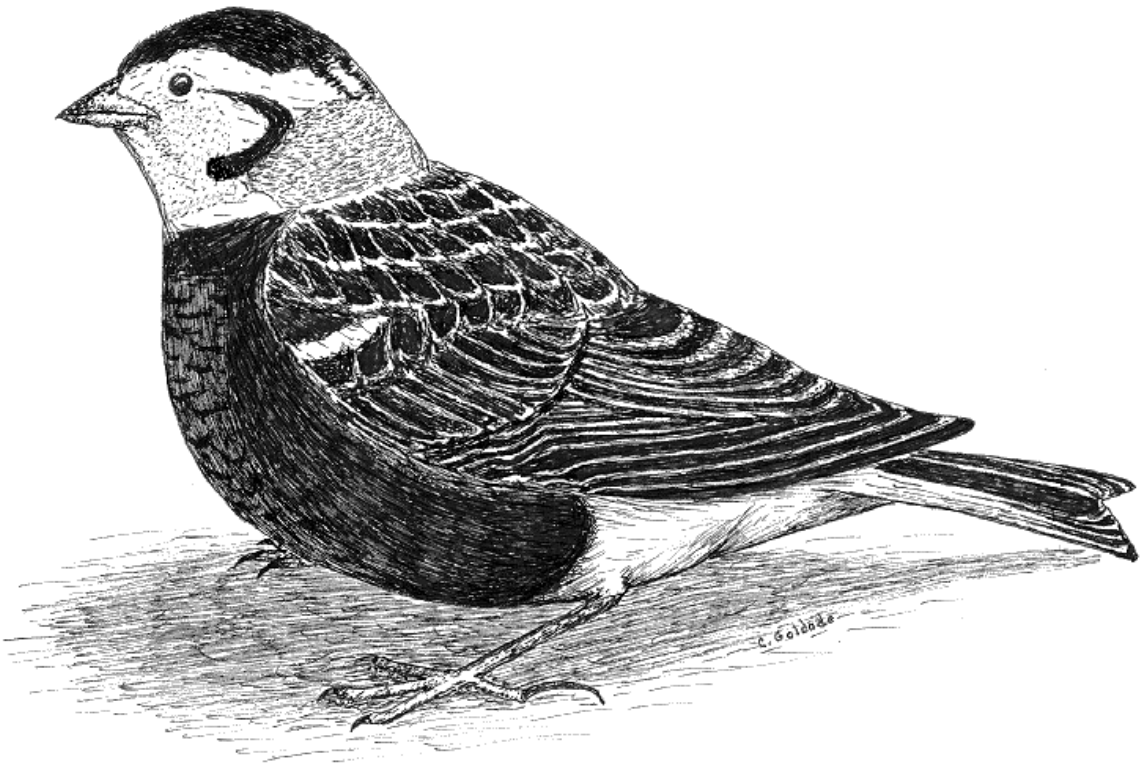
EFFECTS OF MANAGEMENT PRACTICES ON GRASSLAND BIRDS:

CHESTNUT-COLLARED LONGSPUR



Grasslands Ecosystem Initiative
Northern Prairie Wildlife Research Center
U.S. Geological Survey
Jamestown, North Dakota 58401

This report is one in a series of literature syntheses on North American grassland birds. The need for these reports was identified by the Prairie Pothole Joint Venture (PPJV), a part of the North American Waterfowl Management Plan. The PPJV recently adopted a new goal, to stabilize or increase populations of declining grassland- and wetland-associated wildlife species in the Prairie Pothole Region. To further that objective, it is essential to understand the habitat needs of birds other than waterfowl, and how management practices affect their habitats. The focus of these reports is on management of breeding habitat, particularly in the northern Great Plains.

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Species for which syntheses are available or are in preparation:

American Bittern
Mountain Plover
Marbled Godwit
Long-billed Curlew
Willet
Wilson's Phalarope
Upland Sandpiper
Greater Prairie-Chicken
Lesser Prairie-Chicken
Northern Harrier
Swainson's Hawk
Ferruginous Hawk
Short-eared Owl
Burrowing Owl
Horned Lark
Sedge Wren
Loggerhead Shrike
Sprague's Pipit
Grasshopper Sparrow
Baird's Sparrow
Henslow's Sparrow
Le Conte's Sparrow
Nelson's Sharp-tailed Sparrow
Vesper Sparrow
Savannah Sparrow
Lark Sparrow
Field Sparrow
Clay-colored Sparrow
Chestnut-collared Longspur
McCown's Longspur
Dickcissel
Lark Bunting
Bobolink
Eastern Meadowlark
Western Meadowlark
Brown-headed Cowbird

