowland riparian woodland habitat typically has an open canopy, a brushy understory, and the presence of snags (Tobalske 1997).

Population density.—Saab and Vierling (2001) reported a breeding season density of 0.008 birds/ac in cottonwood-dominated riparian woodland along the Arkansas River in central CO. The same authors reported a breeding density of 0.0323 birds/ac in burned ponderosa pine forest in Idaho. Blancher (2002) reports a 0.003 birds/ac BBS derived density in BCR 16-CO, and 0.0004 birds/ac in BCR 18 – NM.

32. Red-headed Woodpecker (*Melanerpes erythrocephalus*)

Distribution and abundance.—Breeding range covers all of NE, extreme eastern BCR18-WY, much of BCR18-CO and KS, all of BCR18-OK, portions of BCR18-NM, and northern parts of BCR19-KS; resident over northern BCR18/19-TX, BCR19-OK, and southern BCR19-KS (Smith et al. 2000). BBS map shows variation in relative abundance in the PLJV region as follows: (1) 3-10 birds/route, on

average, in BCR19-KS, (2) 1-3 birds/route, on average, throughout BCR19-OK and BCR19-NE, and (3) <1 birds/route throughout BCR18 (Sauer et al. 2005).

Habitat.—Breeds primarily in riparian woodland in BCR18-WY/CO/KS/NE (Gutzwiller and Anderson 1987, Kingery 1998, Busby and Zimmerman 2001, Dinan and Johnsgard 2004). In BCR 18 – OK also noted using cities where trees grow under artificial conditions. In eastern OK it breeds in almost any relatively open woodland with a few standing snags preferring open conditions and habitats with little understory (Reinking 2004).

Population density.—Few breeding population data are available for the PLJV region, but Wagner (1984a) documented 0.054 birds/ac in riparian woodland in southwestern KS. Density is much higher in riparian woodland along the central Platte River in BCR19-NE, where estimates range from 0.1142 birds/ac (Faanes and Lingle 1995) to 0.2753 birds/ac (Davis 2005). Density in residential areas in NE were 0.0502 birds/ac (Faanes and Lingle 1995). In southeastern OK (Muskogee Co.) densities in upland forest were 0.13 birds/ac (Carter 1967). BBC documented 0.01 birds/ac in Morton Co. KS in riparian woodland.

In SD, Rumble and Gobeille (2004) quantified variation in breeding density among seral stages of riparian woodland. Red-headed Woodpeckers did not use early and early-intermediate seral stages (0 birds/ac), but increased to 0.0202 birds/ac in late-intermediate seral stages, and 0.2389 birds/ac in late seral stages (Rumble and Gobeille 2004).

33. Western Kingbird (*Tyrannus verticalis*)

Distribution and abundance.—Breeds throughout the PLJV region (Gamble and Bergin 1996, Gillihan and VerCauteren 2003). BBS data show variation in abundance in the PLJV as follows: (1) >30 birds/route in BCR18-TX, (2) 10-30 birds/route, on average, throughout BCR18-WY/CO/NE/KS/OK/NM and BCR19-KS/TX, and (3) 3-10 birds/route, on average, in BCR19-NE/OK (Sauer et al. 2005).

Habitat.—Breeds in a wide array of open habitats (e.g., grasslands, desert shrub, pastures, agricultural land) where trees or other structures are available for nesting (Gamble and Bergin 1996). Most common in shortgrass and mixed grass prairie, cropland, riparian woodland, and pinyon-juniper woodland in CO (Kingery 1998). Uses sand sage, shortgrass, mixed grass, and sand hills prairie, badlands, and woodland (e.g., riparian) edge in NE (Dinan and Johnsgard 2004), as well as hay and alfalfa fields in central (BCR19) NE (Faanes and Lingle 1995).

Population density.—Density appears to vary more among areas within habitats than among habitats (Table 33.1). Note that Wagner's (1984a) density from riparian woodland in western KS appears to be abnormally high given other riparian woodland estimates (see Table 33.1), although Faanes and Lingle (1995) reported an 11-year average density of 1.094 birds/ac in central NE shelterbelts.

Response to management.—No data are available on how management (fire) or grazing affects Western Kingbird use of grassland and shrubland.

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Table 33.1. Western Kingbird breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Native prairie			
BCR18-wide	0.0560	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0550	4-yr avg	RMBO unpubl. data
BCR18-NE	0.0337	2-yr avg	RMBO unpubl. data
BCR18-KS	0.0595	2-yr avg	RMBO unpubl. data

BCR18-OK	0.1818	2-yr avg	RMBO unpubl. data
BCR18-NM	0.1092	1 yr	RMBO unpubl. data
Grassland			
Eastern (BCR18) CO	0.0145	4-yr avg	RMBO MCB data[1,2,3,4]
BCR 19-NE	0.0202	upland prairie	Faanes & Lingle 1995
Semidesert shrubland			
CO (statewide)	0.0088	4-yr avg	RMBO MCB data[1,2,3,4]
Riparian woodland			
CO (statewide)	0.0349	2-yr avg	RMBO MCB data[3,4]
Western (BCR18) KS	0.7557	1 yr	Wagner 1984a
BCR19-NE	0.0243	11 yr.	Faanes & Lingle 1995
SD	0	Early seral stage	Rumble & Gobeille 2004
SD	0	Early-mid seral	Rumble & Gobeille 2004
SD	0.0891	Mid-late seral	Rumble & Gobeille 2004
SD	0	Late seral stage	Rumble & Gobeille 2004
Agriculture			
BCR18-wide	0.0331	2-yr avg, dryland	RMBO unpubl. data
BCR18-CO	0.0722	2-yr avg, dryland	RMBO unpubl. data
BCR18-KS	0.0237	2-yr avg, dryland	RMBO unpubl. data
BCR18-NE	0.0369	1 yr, dryland	RMBO unpubl. data
BCR 19-NE	0.004	11 yr. - alfalfa	Faanes & Lingle 1995
BCR 19-NE	0.004	11 yr. - hayland	Faanes & Lingle 1995
Residential			
BCR 19-NE	0.2575	11 yr.	Faanes & Lingle 1995
All habitats			
BCR 19-OK	0.02		Baumgartner and Baumgartner 1992

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 33.2. Western Kingbird breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0482	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0439	Sparks et al. 2005
High (70-100%)	Light grazing	0.0429	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0409	Sparks et al. 2005
Low (1-3%)	Managed	0.0472	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0514	Sparks et al. 2005
High (>10%)	Not managed	0.0332	Sparks et al. 2005

34. Eastern Kingbird (*Tyrannus tyrannus*)

Distribution and abundance.—Except for southern areas of BCR18-NM/TX, breeds throughout the PLJV region (Murphy 1996, Gillihan and VerCauteren 2003). BBS data show variation in abundance within PLJV as follows: (1) 10-30 birds/route throughout BCR19-NE/KS, (2) 3-10 birds/route in BCR18-NE and BCR19-OK, (3) 1-3 birds/route, on average, over BCR18-WY/CO/KS, and (4) <1 bird/route elsewhere in PLJV (BCR18-OK/NM/TX and BCR19-TX) (Sauer et al. 2005).

Habitat.—Breeds in a wide variety of open habitats where scattered trees or patches of trees are available for nesting (Murphy 1996). Uses sand sage, shortgrass, mixed grass, and sand hills prairie, badlands, woodland (e.g., riparian) edge, and riparian shrub habitat in NE and CO (Kingery 1998, Dinan and Johnsgard 2004).

Population density.—Few estimates of breeding population density are available for the PLJV region. RMBO surveys show a single-year density of 0.0085 birds/ac on native habitat throughout BCR18 (Sparks et al. 2005).

Response to management.—No data are available on how management (fire) or grazing affects rangeland as foraging habitat for Western Kingbirds..

Table 34.1. Eastern Kingbird breeding density by habitat and geographic area.

