

# The Effects of Management Practices on Grassland Birds— American Bittern (*Botaurus lentiginosus*)

Chapter K of

**The Effects of Management Practices on Grassland Birds**



Professional Paper 1842–K

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Background photograph: Northern mixed-grass prairie in North Dakota, by Rick Bohn, used with permission.

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## **The Effects of Management Practices on Grassland Birds**

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## Conversion Factors

International System of Units to U.S. customary units

Multiply	By	To obtain
Length		
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
Area		
square meter (m <sup>2</sup> )	0.0002471	acre
hectare (ha)	2.471	acre
square kilometer (km <sup>2</sup> )	247.1	acre
square meter (m <sup>2</sup> )	10.76	square foot (ft <sup>2</sup> )
hectare (ha)	0.003861	square mile (mi <sup>2</sup> )
square kilometer (km <sup>2</sup> )	0.3861	square mile (mi <sup>2</sup> )

## Abbreviations

CRP Conservation Reserve Program

spp. species (applies to two or more species within the genus)

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## Capsule Statement

Keys to American Bittern (*Botaurus lentiginosus*) management include protecting wetlands and adjacent uplands and maintaining idle upland habitat. American Bitterns have been reported to use habitats with 30–203 centimeters (cm) average vegetation height, 44–99 cm visual obstruction reading, and less than 91 cm water depth. The descriptions of key vegetation characteristics are provided in table K1 (after the “References” section). Vernacular and scientific names of plants and animals follow the Integrated Taxonomic Information System (<https://www.itis.gov>).

## Breeding Range

American Bitterns breed from the southern Northwest Territories through central British Columbia; east through Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and southern New Brunswick; south through the Great Plains to northeastern New Mexico and southern Texas; west through northern Utah and Nevada to south-central California; and east to the East Coast, extending from Maine south to western South Carolina (National Geographic Society, 2011). The relative densities of American Bitterns in the United States and southern Canada, based on North American Breeding Bird Survey data (Sauer and others, 2014), are shown in figure K1 (not all geographic places mentioned in report are shown on figure).



American Bittern. Illustration by Christopher M. Goldade, U.S. Geological Survey.

## Suitable Habitat

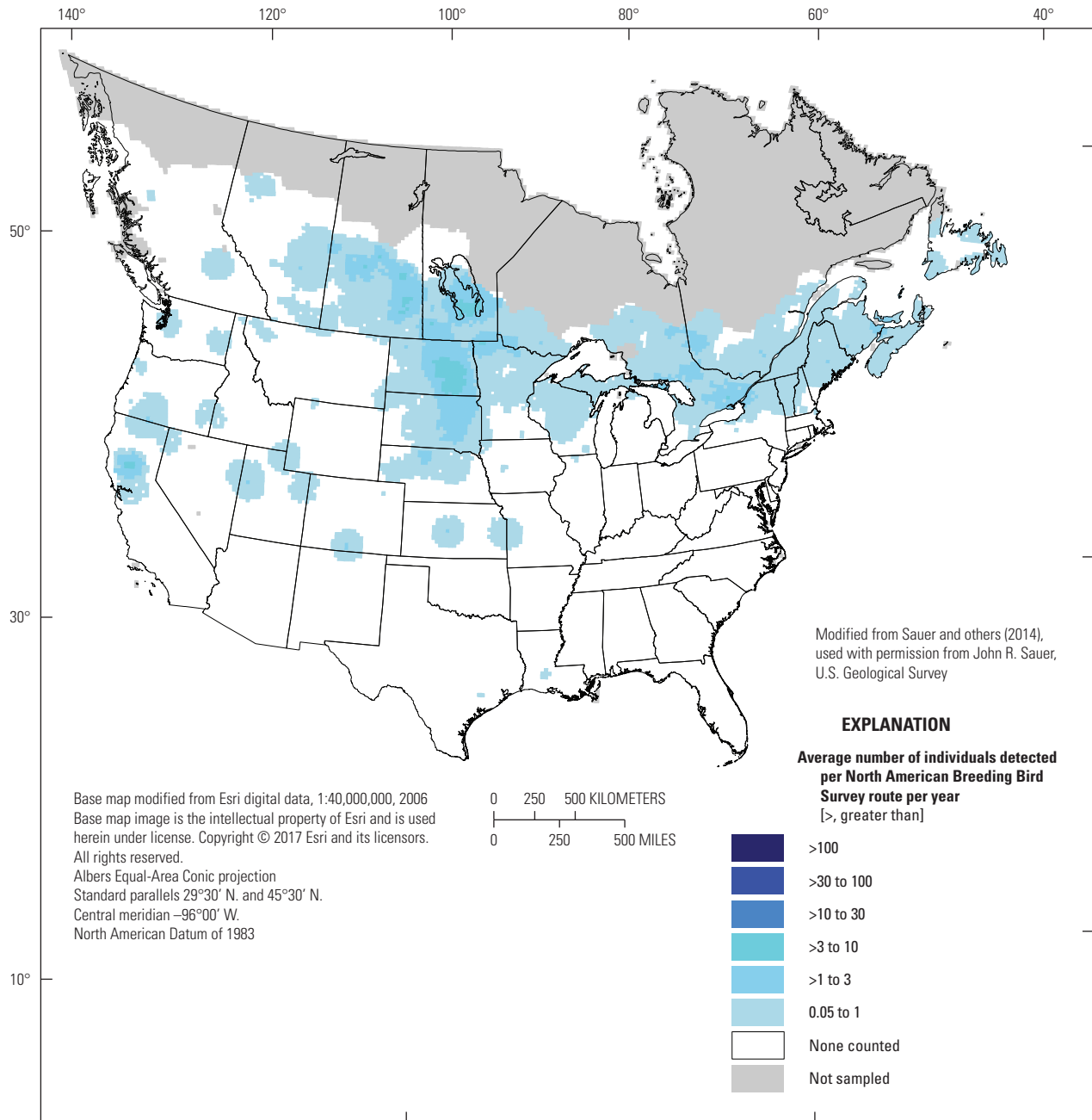
During the breeding season, American Bitterns use tall, dense, shallow- or deep-water emergent vegetation in wetlands; native vegetation in wet meadows; and moderately tall, dense, native or tame vegetation in uplands adjacent to wetlands (Bent, 1963; Stewart, 1975; Duebbert and Lokemoen, 1977; Faanes, 1981; Hanowski and Niemi, 1986, 1988; Faanes and Lingle, 1995; Kent and Dinsmore, 1996; Azure, 1998; Lor, 2007; Lowther and others, 2009; Baschuk and others, 2012). The species breeds in temporary, seasonal, semipermanent, permanent, fen, and alkali wetlands (wetland classifications based on Stewart and Kantrud, 1971); and in restored