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Jill A. Dechant, Marriah L. Sondreal, Douglas H. Johnson, Lawrence D. Igl,
Christopher M. Goldade, Melvin P. Nenneman, and Betty R. Euliss

Series Coordinator: Douglas H. Johnson
Series Assistant Coordinator: Lawrence D. Igl

Reviewer: Dorothy P. Hill

Range Map: Jeff T. Price

Cover Art: Christopher M. Goldade

Major Funding: Prairie Pothole Joint Venture, U.S. Fish and Wildlife Service
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Collaborators:

Louis B. Best, Iowa State University
Carl E. Bock, University of Colorado
Brenda C. Dale, Canadian Wildlife Service
Stephen K. Davis, Saskatchewan Wetland Conservation Corporation
James J. Dinsmore, Iowa State University
James K. Herkert, Illinois Endangered Species Protection Board
Fritz L. Knopf, Midcontinent Ecological Science Center
Rolf R. Koford, Iowa Cooperative Fish and Wildlife Research Unit
David R. C. Prescott, Alberta NAWMP Centre
Mark R. Ryan, University of Missouri
David W. Sample, Wisconsin Department of Natural Resources
David A. Swanson, Ohio Division of Wildlife
Peter D. Vickery, Massachusetts Audubon Society
John L. Zimmerman (retired), Kansas State University

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ORGANIZATION AND FEATURES OF THIS SPECIES ACCOUNT

Information on the habitat requirements and effects of habitat management on grassland birds were summarized from information in more than 4,000 published and unpublished papers. A ***range map*** is provided to indicate the relative densities of the species in North America, based on Breeding Bird Survey (BBS) data. Although birds frequently are observed outside the breeding range indicated, the maps are intended to show areas where managers might concentrate their attention. It may be ineffectual to manage habitat at a site for a species that rarely occurs in an area. The species account begins with a brief ***capsule statement***, which provides the fundamental components or keys to management for the species. A section on ***breeding range*** outlines the current breeding distribution of the species in North America, including areas that could not be mapped using BBS data. The ***suitable habitat*** section describes the breeding habitat and occasionally microhabitat characteristics of the species, especially those habitats that occur in the Great Plains. Details on habitat and microhabitat requirements often provide clues to how a species will respond to a particular management practice. A ***table*** near the end of the account complements the section on suitable habitat, and lists the specific habitat characteristics for the species by individual studies. A special section on ***prey habitat*** is included for those predatory species that have more specific prey requirements. The ***area requirements*** section provides details on territory and home range sizes, minimum area requirements, and the effects of patch size, edges, and other landscape and habitat features on abundance and productivity. It may be futile to manage a small block of suitable habitat for a species that has minimum area requirements that are larger than the area being managed. The Brown-headed Cowbird (*Molothrus ater*) is an obligate brood parasite of many grassland birds. The section on ***cowbird brood parasitism*** summarizes rates of cowbird parasitism, host responses to parasitism, and factors that influence parasitism, such as nest concealment and host density. The impact of management depends, in part, upon a species' nesting phenology and biology. The section on ***breeding-season phenology and site fidelity*** includes details on spring arrival and fall departure for migratory populations in the Great Plains, peak breeding periods, the tendency to renest after nest failure or success, and the propensity to return to a previous breeding site. The duration and timing of breeding varies among regions and years. ***Species' response to management*** summarizes the current knowledge and major findings in the literature on the effects of different management practices on the species. The section on ***management recommendations*** complements the previous section and summarizes specific recommendations for habitat management provided in the literature. If management recommendations differ in different portions of the species' breeding range, recommendations are given separately by region. The ***literature cited*** contains references to published and unpublished literature on the management effects and habitat requirements of the species. This section is not meant to be a complete bibliography; a searchable, annotated bibliography of published and unpublished papers dealing with habitat needs of grassland birds and their responses to habitat management is posted at the Web site mentioned below.

 Please direct comments and suggestions to Douglas H. Johnson, Northern Prairie Wildlife Research Center, U.S. Geological Survey, 8711 37th Street SE, Jamestown, North Dakota 58401; telephone: 701-253-5539; fax: 701-253-5553; e-mail: Douglas_H_Johnson@usgs.gov.