Habitat **Area**	**D (birds/ac)**	**Comments**	**Reference**
Mixed grass prairie			
ND (s-c.)	0.1450	W/ shrubs	Arnold & Higgins 1986
ND (s-c.)	0.0110	W/out shrubs	Arnold & Higgins 1986
ND (s-c.)	0.0850	Grazed	Renken & Dinsmore 1987
ND (s-c.)	0.1680	Unmanaged	Renken & Dinsmore 1987
Riparian woodland			
CO	0.0672	3-yr avg	RMBO MCB data[1,2,3]
SD	0.2632	Early seral stage	Rumble & Gobeille 2004
SD	0.2105	Early-mid seral stage	Rumble & Gobeille 2004
SD	0.4291	Mid-late seral stage	Rumble & Gobeille 2004
SD	0.5304	Late seral stage	Rumble & Gobeille 2004
Unspecified			
BCR19-OK	0.060	Assumed native habitat	Baumgartner and Lawrence 1954
Agriculture			
ND (s-c.)	0.0040	Alfalfa-wheatgrass	Renken & Dinsmore 1987

[1] Leukering et al. 2002; [2] Leukering et al. 2004; [3] Beason et al. 2005

Table 34.2. Eastern Kingbird breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	NA	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	0.0080	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0036	Sparks et al. 2005
Low (1-3%)	Managed	0.0023	Sparks et al. 2005
Moderate (3-10%)	Managed	NA	Sparks et al. 2005
High (>10%)	Not managed	NA	Sparks et al. 2005

35. Scissor-tailed Flycatcher (*Tyrannus forficatus*)

Distribution and abundance.—Breeds throughout BCR19-KS/OK/TX and BCR18-KS/OK/TX, southeastern BCR18-CO, and southern half of BCR18-NM (Regosin 1998, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) 10-30 birds/route, on average, over BCR19-TX/OK, (2) 3-10 birds/route, on average, over BCR18-TX, (3) 1-

3 birds/route, on average, over BCR18-OK, and (4) <1 bird/route in BCR18/19-KS and BCR18-NM (Sauer et al. 2005).

Habitat.—Breeds in open, savanna-like, areas with scattered trees (Regosin 1998). The species is not generally associated with riparian woodland (e.g., KS; Busby and Zimmerman 2001), but appears to use that habitat in its limited CO range (Kingery 1998).

Population density.—Few estimates of breeding density are available, and fewer still for the PLJV region. RMBO surveys show a BCR18-wide single-year density estimate of 0.0056 birds/ac in native habitat, and 0.0167 birds/ac in native habitat in BCR18-NM (RMBO unpubl. data). In BCR19-OK, Regosin (1998) reported densities of 0.0405, 0.0567, and 0.0890 birds/ac in mesquite prairie, while Baumgartner and Lawrence (1954) reported an overall density of 0.01 birds/ac in eastern BCR19-OK. Data from two areas described as Floodplain Tallgrass Prairie Shrub-Sucession from Douglas County (BCR 22) in Kansas provides densities of 0.008262 and 0.0041 (BBC data).

Response to management.—Some evidence suggests that herbicide treatment and brush management practices that decrease the density of mesquite scrub may reduce availability of nest sites for Scissor-tailed Flycatchers (Nolte and Fulbright 1996).

Although additional data are needed, the few available RMBO density estimates from BCR18 suggest that Scissor-tailed Flycatchers may prefer grazed lands with low shrub density (Table 35.1).

Table 35.1. Scissor-tailed Flycatcher breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	Management	D (birds/ac)	Reference
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0031	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	NA	Sparks et al. 2005
Low (1-3%)	Managed	0.0128	Sparks et al. 2005
Moderate (3-10%)	Managed	NA	Sparks et al. 2005
High (>10%)	Not managed	NA	Sparks et al. 2005

36. Loggerhead Shrike (*Lanius ludovicianus*)

Distribution and abundance.—Breeds throughout PLJV (resident in NM, TX, and OK) (Yosef 1996, Gillihan and VerCauteren 2003). BBS data show abundance as 1-3 birds/route, on average, over the entire PLJV region, except for BCR18-OK/KS where abundance is <1 bird/route (Sauer et al. 2005).

Habitat.—Breeds in wide array of open habitats with scattered trees or patches of trees (e.g., riparian woodland) (Yosef 1996). Uses native grasslands throughout BCR18 (Sparks et al. 2005), in addition to cropland, riparian woodland, and pinyon-juniper woodland in CO (Kingery 1998). Uses sand sage, shortgrass, mixed grass, and sand hills prairie, and riparian shrub habitats in NE (Dinan and Johnsgard 2004). Prefers pasture, alfalfa, and oats over row crops (Dechant al. 2002c).

Population density.—Few data available for the PLJV region, but see Tables 36.1 and 36.2. Note that breeding density in sagebrush grassland in southeastern WA was 0.0015 birds/ac (Schuler et al. 1993), which is generally similar to that observed in BCR19 (see Table 36.1).

Response to management.—In shortgrass habitats, Loggerhead Shrikes appear to prefer ungrazed areas, which provide taller grass (> 20 cm) than grazed areas (Prescott and Collister 1993—**NC**). Fire likely benefits the species by stimulating herbaceous growth, preventing woody vegetation from dominating the habitat, and generally maintaining habitat heterogeneity (Dechant et al. 2002c).

In native grasslands across BCR18, uses habitats with very short grass (0-10 % of grass > 15 cm tall) more than expected based on availability, and areas with over 3 % shrub cover more than expected based on availability (avoids areas with < 1 % shrub cover) (Table 36.2; Sparks et al. 2005).

Table 36.1. Loggerhead Shrike breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Native prairie			
BCR18-wide	0.0069	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0045	4-yr avg	RMBO unpubl. data
BCR18-NM	0.0233	1 yr	RMBO unpubl. data
BCR19-NE	0.0016	Upland prairie	Faanes and Lingle 1995
BCR19-NE	0.0016	Wet prairie	Faanes and Lingle 1995
Unspecified Payne Co.			
BCR19-OK	0.0027		Baumgartner & Baumgartner 1992
BCR19-OK	0.0080	"best habitat"	Baumgartner & Baumgartner 1992

Table 36.2. Loggerhead Shrike breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	Management	D (birds/ac)	Reference
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0051	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0060	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0018	Sparks et al. 2005
Low (1-3%)	Managed	0.0100	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0049	Sparks et al. 2005
High (>10%)	Not managed	0.0220	Sparks et al. 2005

37. Bell's Vireo (*Vireo bellii*)

Distribution and abundance.—Breeds throughout BCR19 and BCR18-KS/OK, and in northern parts of BCR18-NE, eastern portions of BCR18-CO, northern parts of BCR18-TX, and southern portions of BCR18-NM/TX (Brown 1993). BBS data show little variation in relative abundance in the PLJV region, with <1 bird/route found, on average, where species breeds in PLJV, but higher (1-3 birds/route) in BCR19-KS (Sauer et al. 2005).

Habitat.—Breeds in riparian woodland and riparian shrubland in CO (Kingery 1998), but also shrubby areas (e.g., draws) in upland habitats (e.g., mixed grass prairie) farther east (e.g., KS, Busby and Zimmerman 2001). Uses upland shrub and riparian shrub habitats, mixed grass and sand hills prairie in NE (Dinan and Johnsgard 2004).

Population density.—See Table 37.1.

Response to management.—No data available.

Table 37.1. Bell's Vireo breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Mixed grass prairie			
BCR19-NE	0.0008	Upland prairie	Faanes & Lingle 1995

Riparian woodland			
BCR19-NE	0.0178		Faanes & Lingle 1995[a]
BCR19-NE	0.0162		Davis 2005; see also Colt 1997
BCR19-OK	2.91	Early seral stage	Byre & Kuhnert 1996[b]
SD	0.0	Early seral stage	Rumble & Gobeille 2004
SD	0.0	Early-mid seral stage	Rumble & Gobeille 2004
SD	0.004	Mid-late seral stage	Rumble & Gobeille 2004
SD	0.008	Late seral stage	Rumble & Gobeille 2004
Grassland-shrub			
BCR 22 - KS	0.0248	Floodplain - Tallgrass Shrub-Sucession	BBC
MO	0.0891		Budnik et al. 2000
Unspecified			
BCR19-OK	0.400	Payne County	Baumgartner & Lawrence 1954
OK (statewide)	0.180		Baumgartner & Baumgartner 1992

[a] Note that Faanes and Lingle (1995) found much higher densities (0.2186 birds/ac) on river channel islands.
[b] Note that this density estimate is exceptionally high and therefore anomalous.