CHESTNUT-COLLARED LONGSPUR
(*Calcarius ornatus*)

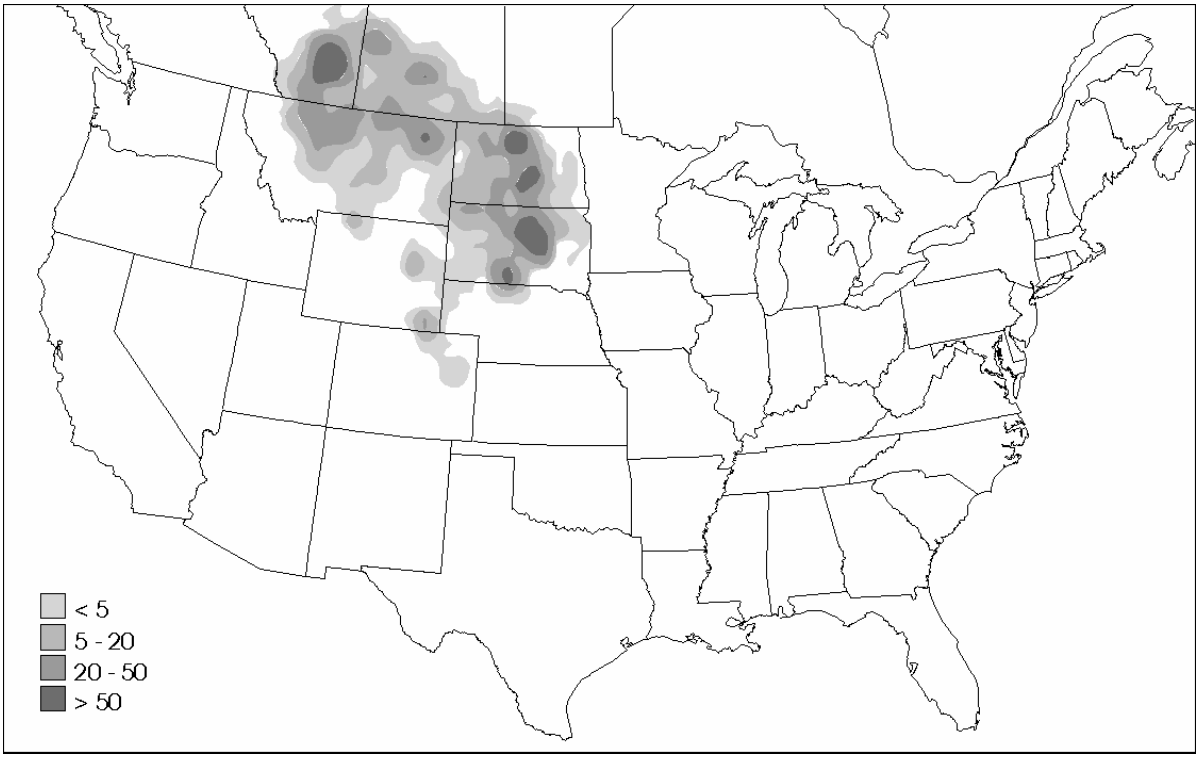

Figure. Breeding distribution of the Chestnut-collared Longspur in the United States and southern Canada, based on Breeding Bird Survey data, 1985-1991. Scale represents average number of individuals detected per route per year. Map from Price, J., S. Droege, and A. Price. 1995. The summer atlas of North American birds. Academic Press, London, England. 364 pages.

Keys to management include providing and maintaining native pastures with fairly short vegetation and sparse litter accumulation, and tailoring grazing intensity to local conditions.

Breeding range:

Chestnut-collared Longspurs breed from southern Alberta to southern Manitoba, south to westcentral Colorado, and east through North Dakota and South Dakota to western Minnesota (National Geographic Society 1987). (See figure for the relative densities of Chestnut-collared Longspurs in the United States and southern Canada, based on Breeding Bird Survey data.)

Suitable habitat:

Chestnut-collared Longspurs use level to rolling mixed-grass and shortgrass uplands, and, in drier habitats, moist lowlands (DuBois 1935, Fairfield 1968, Owens and Myers 1973, Stewart 1975, Wiens and Dyer 1975, Kantrud and Kologiski 1982). They prefer open prairie and avoid excessively shrubby areas (Arnold and Higgins 1986). However, scattered shrubs and other low elevated perches such as Canada thistle (*Cirsium arvense*) often are used for singing (Harris 1944, Fairfield 1968, Creighton 1974, Creighton and Baldwin 1974). Grasslands with dense litter accumulations are avoided (Renken 1983, Berkey et al. 1993, Anstey et al. 1995). In

Alberta croplands, litter depth was positively correlated with number of productive territories and total productivity (Martin and Forsyth 2003).