38. Black-capped Vireo (*Vireo atricapilla*)

Distribution and abundance.—In the PLJV region, breeds in BCR19-OK and southern BCR19-TX (Grzybowski 1995).

Habitat.—Breeding habitat is structurally-heterogeneous scrub-shrubland with scattered clumps of deciduous shrubs, especially oaks, and open areas (Grzybowski 1995). Birds at Wichita Mountains NWR prefer what is classified as "hilly stone savannah".

Population density.—Almost no data available. Extrapolating from habitat surveys at Wichita Mountains NWR in southwestern OK (BCR 19). Density figures have been provided for areas burned within the last 15 years (0.1419 birds/ac) and those where fires have not recently occurred (0.1116 birds/ac.) (C. Kimball, pers. comm., 2006). Baumgartner and Baumgartner, 1992, cite information from a doctoral thesis at University of Oklahoma in the 1950s detailing 10-12 pairs/mi² (averaging 22 birds/640 ac or 0.0343 birds/ac).

Response to management.—Black-capped Vireo prefer areas which have been burned within the previous fifteen years. Hot, naturally ignited fires have produced the highest response rate from Black-capped Vireos. Cool, controlled burns at Wichita Mountains have not produced the desired population response.

39. Pinyon Jay (*Gymnorhinus cyanocephalus*)

Distribution and abundance.—Breeds in southern half of BCR18-CO and northern BCR18-NM, western BCR18-OK, and (irregularly) northwestern BCR18-NE (Balda 2002). BBS data show species is more common in southern BCR18-CO (1-3 birds/route, on average) than in BCR18-NM/OK (<1 bird/route, on average) (Sauer et al. 2005).

Habitat.—Breeding birds are associated primarily with pinyon-juniper woodland in the PLJV area (e.g., CO; Andrews and Righter 1992, Kingery 1998), but may also use scrub oak and sagebrush habitats (Balda 2002).

Population density.—Few data are available. Single-year estimates of breeding population density in Colorado pinyon-juniper woodland include 0.0109 and 0.0081 birds/ac, resulting in a two-year average density of 0.0095 birds/ac (Leukering et al. 2004, Beason et al. 2005 – MCB reports).

Inference from studies in Arizona (Balda 2002) is 0.0133 birds/ac. in pinyon-juniper habitat. Blancher (2002) reports 0.0033 birds/ac in BCR 16-NM presumed to be primarily pinyon-juniper habitat.

Response to management.—No data available.

40. Chihuahuan Raven (*Corvus cryptoleucus*)

Distribution and abundance.—Resident throughout BCR18-NM/TX/OK, southern BCR18-CO/KS, throughout BCR19-TX, and western extreme of BCR19-OK (Bednarz and Raitt 2002, Gillihan and VerCauteren 2003). BBS data shows variation in relative abundance in the PLJV region as follows: (1) 3-10 birds/route, on average, throughout BCR18-NM/TX, (2) 1-3 birds/route, on average, in BCR18-OK and in southern half of BCR18-CO, and (3) <1 bird/route, on average, in BCR19-TX and where it occurs in western BCR19-OK (Sauer et al. 2005).

Habitat.—Breeding habitat consists of open grassland/shrubland, particularly shinnery oak and mesquite in eastern NM and TX (Bednarz and Raitt 2002). Uses primarily shortgrass prairie with few trees in CO, KS, and OK (Baumgartner and Baumgartner 1992, Andrews and Righter 1992, Bednarz and Raitt 2002), but also outcrops, pinyon-juniper woodland, riparian woodland, and cropland in CO (Kingery 1998).

Population density.—Few density estimates are available for the PLJV region (Tables 40.1 and 40.2).

Response to management.—Data are not available on the species' response to fire management or grazing. Herbicide treatment to reduce shinnery oak caused significant reductions in Chihuahuan Raven reproductive success, either through reduced food availability or direct interference with physiological processes (Bednarz and Raitt 2002).

Table 40.1. Chihuahuan Raven breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Native prairie			
BCR18-wide	0.0054	1 yr	RMBO unpubl. data
BCR18-CO	0.0018	2-yr avg	RMBO unpubl. data
BCR18-NM	0.0084	1 yr	RMBO unpubl. data
BCR18-NM	0.0013		Bednarz et al. 1990

Table 40.2. Chihuahuan Raven breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	Management	D (birds/ac)	Reference
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.003	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0013	Sparks et al. 2005
Low (1-3%)	Managed	NA	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0051	Sparks et al. 2005
High (>10%)	Not managed	0.0048	Sparks et al. 2005

41. Cassin's Sparrow (*Aimophila cassinii*)

Distribution and abundance.— Except for BCR18-WY and northern BCR18-NE, breeds throughout BCR18, and in western BCR19-KS/OK and throughout BCR19-TX (Dunning et al. 1999, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) 30-100 birds/route throughout BCR18-NM, (2) 10-30 birds/route, on average, throughout BCR18-CO/OK, BCR18-TX, and BCR19-TX, (3) 3-10 birds/route in BCR18-KS, and (4) <1 bird/route in BCR18-WY/NE, where it occurs in BCR19-NE, and, on average, over BCR19-KS/OK (Sauer et al. 2005).

Habitat.—Uses grasslands with scattered shrubs or small trees (e.g., mesquite, oak) (Dunning et al. 1999), primarily shortgrass and sand sage prairie in CO (Kingery 1998) and shortgrass in KS (Busby and Zimmerman 2001), and cropland (e.g., wheat, Thompson and Ely 1992) throughout range. Uses sand sage in NE (Dinan and Johnsgard 2004). Uses CRP planted in native grasses in TX (Berthelsen and Smith 1997).

Population density.—Estimates for the PLJV region come from RMBO surveys and from the literature (Tables 41.1 and 41.2).

Response to management.—Cassin's Sparrow appears to be relatively sensitive to grazing, avoiding moderately to heavily grazed land in favor of ungrazed land (Bock and Webb 1984). The species' prefers intermediate mesquite cover (see Dunning et al. 1999). Although Cassin's Sparrows tend to avoid recently burned areas, fire likely benefits the species by creating a heterogeneous habitat structure and providing areas of bare ground for foraging (Dunning et al. 1999).

In BCR18 Cassin's Sparrows prefer native habitats with intermediate grass height (avoids areas of 0-10 % of grass > 15 cm tall and areas of 91-100 % of grass > 15 cm tall more than expected based on availability, preferring areas with 41-80 % of grass > 15 cm tall); also avoids habitat with < 1 % shrub cover more than expected based on availability, preferentially using habitat with > 1 % shrub cover (Sparks et al. 2005).

Table 41.1. Cassin's Sparrow breeding density by habitat and geographic area.

Habitat **Area**	**D (birds/ac)**	**Comments**	**Reference**
Native prairie			
BCR18-wide	0.0714	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0496	4-yr avg	RMBO unpubl. data
e. (BCR18) CO	0.0348	4-yr avg	RMBO MCB data[1,2,3,4]
BCR18-KS	0.1473	2-yr avg	RMBO unpubl. data
BCR18-OK	0.1435	2-yr avg	RMBO unpubl. data
BCR18-NM	0.1484	1 yr	RMBO unpubl. data
Sand sage			
BCR18-wide	0.1766	1-3% shrub cover	RMBO unpubl. data
BCR18-wide	0.1485	>10% shrub cover	RMBO unpubl. data
BCR18-KS	0.2374	1 yr	BBC unpublished
Sagebrush-yucca			
BCR18-KS	0.4318	Burned	Wagner 1984b
BCR18-KS	0.5398	Untreated	Wagner 1984c
CRP			
BCR18-wide	0.0544	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0476	1 yr	RMBO unpubl. data
BCR18-OK	0.1196	1 yr	RMBO unpubl. data
BCR18-TX	1.3760	Native CRP	Berthelsen and Smith 1995
Dryland agriculture			

BCR18-wide	0.0084	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0058	1 yr	RMBO unpubl. data
BCR18-KS	0.0170	1 yr	RMBO unpubl. data
BCR18-OK	0.0483	1 yr	RMBO unpubl. data
Unspecified			
BCR18-TX	0.1557	Midland area	Williams and LeSarrier 1968
BCR18-TX	0.1012	Midland area	Williams and LeSarrier 1968

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 41.2. Cassin's Sparrow breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0502	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0979	Sparks et al. 2005
High (70-100%)	Light grazing	0.0743	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0198	Sparks et al. 2005
Low (1-3%)	Managed	0.0619	Sparks et al. 2005
Moderate (3-10%)	Managed	0.1326	Sparks et al. 2005
High (>10%)	Not managed	0.2170	Sparks et al. 2005

42. Brewer's Sparrow (*Spizella breweri*)

Distribution and abundance.—Widespread breeder in BCR18-WY/CO and southern BCR18-NE; very limited breeding in BCR-NE/KS/OK/NM/TX (Rotenberry et al. 1999, Sauer et al. 2005, Gillihan and VerCauteren 2003). BBS maps reflect variation in relative abundance from west to east in BCR18, as follows: (1) 3-10 birds/route throughout BCR18-WY, (2) 1-3 birds/route, on average, over BCR18-CO, and (3) <1 bird/route on eastern fringe of range, in western BCR18-NE/KS and portions of BCR18-NM/TX (Sauer et al. 2005).

Habitat.—Breeds in habitats where native shrubs, especially sagebrush, and bunchgrasses are co-dominant (Walker 2004). Breeds in shortgrass prairie in CO, and sand sage in CO, KS, and NE (Kingery 1998, Busby and Zimmerman 2001, Dinan and Johnsgard 2004).

Population density.—Estimates for the PLJV region come from RMBO surveys and from the literature (Tables 42.1, 42.2, 42.3).

Response to management.—Although Brewer's Sparrow often show short-term decline following fire, partial fire (i.e., fire that does not remove all shrub cover) does not negatively affect, and may benefit, populations (Peterson and Best 1987, Walker 2004). Brewer's Sparrows typically occur at higher densities and have higher nest success in ungrazed or lightly-moderately grazed areas than in heavily grazed areas (Kantrud and Kologiski 1982, Walker 2004).

In BCR18, Brewer's Sparrows use habitats with very short grass (0-10 % of grass > 15 cm tall) and > 10 % shrub cover more than expected based on availability; avoids habitats with very tall grass (91-100 % of grass > 15 cm tall) and habitats with < 1 % shrub cover more than expected based on availability (Sparks et al. 2005). Work by Giezentanner (1970) and Wiens (1973) on shortgrass prairie shows that species responds negatively to all levels of breeding-season grazing pressure.

Table 42.1. Brewer's Sparrow breeding density by habitat and geographic area.

Habitat	**D (birds/ac)**	**Comments**	**Reference**
Area			

Native prairie			
BCR18-wide	0.0041	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0128	3-yr avg	RMBO unpubl. data
e. (BCR18) CO	0.0197	3-yr avg	RMBO MCB data[2,3,4]
Sagebrush-yucca			
BCR18-KS	0.1079	Untreated	Wagner 1984c
Pinyon-juniper wood			
CO (statewide)	0.0237	4-yr avg	RMBO MCB data[1,2,3,4]
Mixed grass prairie			
BCR19-NE	0.0032	Upland prairie	Faanes and Lingle 1995

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 42.2. Brewer's Sparrow breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0037	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	NA	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0025	Sparks et al. 2005
Low (1-3%)	Managed	0.0044	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0040	Sparks et al. 2005
High (>10%)	Not managed	0.0191	Sparks et al. 2005

Table 42.3. Brewer's Sparrow breeding density among grazing regimes on shortgrass prairie in northeastern (BCR18) CO.

Grazing intensity	**Grazing season**	**Shrub density**	**D (birds/ac)**	**Reference**
Heavy	Summer	Low	0.0	Giezentanner 1970
Moderate	Summer	Low	0.0	Giezentanner 1970
Light	Summer	Low	0.0	Giezentanner 1970
Heavy	Winter	Moderate	0.200	Giezentanner 1970
Heavy	Winter		0.103	Wiens 1973
Moderate	Winter	High	0.336	Giezentanner 1970
Moderate	Winter		0.290	Wiens 1973
Light	Winter	High	0.296	Giezentanner 1970
Light	Winter		0.230	Wiens 1973

43. Lark Sparrow (*Chondestes grammacus*)

Distribution and abundance.—Breeds throughout the PLJV region, and is resident in extreme south (Martin and Parrish 2000, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) 10-30 birds/route, on average, throughout BCR18-NE, BCR19-OK/TX, and BCR18-NM, (2) 3-10 birds/route, on average, throughout BCR18-TX/OK/KS/CO and BCR19-NE/KS (Sauer et al. 2005).

Habitat.—Grasslands with a shrub component, and other open habitats with scattered shrubs or trees, including cropland, fallow fields, pastures, savannah and open woodland (Martin and Parrish 2000, Johnson et al. 2004). Uses shortgrass, sand sage, and mixed grass prairie, outcrops, and cropland in CO (Kingery 1998), shortgrass, sand sage, mixed grass, and sand hills prairie in NE (Dinan and

Johnsgard 2004), and noted in pasture in OK (Reinking 2004), and fallow fields and borders of cultivated fields in KS (Busby and Zimmerman 2001).

Population density.—Estimates for the PLJV area come from RMBO surveys and from the literature (Tables 43.1, 43.2).

Response to management.—Fire generally affects Lark Sparrow populations positively in the short term, barring the complete removal of woody shrubs, and the birds gradually decrease their use of burned areas over time (Martin and Parrish 2000, Dechant et al. 2002e). In TX mesquite grassland, breeding density decreased as grass cover increased over 55 % (Renwald 1977). Lark Sparrows prefer grazed over ungrazed habitats (Martin and Parrish 2000), and, in Arizona, often use areas with grass cover <15 cm tall and <3 % shrub cover (Bock and Webb 1984).

Table 43.1. Lark Sparrow breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Native prairie			
BCR18-wide	0.0916	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0665	4-yr avg	RMBO unpubl. data
e. (BCR18) CO	0.0247	3-yr avg	RMBO MCB data[1,2,3]
BCR18-NE	0.1222	2-yr avg	RMBO unpubl. data
BCR18-KS	0.1209	2-yr avg	RMBO unpubl. data
BCR18-OK	0.1289	2-yr avg	RMBO unpubl. data
BCR18-NM	0.1252	1 yr	RMBO unpubl. data
Sand sage prairie			
BCR18-wide	0.1371	1-3% shrub cover	RMBO unpubl. data
BCR18-wide	0.1470	>10% shrub cover	RMBO unpubl. data
BCR18-KS	0.0875		BBC unpubl.
Sage shrubland			
CO (statewide)	0.0439	4-yr avg	RMBO MCB data[1,2,3,4]
Upland prairie			
BCR19-NE	0.0340		Faanes & Lingle 1995
Sand hills prairie			
BCR19-NE	0.2510	Mgmt: bison w/ fire	Griebel et al. 1998
BCR19-NE	0.1457	Mgmt: cattle w/out fire	Griebel et al. 1998
Pinyon-juniper			
CO (statewide)	0.0095	2-yr avg	RMBO MCB data[2,3]
BCR 16-CO	0.4361	BBS derived density	Blancher 2004
Riparian woodland			
BCR19-NE	0.0016		Faanes & Lingle 1995
SD	0.1579	Early seral stage	Rumble & Gobeille 2004
SD	0.0931	Early-mid seral stage	Rumble & Gobeille 2004
SD	0.0607	Mid-late seral stage	Rumble & Gobeille 2004
SD	0.2834	Late seral stage	Rumble & Gobeille 2004
Unspecified habitat			
BCR19-OK (Payne Co.)	0.080		Baumgartner & Baumgartner 1992
Dryland agriculture			
BCR18-wide	0.0467	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0253	1 yr	RMBO unpubl. data
BCR18-KS	0.0871	1 yr	RMBO unpubl. data