In order of preference, Chestnut-collared Longspurs use native pastures, followed by other grazed grasslands and hayland (Fairfield 1968, Owens and Myres 1973, Maher 1974, Stewart 1975, Faanes 1983, Anstey et al. 1995, Skeel et al. 1995, Davis and Duncan 1999). Preferred vegetation height is <20-30 cm (Fairfield 1968). In Saskatchewan, Chestnut-collared Longspurs were more frequent in pastures than in either hayland or cropland (Davis et al. 1999). Within grazed mixed-grass areas in North Dakota, abundance of Chestnut-collared Longspurs was positively associated with percent clubmoss (*Selaginella densa*) cover, percent bare ground, and plant communities dominated solely by native grass (*Stipa*, *Bouteloua*, *Koeleria*, and *Schizachyrium*) (Schneider 1998). Abundance was negatively associated with percent grass cover, visual obstruction (vegetation height/density), vegetation density, litter depth, density of low-growing shrubs (western snowberry [*Symphoricarpos occidentalis*] and silverberry [*Elaeagnus commutata*]), plant communities dominated by Kentucky bluegrass (*Poa pratensis*) and native grass, and plant communities dominated by shrubs and introduced grass (smooth brome [*Bromus inermis*], Kentucky bluegrass, and quackgrass [*Agropyron repens*]). Strongest vegetational predictors of the presence of Chestnut-collared Longspur were increasing grass cover, increasing bare ground, decreasing litter depth, and decreasing cover of low-growing shrubs. Within grazed mixed-grass areas in Saskatchewan, occurrence of Chestnut-collared Longspurs was negatively associated with litter depth and density of narrow-leaved grasses $\leq$10 cm tall (Davis et al. 1999). Also in grazed mixed-grass in Saskatchewan, Smith and Smith (1966) found that 37 of 38 nests were well concealed in grasses, rose (*Rosa*), sage (*Artemisia*), or western snowberry. The remaining nest was situated in sparse grass 10.2 cm tall.

Within drier shortgrass habitats, Chestnut-collared Longspurs prefer wetter, taller, and more densely vegetated areas than McCown's Longspur (*Calcarius mccownii*) and Horned Lark (*Eremophila alpestris*) (DuBois 1937, Strong 1971, Creighton 1974, Creighton and Baldwin 1974, Kantrud and Kologiski 1982, Wershler et al. 1991). Low, moist areas and wet-meadow zones around wetlands provide suitable habitat in these areas (DuBois 1937, Rand 1948, Giezentanner 1970, Stewart 1975). In Saskatchewan, Chestnut-collared Longspurs were more abundant on native pasture in good condition than in native pasture in poor condition; thus overgrazing is probably detrimental (Anstey et al. 1995). In Colorado, Chestnut-collared Longspurs preferred areas with heterogeneous cover of short and mid-grasses, and were associated with bunchgrasses (Creighton 1974, Creighton and Baldwin 1974).

In Nebraska, breeding occurred more frequently on idle shortgrass and mowed mixed-grass prairie than in low meadow zones or pasture (Johnsgard 1980). In moister, more thickly vegetated mixed-grass habitat, Chestnut-collared Longspurs avoid tall, dense vegetation, preferring sparser upland grasslands with more bare ground (Renken 1983, Renken and Dinsmore 1987, Berkey et al. 1993, Johnson and Schwartz 1993, Anstey et al. 1995).

Although usually avoided, cultivated fields, fallow fields, stubble, and dense, idle areas may support a small number of Chestnut-collared Longspurs if vegetation is of suitable height and density (Fairfield 1968, Owens and Myres 1973, Stewart 1975, Anstey et al. 1995). Other habitats used include waste and idle areas, such as fence borders and mowed aircraft landing strips (DuBois 1935, Fairfield 1968, Stewart 1975). A table near the end of the account lists the specific habitat characteristics for Chestnut-collared Longspurs by study.

Area requirements:

Little information is available regarding the area requirements of Chestnut-collared Longspurs. Territory sizes for two males in Manitoba were about 0.2 ha and 0.4 ha (Harris 1944). In Saskatchewan, territories were about 0.4-0.8 ha, increasing to almost 4 ha in marginal habitat (Fairfield 1968). In southeastern Alberta, territories were about 1 ha (Hill and Gould 1997). In Saskatchewan, their minimum area requirements were about 58 ha (SWCC 1997). Nests were parasitized by Brown-headed Cowbirds (*Molothrus ater*) at a frequency of 20%; results from a stepwise logistic regression model indicated that 700-1600 ha would be needed to halve the current parasitism rate.