Other agriculture			
BCR19-NE	0.0364	Soybeans	Fitzmaurice 1995

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 43.2. Lark Sparrow breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0680	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0654	Sparks et al. 2005
High (70-100%)	Light grazing	0.0831	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0334	Sparks et al. 2005
Low (1-3%)	Managed	0.0645	Sparks et al. 2005
Moderate (3-10%)	Managed	0.1013	Sparks et al. 2005
High (>10%)	Not managed	0.1857	Sparks et al. 2005

44. Lark Bunting (*Calamospiza melanocorys*)

Distribution and abundance.—Breeds throughout the PLJV region, but irregularly in eastern portions of BCR19-KS/OK/TX and extreme southern BCR18 (the species is resident in portions of BCR18-OK/TX/NM) (Shane 2000, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) >100 birds/route throughout BCR18-WY/CO, (2) 30-100 birds/route, on average, throughout BCR18-NE/KS, (3) 10-30 birds/route in BCR18-OK, and (4) 1-3 birds/route, on average, elsewhere in PLJV (i.e., BCR18-NM/TX, BCR19-TX/OK/KS/NE) (Sauer et al. 2005).

Habitat.—Breeds in grasslands of low to moderate height, often with some shrubs, weedy fallow fields, CRP, hay, pasture, alfalfa (Dechant et al. 2000h, Sparks et al. 2005). Breeding associated primarily with shortgrass, sand sage, and mixed grass prairie in CO, KS, and NE (Kingery 1998, Busby and Zimmerman 2001, Dinan and Johnsgard 2004), plus sand hills prairie in NE (Dinan and Johnsgard 2004). Specifically noted using fallow cropland and stubble, cultivated crops (e.g., wheat), and alfalfa in OK and KS (Busby and Zimmerman 2001, Reinking 2004).

Population density.—Breeding population density is relatively similar among BCR18-state areas in interior of range (i.e., not including NM) (Table 44.1), and varies little among grass height and shrub density coverage categories (Sparks et al. 2005; Table 44.2).

Response to management.—Effects of burning on Lark Bunting populations are unclear. Effects of livestock grazing on Lark Buntings depend on grazing intensity and habitat. Heavy livestock grazing affects shortgrass populations of Lark Buntings negatively (Kantrud and Kologiski 1982), but has little effect in mixed grass (Shane 2000, Dechant et al. 2002i).

In BCR18 native habitats, Lark Bunting prefers taller grass (81-90 % and 91-100 % of grass > 15 cm tall), and avoids habitats with very short grass (0-10 % of grass > 15 cm tall); prefers habitats with no shrub cover (< 1 % shrub cover); avoids all shrub cover categories with > 1 % shrub cover (1-3 %, 3-10 %, and > 10 % shrub cover) (Sparks et al. 2005).

Table 44.1. Lark Bunting breeding density by habitat and geographic area.

Habitat Area	**D (birds/ac)**	**Comments**	**Reference**
Native prairie			
BCR18-wide	0.1532	2-yr avg	RMBO unpubl. data

BCR18-CO	0.2038	3-yr avg	RMBO unpubl. data
e. (BCR18) CO	0.1805	4-yr avg	RMBO MCB data[1,2,3,4]
BCR18-NE	0.1685	2-yr avg	RMBO unpubl. data
BCR18-KS	0.0978	2-yr avg	RMBO unpubl. data
BCR18-OK	0.1892	2-yr avg	RMBO unpubl. data
BCR18-NM	0.0235	1 yr	RMBO unpubl. data
Shortgrass			
BCR18-KS	0.2429		Wagner 1984d
Sand sage			
BCR18-wide	0.1342	1-3% shrub cover	RMBO unpubl. data
BCR18-wide	0.0760	>10% shrub cover	RMBO unpubl. data
Sage shrubland			
CO (statewide)	0.0834	4-yr avg	RMBO MCB data[1,2,3,4]
"Other" grassland			
BCR18-KS	0.2699	Burned sagebrush-yucca	Wagner 1984b
BCR18-KS	0.5398	Untreated sagebrush-yucca	Wagner 1984c
BCR18-CO	0.4533	Rabbitbrush	Fairbanks et al. 1977
BCR18-CO	0.3966	Sand dropseed	Fairbanks et al. 1977
BCR18-CO	0.2509	Seeded w/ crested wheatgrass	Fairbanks et al. 1977
BCR19-NE	0.1271	"upland prairie"	Faanes and Lingle 1995
BCR19-NE	0.0081	"wet prairie"	Faanes and Lingle 1995
CRP			
BCR18-wide	0.2156	2-yr avg	RMBO unpubl. data
BCR18-CO	0.3443	2-yr avg	RMBO unpubl. data
BCR 18-KS	0.1077	1-yr avg (from 2006)	RMBO unpubl. data
BCR18-OK	0.2044	2-yr avg	RMBO unpubl. data
Dryland agriculture			
BCR18-wide	0.1338	2-yr avg	RMBO unpubl. data
BCR18-CO	0.1526	2-yr avg	RMBO unpubl. data
BCR18-NE	0.1263	2-yr avg	RMBO unpubl. data
BCR18-KS	0.1797	2-yr avg	RMBO unpubl. data
BCR18-OK	0.0976	1 yr	RMBO unpubl. data
BCR19-NE	0.1822	Wheat	Faanes and Lingle 1995
BCR19-NE	0.0259	Alfalfa	Faanes and Lingle 1995

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 44.2. Lark Bunting breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0975	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.1123	Sparks et al. 2005
High (70-100%)	Light grazing	0.1266	Sparks et al. 2005
Shrub density coverage			
Very low (<1%)	Managed	0.0752	Sparks et al. 2005
Low (1-3%)	Managed	0.0622	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0696	Sparks et al. 2005
High (>10%)	Not managed	0.0568	Sparks et al. 2005

Table 44.3. Lark Bunting breeding density among grazing regimes on shortgrass prairie in northeastern (BCR18) CO.

Grazing intensity	Grazing season	Shrub cover	D (birds/ac)	Reference
Heavy	Summer	Low	0.0	Giezentanner 1970
Heavy	Summer		0.151	Wiens 1973
Moderate	Summer	Low	0.306	Giezentanner 1970
Moderate	Summer		0.310	Wiens 1973
Light	Summer	Low	0.530	Giezentanner 1970
Light	Summer		0.480	Wiens 1973
Heavy	Winter	Moderate	0.336	Giezentanner 1970
Heavy	Winter		0.416	Wiens 1973
Moderate	Winter	High	0.340	Giezentanner 1970
Moderate	Winter		0.290	Wiens 1973
Light	Winter	High	0.300	Giezentanner 1970
Light	Winter		0.300	Wiens 1973

45. Grasshopper Sparrow (*Ammodramus savannarum*)

Distribution and abundance.—Breeds virtually throughout the PLJV region, but may be absent and/or breed at very low densities in much of BCR18-NM (Vickery 1996, Sauer et al. 2005, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) 10-30 birds/route, on average, throughout BCR18-NE/CO/KS/OK and BCR19-NE/KS, (2) 3-10 birds/route, on average, throughout BCR18-WY, BCR18-TX, and BCR19-TX/OK, and (3) <1 bird/route in BCR18-NM (Sauer et al. 2005).

Habitat.—Breeds in native prairie, cropland, and CRP throughout BCR18 (Sparks et al. 2005). Known to use hayfields and pasture, and occasionally cultivated cropland (e.g., corn, oats), but at much lower density (Dechant et al. 2002d). In the PLJV region, breeds in shortgrass, sand sage, and mixed grass prairie in CO and NE (Kingery 1998, Dinan and Johnsgard 2004), plus sand hills prairie in NE (Dinan and Johnsgard 2004), midgrass and hayfields in KS (Busby and Zimmerman 2001); also noted using pasture and hay in OK (Reinking 2004).