Brown-headed Cowbird brood parasitism:

Brown-headed Cowbird brood parasitism is not known to have a major effect on Chestnut-collared Longspur productivity (Friedmann 1963, Fairfield 1968, Hill and Gould 1997). Parasitism rates vary from 0% of 36 nests (Fairfield 1968) to 23% of 62 nests (Stewart 1975). Refer to Table 1 in Shaffer et al. (2003) for rates of cowbird brood parasitism. Chestnut-collared Longspur may be multiply-parasitized (Currie 1892, Friedmann 1963, Kondla and Pinel 1971, SWCC 1997; Davis and Sealy 2000). In Saskatchewan, unparasitized nests were significantly farther from cowbird perches than parasitized nests; there was no difference in concealment cover between parasitized and unparasitized nests (S. K. Davis, Saskatchewan Wetland Conservation Corporation, Regina, Saskatchewan, *unpublished data*).

Breeding-season phenology and site fidelity:

Chestnut-collared Longspurs arrive on the breeding grounds from late March to late April, with males preceding females by 1-2 wk (Currie 1892, Fairfield 1968, Maher 1973, Johnsgard 1980, O'Grady 1996, Hill and Gould 1997). First clutches are initiated in early to mid-May, and second or replacement clutches may be initiated through late July (DuBois 1935, Fairfield 1968, Maher 1973). Chestnut-collared Longspurs produced two broods per season in Colorado (Strong 1971), and initiation dates of confirmed second clutches in Alberta ranged from early June to mid-July (Hill and Gould 1997). Third broods occur occasionally (Harris 1944, Hill and Gould 1997). Flocking occurs as nesting ends in mid-August, and flocks forage in ditches, dry sloughs, and rough ground outside of the breeding areas (Harris 1944). Fall migration occurs in September and October (Fairfield 1968, Maher 1973, Johnsgard 1980).

Males display stronger philopatric tendencies than females (Hill and Gould 1997). Of 30 banded males, 67% returned to the subsequent year's breeding site compared to 32% of 65 females. Of 20 resighted males, 85% returned to the subsequent year's breeding territory compared to 43% of 21 resighted females. Ryder (1972) reported that a banded pair returned to the same territory the year following banding.

Species' response to management:

In Saskatchewan, abundance of Chestnut-collared Longspurs declined during the first season after burning, but during the second year postburn abundance increased to a level similar to that on grazed pastures (Maher 1973). In South Dakota, spring burning of mixed-grass habitat provided open areas of short vegetation that was used by Chestnut-collared Longspurs during the first few months postburn, after which use declined (Huber and Steuter 1984). In North Dakota, Chestnut-collared Longspurs have begun re-colonizing areas that receive frequent fires (Madden et al. 1999).

Mowing can improve habitat in mixed-grass areas by decreasing vegetation height and density (Owens and Myres 1973, Stewart 1975). However, grazed areas usually are preferred to mowed areas (Owens and Myres 1973, Kantrud 1981, McMaster and Davis 1998). Periodically hayed fields (every 3 yr) were avoided by Chestnut-collared Longspurs in southcentral Saskatchewan (Dale et al. 1997).

Throughout their range, Chestnut-collared Longspurs prefer grazed areas to ungrazed areas (Felske 1971; Maher 1973; Dale 1983, 1984; Kantrud 1981; Kantrud and Kologiski 1983; Renken 1983), and native pastures to other types of pasture (Owens and Myres 1973, Anstey et al. 1995, Davis and Duncan 1999). In Saskatchewan, Chestnut-collared Longspurs occurred most often in native mixed-grass pasture than in tame pastures of crested wheatgrass (*Agropyron cristatum*) (Davis and Duncan 1999). In another Saskatchewan study, no significant difference in abundance was found between lightly grazed mixed-grass prairie and lightly grazed stands of crested wheatgrass (Sutter and Brigham 1998). Davis et al. (1999) detected no difference in frequency of occurrence of Chestnut-collared Longspurs between native and tame pastures throughout the grassland regions of Saskatchewan. In Alberta, Chestnut-collared Longspur frequency of occurrence did not differ significantly between four grazing treatments: early-season tame (grazed from late April to mid-June), early-season native (grazed in early summer), deferred-grazed native (grazed after 15 July), and continuously grazed native (Prescott and Wagner 1996).

Chestnut-collared Longspurs in native pastures may tolerate a wider range of grazing intensities than those in tame pastures (Anstey et al. 1995). Optimal grazing intensity varies according to prairie type. In mixed-grass or wetter prairie areas where grass is too tall or thick for Chestnut-collared Longspurs, moderate to heavy grazing can effectively improve habitat by providing shorter, sparser vegetation (Ryder 1980, Kantrud and Kologiski 1982, Messmer 1990). In mixed-grass prairie in Saskatchewan, however, grazing had little influence on occurrence of Chestnut-collared Longspurs (Davis et al. 1999). In dry, sparse shortgrass prairie, light to moderate grazing is more appropriate, and heavy grazing or overgrazing may be detrimental (Strong 1971, Ryder 1980, Kantrud and Kologiski 1982, Bock et al. 1993, Anstey et al. 1995).