Population density.—Breeding population density estimates recorded primarily within the PLJV region are presented in Tables 45.1 and 45.2.

Response to management.—Grasshopper Sparrow density typically decreases as grazing intensity increases, being significantly higher in lightly grazed than heavily grazed areas, and intermediate under moderate grazing intensity (Kantrud and Kologiski 1982).

In BCR18, used taller grasses (81-90 % and 91-100 % of grass > 15 cm tall) in greater proportions than expected based on availability. and used shorter grass (0-10 %, 11-20 %, and 21-30 % of grass > 15 cm tall) in lesser proportions; used habitats with no shrub cover (< 1 % shrub cover) in greater proportions than expected based on availability, and lesser proportions of habitats with taller shrub cover categories (1-3 % and 3-10 % shrub cover) (Sparks et al. 2005).

Table 45.1. Grasshopper Sparrow breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Native prairie			
BCR18-wide	0.0709	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0272	4-yr avg	RMBO unpubl.data
e. (BCR18) CO	0.0669	4-yr avg	RMBO MCB data[1,2,3,4]

BCR18-NE	0.1733	2-yr avg	RMBO unpubl. data
BCR18-KS	0.1579	2-yr avg	RMBO unpubl. data
BCR18-OK	0.3584	2-yr avg	RMBO unpubl. data
BCR18-NM	0.0452	1 yr	RMBO unpubl. data
"Other" grassland			
BCR18-KS	0.2159	Burned sagebrush-yucca	Wagner 1984b
BCR18-KS	0.1619	Untreated sagebrush-yucca	Wagner 1984c
BCR19-NE	0.03	"prairie wetland"	Faanes & Lingle 1995
BCR19-NE	0.119	"wet prairie"	Faanes & Lingle 1995
BCR19-NE	0.1457	"upland" prairie	Faanes & Lingle 1995
Shortgrass prairie			
BCR18-KS	0.2159		Wagner 1984d
BCR18-TX	0.069	Grazed	Wiens 1973
BCR18-TX	0.079	Ungrazed	Wiens 1973
Sand sage prairie			
BCR18-wide	0.1009	1-3% shrub cover	RMBO unpubl. data
BCR18-wide	0.0650	>10% shrub cover	RMBO unpubl. data
BCR18-KS	0.0013		BBC unpubl.
Sage shrubland			
CO (statewide)	0.0263	4-yr avg	RMBO MCB data[1,2,3,4]
Mixed Grass prairie			
Western SD	0.015	Grazed	Wiens 1973
Western SD	0.623	Ungrazed	Wiens 1973
Tallgrass prairie			
BCR22-OK	0.289	Grazed	Wiens 1973
North-central IA	0.0648	10 sites over 2 yrs avg.	Fletcher & Koford 2002
CRP			
BCR18-wide	0.2672	2-yr avg	RMBO unpubl. data
BCR18-CO	0.1958	1 yr	RMBO unpubl. data
BCR18-KS	0.7499	1 yr	RMBO unpubl. data
BCR18-OK	0.3460	2-yr avg	RMBO unpubl. data
BCR22- NE	0.211	4-yr avg	Delisle and Savidge 1997
Dryland agriculture			
BCR18-wide	0.1090	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0426	2-yr avg	RMBO unpubl. data
BCR18-KS	0.1378	2-yr avg	RMBO unpubl. data
BCR18-OK	0.4182	1 yr	RMBO unpubl. data
w-central NE	0.0583	11 yr - Alfalfa	Faanes & Lingle 1995
w-central NE	0.1012	11 yr – domestic Hayland	Faanes & Lingle 1995
w-central NE	0.0008	11 yr – corn	Faanes & Lingle 1995
w-central NE	0.0364	11 yr.- wheat	Faanes & Lingle 1995

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 45.2. Grasshopper Sparrow breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0328	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0486	Sparks et al. 2005

High (70-100%)	Light grazing	0.1583	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0539	Sparks et al. 2005
Low (1-3%)	Managed	0.0323	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0405	Sparks et al. 2005
High (>10%)	Not managed	0.0323	Sparks et al. 2005

46. Henslow's Sparrow (*Ammodrammas henslowii*)

Distribution and abundance.— Breeds in eastern BCR 19-KS and possibly in BCR 19-OK (Busby and Zimmerman 2001, Reinking 2004). BBS data show species breeds at low densities (<1 birds/route on average) where it is found in the PLJV region (Sauer et al. 2005).

Habitat.—Breeds on tallgrass prairie in KS and OK with a large amount of tall grasses and a heavy litter layer, and little woody vegetation (Busby and Zimmerman 2001, Reinking 2004).

Population density.—No estimates from the PLJV region. An estimate of 0.46135 birds/ac is an average of 27 studies across the species range (Robins 1967).

Response to management.—Abandons grasslands that have woody encroachment brought on by fire suppression. Returns to burned tallgrass areas after approximately 3 years when substantial litter layer has developed.

46. McCown's Longspur (*Calcarius mccownii*)

Distribution and abundance.—Breeds throughout BCR18-WY and the majority of BCR18-NE, and in extreme northern portion of BCR18-CO (With 1994, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in occupied portion of the PLJV region as follows: (1) 10-30 birds/route throughout BCR18-WY, and (2) 1-3 birds/route, on average, throughout BCR18-NE and where species occurs in BCR18-CO (Sauer et al. 2005).

Habitat.—Breeds on shortgrass prairie in CO and NE (Kingery 1998, Dinan and Johnsgard 2004), as well as mixed grass prairie of short stature, and overgrazed pastures (With 1994).

Population density.—Estimates for the PLJV region come from RMBO surveys and from the literature (Tables 46.1, 46.2, 46.3).

Response to management.—In the PLJV region, McCown's Longspur density may be high under both high and low grazing intensity (Giezentanner 1970), but generally appears to be highest under moderate to high grazing (Kantrud and Kologiski 1982).

In BCR18 McCown's Longspur prefers habitats with very short grass (0-10 % of grass > 15 cm tall) and avoids areas with tall grass (81-90 % and 91-100 % of grass > 15 cm tall); also prefers habitats with < 1 % shrub cover and avoids habitats with > 1 % shrub cover (1-3 %, 3-10 %, and > 10 %) (Sparks et al. 2005).

Table 46.1. McCown's Longspur breeding density by habitat and geographic area.

Habitat Area	**D (birds/ac)**	**Comments**	**Reference**
Native prairie			
BCR18-wide	0.0059	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0104	4-yr avg	RMBO unpubl. data
e. (BCR18) CO	0.0287	4-yr avg	RMBO MCB data[1,2,3,4]
BCR18-NE	0.0038	1 yr	RMBO unpubl. data

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

Table 46.2. McCown's Longspur breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	Management	D (birds/ac)	Reference
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0060	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0069	Sparks et al. 2005
High (70-100%)	Light grazing	0.0053	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0048	Sparks et al. 2005
Low (1-3%)	Managed	0.0066	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0050	Sparks et al. 2005
High (>10%)	Not managed	NA	Sparks et al. 2005

Table 46.3. McCown's Longspur breeding density among grazing regimes on shortgrass prairie in northeastern (BCR18) CO.

Grazing intensity	Grazing season	Shrub density	D (birds/ac)	Reference
Heavy	Summer	Low	0.356	Giezentanner 1970
Heavy	Summer		0.3182	Wiens 1973
Moderate	Summer	Low	0.000	Giezentanner 1970
Light	Summer	Low	0.220	Giezentanner 1970
Light	Summer		0.3299	Wiens 1973
Heavy	Winter	Moderate	0.000	Giezentanner 1970
Moderate	Winter	High	0.060	Giezentanner 1970
Moderate	Winter		0.0400	Wiens 1973
Light	Winter	High	0.000	Giezentanner 1970

47. Chestnut-collared Longspur (*Calcarius ornatus*)

Distribution and abundance.— Breeds throughout BCR18-WY and majority of BCR18-NE, and northern areas of BCR18-CO (Hill and Gould 1997, Gillihan and VerCauteren 2003). BBS data reflect relatively similar relatively abundances across species' range in the PLJV region, showing 1-3 birds/route, on average, throughout, with areas of much higher density (Sauer et al. 2005).

Habitat.—Breeds on shortgrass prairie in CO (Kingery 1998), and shortgrass and mixed grass prairie in NE (Dinan and Johnsgard 2004); uses areas with taller grass than McCown's Longspur (Hill and Gould 1997).

Population density.—Estimates for the PLJV region come from RMBO surveys and from the literature (Tables 47.1, 47.2).

Response to management.—In the PLJV region, Chestnut-collared Longspur density is highest under light to moderate grazing intensity (Giezentanner 1970, Kantrud and Kologiski 1982).

In BCR18, RMBO data suggest little pattern in preference for grass height (% cover of grass > 15 cm tall), but suggest a preference for habitat with no shrub cover (< 1 %) and avoids all habitats with > 1 % shrub cover (1-3 %, 3-10 %, and > 10 %) (Sparks et al. 2005).

Table 47.1. Chestnut-collared Longspur breeding density by habitat and geographic area.

Habitat Area	D (birds/ac)	Comments	Reference
Native prairie			
BCR18-wide	0.0054	1 yr	RMBO BCR18 data
BCR18-CO	0.0018	2-yr avg	RMBO BCR18 data
BCR18-NE	0.0214	1 yr	RMBO BCR18 data

Shortgrass prairie			
BCR18-CO	0.1000	Moderate summer grazing	Wiens 1973
BCR18-CO	0.0498	Light summer grazing	Wiens 1973
Mixed grass prairie			
SD	0.019	Ungrazed	Wiens 1973
ND	0.004	With shrubs	Arnold & Higgins 1986
ND	0.259	Without shrubs	Arnold & Higgins 1986
CRP			
SD, ND, MT	0.018	Native & non-native	Johnson & Swartz 1993
ND	0.002		Johnson & Igl 1995
Cropland			
ND	0.014		Johnson & Igl 1995

Table 47.2. Chestnut-collared Longspur breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0016	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0019	Sparks et al. 2005
High (70-100%)	Light grazing	0.0025	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	0.0019	Sparks et al. 2005
Low (1-3%)	Managed	NA	Sparks et al. 2005
Moderate (3-10%)	Managed	NA	Sparks et al. 2005
High (>10%)	Not managed	NA	Sparks et al. 2005

48. Painted Bunting (*Passerina ciris*)

Distribution and abundance.—Breeds throughout BCR19-TX/OK and southern BCR19-KS, and in parts of BCR18-TX/NM (Lowther et al. 1999). BBS data show variation in abundance in the PLJV region as follows: (1) 3-10 birds/route, on average, in BCR19-TX/OK, and (2) <1 bird/route, on average, in BCR18-TX, southern BCR19-KS, and where breeds in extreme eastern BCR18-NM (Sauer et al. 2005).

Habitat.—Generally breeds in semi-open areas with scattered trees and shrubby thickets (Lowther et al. 1999). Breeders associated with scrub oak and riparian shrub thickets in KS (Thompson and Ely 1992).

Population density.—Few breeding density data are available for the PLJV area. In eastern BCR19-OK (Payne Co.), Baumgartner and Lawrence (1954) reported 0.006 birds/ac. Farther west, in BCR18-TX, Seyffert (1967, 1968) reported a two-year average of 0.18 birds/ac in hillside woodland. Shugart and James reported 0.0607 birds/ac in AR.

Response to management.—No data available.

49. Dickcissel (*Spiza americana*)

Distribution and abundance.—Breeds throughout BCR19, except for northwestern portion of BCR19-NE, and throughout BCR18-KS/OK, eastern portions of BCR18-CO, most of BCR18-TX, and irregularly or at very low densities in BCR18-WY/NE and BCR18-NM (Temple 2002, Gillihan and VerCauteren 2003, Sauer et al. 2005). BBS map shows variation in relative abundance in the PLJV region as follows: (1) >100 birds/route throughout BCR19-KS, (2) 30-100 birds/route throughout

BCR19-OK, (3) 10-30 birds/route, on average, over BCR19-TX, BCR18-KS, and BCR19-NE, (4) 3-10 birds/route, on average, over BCR18-OK, and (5) <1 bird/route, on average, over BCR18-TX/NM/CO/WY/NE (Sauer et al. 2005).

Habitat.—Breeds in wide variety of grasslands of moderate-tall height, fallow and no-till farmland, pastures and hay fields, and CRP (Temple 2002, Dechant et al. 2002h). Uses mixed grass prairie, disturbed fields, CRP, cropland, and riparian woodland (edges) in CO (Kingery 1998); noted using pasture in OK (Reinking 2004), and native prairie, unmanaged prairie, hay, pasture, and cropland (alfalfa, clover, wheat) in KS (Thompson and Ely 1992, Busby and Zimmerman 2001). Uses mixed grass prairie and cropland in NE (Dinan and Johnsgard); also, noted using small grain cropland (wheat, corn), and hay and alfalfa fields in central NE (Faanes and Lingle 1995).

Population density.—Few estimates of breeding population density are available for the PLJV region. A single-year estimate from sand sage prairie in BCR18-KS was 0.025 birds/ac (BBC unpubl. data). A density from BCR 19-NE is 0.0324 birds/ac (Faanes and Lingle 1995). Estimates come from RMBO surveys and from the literature (Tables 49.1)

Breeding densities are much higher east of the PLJV region in Nebraska. In eastern Nebraska, average density estimates include 0.369 birds/ac in tallgrass prairie (3 years, 2 sites), and 0.425 birds/ac in wetland sedge meadow (2 years, 2 sites) (BBC unpubl. data).

Response to management.—In ND, Dickcissels use areas with high grass cover (> 75%) and low shrub cover (< 1%) (Renken and Dinsmore 1987). RMBO data also demonstrates that Dickcissels use low shrub cover more than would be expected based on availability . Beecher et al. (2002) demonstrated higher densities in organically grown corn (0.34818 birds/ac) vs. non-organically grown corn (0.08907 birds/ac).

Table 49.1. Dickcissel breeding density by habitat and geographic area.

Habitat Area	**D (birds/ac)**	**Comments**	**Reference**
Native prairie			
BCR18-wide	0.0033	2 yr avg	RMBO BCR18 data
BCR18-KS	0.0393	2-yr avg	RMBO BCR18 data
BCR18-NE	0.0214	1 yr	RMBO BCR18 data
BCR 19-KS	1.41643		Zimmerman 1971
Dryland agriculture			
BCR18-wide	0.0441	1 yr	RMBO BCR18 data
BCR18-KS	0.0716	1 yr	RMBO BCR18 data
Cropland			
NE –alfalfa	0.1093	11 yr	Faanes and Lingle 1995
NE – dom. hayland	0.0704	11 yr	Faanes and Lingle 1995
NE – corn	0.0028	11 yr	Faanes and Lingle 1995
NE - wheat	0.0016	11 yr	Faanes and Lingle 1995
NE - soybeans	0.05668	2 yr - only birds in crop	Fitzmaurice 1995
CRP			
NE	0.68	4 yr - Lancaster Co.	Delisle and Savidge 1997
IA	0.02364	20 sites – Marshall Co.	Patterson and Best 1996
ND	.006		Johnson and Igl 1995

50. Eastern Meadowlark (*Sturnella magna*)

Distribution and abundance.—Breeds virtually throughout BCR18- TX/OK/KS, southern BCR 18-NM, and throughout BCR19-TX/OK/KS/NE (Lanyon 1995, Gillihan and VerCauteren 2003, Sauer et al. 2005). BBS data show variation in relative abundance in the PLJV region as follows: (1) 30-100 birds/route, on average, over BCR19-TX/OK, (2) 10-30 birds/route, on average, over BCR18-NM and BCR19-KS, (3) 3-10 birds/route, on average, over BCR18-TX, (4) 1-3 birds/route, on average, in BCR19-NE, and (5) <1 bird/route on western fringe of range (i.e., BCR18-OK/CO/NE) (Sauer et al. 2005).