In North Dakota, Chestnut-collared Longspur densities were higher in cropland than in the tall, dense vegetation provided by idle Conservation Reserve Program fields (Johnson and Igl 1995). However, in Alberta, Manitoba, and Saskatchewan, Chestnut-collared Longspurs were more common in grasslands enrolled in the Permanent Cover Program (PCP) than in cropland; frequency of occurrence was higher in grazed PCP than in hayed PCP (McMaster and Davis 1998). PCP was a Canadian program that paid farmers to seed highly erodible land to perennial cover; it differed from CRP in that haying and grazing were allowed annually in PCP.

In Alberta, Chestnut-collared Longspurs were eliminated by cultivation (Owens and Myers 1973). Also in Alberta, cropland managed with minimum-tillage practices had more breeding territories, higher frequency of productive territories, and higher total productivity than cropland managed with conventional-tillage practices (Martin and Forsyth 2003).

In Montana, numbers of Chestnut-collared Longspurs were unaffected by application rates of 175 g/ha of BAY 77488* (phenylglyoxylonitrile oxime 0,0-diethyl phosphorothioate) (McEwen et al. 1972). Rates of 322 and 651 g/ha caused significant declines between pre- and

*References to chemical trade names does not imply endorsement of commercial products by the Federal Government.

post-spray censuses with the highest decline at 651 g/ha. Numbers declined significantly on areas sprayed with 441 and 672 g/ha applications of fenitrothion. In Wyoming and Montana, numbers did not decline significantly from application rates of 140 g/ha of BAYGON* *(o*-isopropoxyphenyl methylcarbamate) but did decline significantly at 210 and 280 g/ha. One adult and 3 dead nestlings were found, and four active nests were abandoned or were unsuccessful.

In a Saskatchewan study that examined whether the abundance of grassland birds differed between roadsides and trailsides, Chestnut-collared Longspurs were significantly more abundant along trailsides than along roadsides (Sutter et al. 2000). Roads were defined as traveling surfaces with adjacent drainage ditches planted to smooth brome and ending with a fence 11-18 m from the traveling surface. Trails were defined as a single pair of wheel ruts visually indistinct from surrounding habitat in terms of plant structure and composition. Habitat along roads and trails were parcels of lightly to moderately grazed native prairie >256 ha.

Management Recommendations:

Protect prairie areas from plowing and cultivation (Owens and Myres 1973, Stewart 1975).

Provide open, grazed native prairie (Owens and Myres 1973, Anstey et al. 1995, Davis and Duncan 1999). Chestnut-collared Longspurs prefer native pastures to all other habitat types, and may tolerate a wider range of grazing intensities in native pastures than in other pastures (Owens and Myres 1973, Anstey et al. 1995, Davis and Duncan 1999).

Avoid managing for idle, dense vegetation, as Chestnut-collared Longspur densities decrease with increased mean vertical density, diversity, and litter depth (Renken 1983, Messmer 1990, Johnson and Igl 1995).

Burning may benefit Chestnut-collared Longspurs, provided that vegetative regrowth is not too tall or dense (Maher 1973, Berkey et al. 1993).

In mixed-grass areas, mow to improve habitat by decreasing vegetation height and density (Owens and Myres 1973, Stewart 1975). Annual mowing was more beneficial than periodic mowing (once every 3 yr) in northern mixed-grass prairie (Dale et al. 1997).

In mixed-grass prairie, graze at moderate to heavy intensity. Graze moister areas to increase diversity and patchiness and reduce tall, thick vegetation (Ryder 1980, Kantrud and Kologiski 1982). Messmer (1990) reported highest densities on pastures grazed using a twice-over rotation system, rather than areas grazed using season-long or short-duration systems.

In shortgrass prairie, graze at light to moderate intensity; avoid overgrazing (Strong 1971, Bock et al. 1993, Anstey et al. 1995).

When pest management is required, use only rapidly degrading chemicals of low toxicity to nontarget organisms and apply at the lowest application rates possible (McEwen et al. 1972). Maintain range in good condition; overgrazed and drought-affected areas are more prone to pest outbreaks.

Table. Chestnut-collared Longspur habitat characteristics.