Habitat.—Most common in native grasslands, typically with moderate-tall grass and some low cover of woody vegetation, but also uses fallow cropland, pastures, hay, alfalfa, and CRP (Lanyon 1995, Hull 2002). In KS, uses primarily hay fields, pasture, and CRP (Busby and Zimmerman 2001), and also moist meadows and small grain fields (Thompson and Ely 1992). Uses mixed grass and sand hills prairie and wet meadows in NE (Dinan and Johnsgard 2004); uses primarily floodplain prairie along Platte River in central NE (Faanes and Lingle 1995). The species is associated with relatively mesic areas in the PLJV region, especially farther west (i.e., BCR18). In the TX panhandle, for example, Eastern Meadowlark is fairly common and relatively widespread in BCR19, where mesic areas are relatively widespread, but is confined to moist meadows associated with drainages in the more arid landscape of BCR18 (Seyffert 2001). In New Mexico shrubby areas with sandy soils in southern areas are used (NM PLJV landbird team) often in conjunction with shinnery.

Population density.—Available breeding population density data, while few, show very low density in BCR18. RMBO surveys show a BCR18-wide two-year average density of 0.0019 birds/ac in native habitat (RMBO unpubl. data; see also Table 50.1). In eastern BCR19-OK, average breeding density was 0.06 birds/ac (Baumgartner and Lawrence 1954) and from grazed tallgrass prairie in northeastern OK, Wiens (1973) determined a density of 0.357 birds/ac. Density in wet prairie in BCR19-NE was 0.0121 birds/ac (Faanes and Lingle 1995). East of BCR19, a density estimate from Lancaster Co., NE (BCR22) CRP was 0.028 birds/ac (Delisle and Savidge 1997), from southwestern WI pastures was 0.072 birds/ac averaged over 60 sites (Renfrew and Ribic 2002) and from southern IL fallow fields 0.04 birds/ac (Roseberry and Klimstra 1970). .

Response to management.—Eastern Meadowlark density is higher in moderately grazed than heavily grazed shortgrass prairie (Baker and Guthery 1990). Rangewide, optimal habitat is characterized by high (> 90%) herbaceous cover (including grass), moderate grass height, and low (< 5%) shrub cover (Schroeder and Sousa 1982). Note that RMBO data shows that densities are higher in areas with >10% shrub cover (Hanni and McLachlan 2004), but this deals with the southwestern subspecies *S.m. lilianae* and thus likely only appropriate for birds in southern BCR 18.

Table 50.1. Eastern Meadowlark breeding density (3-year average) by grass height and shrub cover in native (prairie) habitat in BCR18.

Vegetation	**Management**	**D (birds/ac)**	**Reference**
Grass-height coverage			
Low (0-30%)	Heavy grazing	0.0025	Sparks et al. 2005
Moderate (30-70%)	Mod. grazing	0.0034	Sparks et al. 2005
High (70-100%)	Light grazing	NA	Sparks et al. 2005
Shrub density coverage			Sparks et al. 2005
Very low (<1%)	Managed	NA	Sparks et al. 2005
Low (1-3%)	Managed	0.0013	Sparks et al. 2005
Moderate (3-10%)	Managed	0.0050	Sparks et al. 2005
High (>10%)	Not managed	0.0086	Sparks et al. 2005

51. Baltimore Oriole (*Icterus galbula*)

Distribution and abundance.—Western edge of breeding range lies more-or-less BCR18-BCR19 border; breeds throughout BCR19, except for BCR19-TX (breeds only in northeastern corner of BCR19-TX), and most of BCR18-KS, southern BCR18-NE, and extreme eastern BCR18-CO (Rising and Flood 1998, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) 10-30 birds/route over BCR19-KS, (2) 3-10 birds/route over majority of BCR19-NE, (3) 1-3 birds/route, on average, over BCR19-KS/OK, and (4) <1 bird/route where species occurs elsewhere in the PLJV (i.e., northeastern portion of BCR19-TX, BCR18-OK/KS/CO/NE (Sauer et al. 2005).

Habitat.—Breeds in diversity of habitats, but especially areas with scattered trees and woodland edge (riparian areas) including urban parks and suburban areas (Rising and Flood 1998). Primarily uses riparian areas, both open- and closed-canopied, in KS (Busby and Zimmerman 2001) and NE (Dinan and Johnsgard 2004), as well as shelterbelts in central NE (Faanes and Lingle 1995).

Population density.—Very few breeding population density estimates are available from PLJV region, especially BCR18.

Response to management.—In riparian woodland, density increases dramatically from early to late seral stages (Table 51.1; Rumble and Gobeille 2004).

Table 51.1. Baltimore Oriole breeding density by habitat and geographic area.

Habitat **Area**	**D (birds/ac)**	**Comments**	**Reference**
Riparian woodland			
BCR19-NE	0.3401	"Northern Oriole"	Faanes & Lingle 1995
BCR22-KS	0.1202	Average of two BBC	BBC data
SD	0.0486	Early seral stage	Rumble & Gobeille 2004
SD	0.1457	Early-mid seral stage	Rumble & Gobeille 2004
SD	0.2429	Mid-late seral stage	Rumble & Gobeille 2004
SD	0.3968	Late seral stage	Rumble & Gobeille 2004
Upland prairie			
BCR19-NE	0.0016		Faanes & Lingle 1995
Shelterbelts			
BCR 19 - NE	1.277		Faanes & Lingle 1995
Other			
BCR 19 - NE	0.1595	Residential	Faanes & Lingle 1995
BCR19-OK	0.08	Habitat unspecified	Baumgartner & Lawrence 1954

52. Bullock's Oriole (*Icterus bullockii*)

Distribution and abundance.—Eastern edge of breeding range more-or-less mirrors western edge of Baltimore Oriole breeding range, along the BCR18-BCR19 border; breeds throughout BCR18 and BCR19-TX and along w. edge of BCR19-OK/KS/NE (Rising and Williams 1999, Gillihan and VerCauteren 2003). BBS data show variation in relative abundance in the PLJV region as follows: (1) 3-10 birds/route, on average, throughout BCR18-CO/NM/TX and BCR19-TX, (2) 1-3 birds/route, on average, over BCR18-WY/NE/OK, and (3) <1 bird/route in w. areas of BCR19-NE/KS/OK (Sauer et al. 2005).

Habitat.—Like Baltimore Oriole on Great Plains, Bullock's Oriole primarily breeds in riparian woodland in BCR18 (Rising and Williams 1999), including CO (Kingery 1998), KS (Busby and Zimmerman 2001), NE (Dinan and Johnsgard 2004).

Population density.—Few estimates of breeding population density are available for the PLJV region. RMBO surveys provide valuable data on a landscape scale in BCR18, and within specific habitats throughout CO (Table 52.1). Wagner (1984a) reported 0.7557 birds/ac in riparian woodland in western KS, but this may refer to both Baltimore and Bullock's orioles combined.

Response to management.—Bullock's Oriole increases in density as riparian woodland advances from early to late seral stages, similar to that documented for Baltimore Oriole (see Table 51.1; Rumble and Gobeille 2004).

Table 52.1. Bullock's Oriole breeding density by habitat and geographic area.

Habitat Area	**D (birds/ac)**	**Comments**	**Reference**
Native habitat			
BCR18-wide	0.0072	2-yr avg	RMBO unpubl. data
BCR18-CO	0.0056	4-yr avg	RMBO unpubl. data
BCR18-NM	0.0172	1 yr	RMBO unpubl. data
Riparian woodland			
CO (statewide)	0.0419	3-yr avg	RMBO MCB data[1,3,4]
Semi-desert shrubland			
CO (statewide)	0.0172	2-yr avg	RMBO MCB data[2,3]

[1] Leukering et al. 2002; [2] Leukering & Levad 2003; [3] Leukering et al. 2004; [4] Beason et al. 2005

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