Author(s)	Location(s)	Habitat(s) Studied*	Species-specific Habitat Characteristics
Anstey et al. 1995	Saskatchewan	Cropland, mixed-grass pasture, tame hayland, tame pasture	Used open areas of low cover and low litter; preferred grazed native prairie
Creighton 1974, Creighton and Baldwin 1974	Colorado	Mixed-grass pasture, shortgrass pasture	Used areas with mix of mid-grasses, shortgrasses, sedges, and shrubs; average vegetation measurements were 15 cm vegetation height, 300 plants/m^2, and percent cover as follows: 45% shortgrass, 22% mid-grass, 11% sedge (*Carex* spp.), 6% forb, 2% cactus (*Opuntia* spp.), 0.2% shrub, 12% bare ground, 0.5% rock
Dale 1983, 1984	Saskatchewan	Idle mixed-grass, mixed-grass pasture	Used open, level grasslands with little residual cover; used areas with lower forb height, litter cover, dead cover, vertical density, dwarfshrub cover, distance to forb, and grass cover, and higher bare ground cover, than unoccupied areas; mean vegetation values for used areas were: 2.9 cm forb height, 83.3% litter cover, 78.1% dead cover, 4.2 contacts (vertical density), 3.1% dwarfshrub cover, 38.5% grass cover, and 11.5% bare ground cover; occurred only on grazed plots
Davis et al. 1999	Saskatchewan	Aspen parkland, cropland, mixed-grass pasture, tame hayland, tame pasture	Occurred as frequently in native pasture as in tame pasture but more frequently in pasture than in hayland or cropland; occurred more frequently in mixed grassland, followed by moist-mixed grassland, aspen parkland, and cypress upland; grazing did not affect occurrence of Chestnut-collared Longspurs on native pasture; occurrence on native pastures was positively associated with mixed grassland and negatively associated with litter depth and density of narrow-leaved grasses $\leq$10 cm tall

Davis and Duncan 1999	Saskatchewan	Mixed-grass pasture, tame pasture	Preferred native pasture to tame pasture; abundance was positively associated with Junegrass (*Koeleria pyramidata*) and clubmoss (*Selaginella densa*)
DuBois 1935, 1937	Montana	Cropland, idle shortgrass, short grass pasture	Used moist, low areas with taller, thicker grasses compared with surrounding shortgrass habitat
Faanes 1983	North Dakota	Idle mixed-grass, mixed-grass pasture, woodland	Used moderately to heavily grazed upland native prairie, avoided wooded vegetation
Fairfield 1968	Saskatchewan	Idle mixed-grass	Nested in uncultivated grasslands, particularly moderately dense, short (<20-30 cm), ungrazed fields; used flat or gently sloping prairie; more abundant on overgrazed pasture than on a lightly grazed adjacent pasture with taller grass
Giezentanner 1970	Colorado	Idle, cropland, hayland**,** shortgrass pasture	Were most common in low areas with denser, taller grass; nested on short to mid-grass pasture with low forb and shrub density, with light to moderate summer grazing (removal of 20-40% of the annual plant growth)
Harris 1944	Manitoba	Pasture	Nested in light to moderately dense grass; nested on the ground, often in short, sparse cover, sometimes among scattered shrubs
Huber and Steuter 1984	South Dakota	Burned mixed-grass pasture, mixed-grass pasture	Preferred short, open habitat during the first month after burning, and decreased as vegetation recovered; avoided unburned area
Johnson and Schwartz 1993	Minnesota, Montana, North Dakota, South Dakota	CRP (idle seeded-native, idle tame), cropland	Preferred bare, sparse cover; densities were highest in already established grass, intermediate in wildlife habitat and introduced grasses and legumes, and lowest in native grasses; abundance was negatively associated with legumes

Kantrud 1981	North Dakota	Mixed-grass hayland, mixed-grass pasture	Preferred heavily grazed areas, followed by moderately grazed, lightly grazed, and hayland
Kantrud and Kologiski 1982, 1983	Colorado, Montana, Nebraska, North Dakota, South Dakota, Wyoming	Mixed-grass pasture, shortgrass pasture, shrubsteppe	Preferred heavily grazed areas with typic soils, moderately grazed areas with aridic boroll soils, and lightly grazed areas with aridic ustoll soils; vegetation heights in these areas ranged from 17 to 23 cm, with 8-15% bare ground
Maher 1973	Saskatchewan	Burned mixed-grass, idle mixed-grass, mixed-grass hayland, mixed-grass pasture	Strongly preferred grazed prairie to ungrazed prairie; high densities were present in burned prairie 2 yr postburn
Martin and Forsyth 2003	Alberta	Cropland, idle	Preferred and had higher productivity in minimum-till fields than in conventional-till fields
McMaster and Davis 1998	Alberta, Manitoba, Saskatchewan	Cropland, Permanent Cover Program (PCP; idle tame, tame hayland, tame pasture)	Were more common in PCP than in cropland; frequency of occurrence was higher in grazed PCP than in hayed PCP
Messmer 1990	North Dakota	Idle mixed-grass/tame, mixed-grass/tame hayland, mixed-grass/tame pasture, wet-meadow pasture	Highest densities were on pastures grazed with twice-over rotation system; densities decreased with vegetation regrowth on season-long and short-duration grazed pastures
Owens and Myres 1973	Alberta	Cropland, idle mixed-grass, mixed-grass hayland, mixed-grass pasture	Preferred grazed areas; mowing and grazing were both beneficial; avoided plowed, fallow, seeded, cultivated, and idle lands
Rand 1948	Alberta	Cropland, idle shortgrass, shortgrass pasture	Were common in open plains, in grassy areas near irrigation ditches, and on sagebrush (*Artemisia*) flats
Renken 1983,	North Dakota	DNC (idle tame), idle	Exclusively used grazed areas with sparser vegetation,

Renken and Dinsmore 1987		mixed-grass, mixed-grass pasture	more bare ground, and less litter than unused areas; mean vegetation values for used areas were: 53.9% grass cover, 17.7% forb cover, 97.1% litter cover, 0% shrub cover, 1.3% bare ground, 6 cm effective height, 1.5 cm litter depth
Schneider 1998	North Dakota	Mixed-grass pasture, tame pasture, wet-meadow pasture	Abundance was positively associated with percent clubmoss cover, percent bare ground, and plant communities dominated solely by native grass (*Stipa*, *Bouteloua*, *Koeleria*, and *Schizachyrium*); abundance was negatively associated with percent grass cover, visual obstruction (vegetation height/density), vegetation density, litter depth, density of low-growing shrubs (western snowberry [*Symphoricarpos occidentalis*] and silverberry [*Elaeagnus commutata*]), plant communities dominated by Kentucky bluegrass (*Poa pratensis*) and native grass, and plant communities dominated by shrubs and introduced grass (smooth brome [*Bromus inermis*], Kentucky bluegrass, and quackgrass [*Agropyron repens*]); strongest vegetational predictors of the presence of Chestnut-collared Longspur were increasing grass cover, increasing bare ground, decreasing litter depth, and decreasing cover of low-growing shrubs
Smith and Smith 1966	Saskatchewan	Mixed-grass pasture	Of 38 nests, all but one were well concealed in grasses, rose (*Rosa*), sagebrush, or western snowberry; the remaining nest was situated in sparse grass 10.2 cm tall
Stewart 1975	North Dakota	Cropland, idle mixed-grass, idle shortgrass, mixed-grass hayland, shortgrass hayland, tame hayland	Preferred grazed or hayed mixed-grass prairie; also used shortgrass prairie, grazed, brackish wet-meadow zones, mowed hayland, and heavily grazed pastures; occasionally used stubble fields or fallow fields
Strong 1971	Colorado	Idle, shortgrass pasture	Nested in lightly to moderately grazed grassland; used

			lower, wetter areas with taller, denser vegetation than the surrounding shortgrass pasture
Sutter and Brigham 1998	Saskatchewan	Mixed-grass pasture, tame pasture	No significant difference in abundance was found between lightly grazed mixed-grass prairie and lightly grazed stands of crested wheatgrass (*Agropyron cristatum*)
Sutter et al. 2000	Saskatchewan	Mixed-grass pasture	Abundance in mixed-grass prairie was 53% lower along roadsides than along trailsides
Wershler et al. 1991	Alberta	Cropland, idle mixed-grass, idle tame, mixed-grass pasture, parkland, wet meadow	Used moderately to heavily grazed mixed-grass

*In an effort to standardize terminology among studies, various descriptors were used to denote the management or type of habitat. "Idle" used as a modifier (e.g., idle tallgrass) denotes undisturbed or unmanaged (e.g., not burned, mowed, or grazed) areas. "Idle" by itself denotes unmanaged areas in which the plant species were not mentioned. Examples of "idle" habitats include weedy or fallow areas (e.g., oldfields), fencerows, grassed waterways, terraces, ditches, and road rights-of-way. "Tame" denotes introduced plant species (e.g., smooth brome [*Bromus inermis*]) that are not native to North American prairies. "Hayland" refers to any habitat that was mowed, regardless of whether the resulting cut vegetation was removed. "Burned" includes habitats that were burned intentionally or accidentally or those burned by natural forces (e.g., lightning). In situations where there are two or more descriptors (e.g., idle tame hayland), the first descriptor modifies the following descriptors. For example, idle tame hayland is habitat that is usually mowed annually but happened to be undisturbed during the year of the study.

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