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**Figure K1.** Breeding distribution of the American Bittern (*Botaurus lentiginosus*) in the United States and southern Canada, based on North American Breeding Bird Survey (BBS) data, 2008–12. The BBS abundance map provides only an approximation of breeding range edges.

wetlands, hayland, cropland, Conservation Reserve Program grasslands, and idle grasslands (Stewart and Kantrud, 1965; Stewart, 1975; Duebbert and Lokemoen, 1977; Faanes, 1981; Kantrud and Stewart, 1984; Hanowski and Niemi, 1986, 1988; Luttschwager and Higgins, 1992; Svedarsky, 1992a, 1992b; VanRees-Siewert, 1993; Faanes and Lingle, 1995; Bringer, 1996; VanRees-Siewert and Dinsmore, 1996; Dault, 2001; Naugle and others, 2001; Lor, 2007; Lowther and others, 2009; Baschuk and others, 2012).

In a survey of breeding birds in 1,190 wetlands within the Prairie Pothole Region of North Dakota and South Dakota, Igl and others (2017) recorded American Bitterns in 96 wetlands, which were characterized by having an average of 39 percent open water, 33 percent emergent vegetation, 26 percent wet meadow, and 2 percent shore/mudflat. American Bitterns were observed in a higher proportion of the permanent or alkali wetlands than in the temporary, seasonal, or semipermanent wetlands. Within wetlands in the Prairie Pothole Region of North



Dakota, Kantrud and Stewart (1984) reported that American Bittern density was highest in fen wetlands, followed by temporary and semipermanent wetlands, seasonal wetlands, and permanent wetlands. In another North Dakota study, the species appeared to be attracted to patches of emergent vegetation near open water (Stewart and Kantrud, 1965).

In South Dakota, American Bitterns were located most frequently in semipermanent wetlands or in wetlands characterized by open water in the center, a band of emergent vegetation around the periphery, and idle grassland in the adjacent uplands (Weber, 1978; Weber and others, 1982). In Minnesota, American Bitterns were never observed near trees, a flood-pool dike, or in water more than 15 cm deep (Svedarsky, 1992a, 1992b). In restored wetlands in Iowa, the occurrence of American Bitterns was positively associated with the number of dominant plant species in the wet meadow and emergent vegetation zones and with water depth in the emergent vegetation zone (Dault, 2001). In western Manitoba, American Bittern occurrence was positively related to increasing water depth, abundance of forage fish, and vegetation edge density (length of the vegetation-water interface divided by the wetland's boundary) (Baschuk and others, 2012).

Within wetlands and wet meadows, American Bitterns nest in rushes (*Juncus* species [spp.]), sedges (*Carex* spp.), bulrushes (*Schoenoplectus* spp., *Scirpus* spp.), prairie cordgrass (*Spartina pectinata*), rivergrass (*Scolochloa festucacea*), tall mannagrass (*Glyceria* spp.), common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), bur-reed (*Sparganium* spp.), or cattails (*Typha* spp.) (Gabrielson, 1914; Lewis, 1930; Mousley, 1939; Vesall, 1940; Provost, 1947; Middleton, 1949; Boyer and Devitt, 1961; Bent, 1963; Stewart, 1975; Duebber and Lokemoen, 1977; Faanes, 1981; Mancini and Rusch, 1988; Brininger, 1996; Azure, 1998; Lor, 2007). American Bitterns nest on floating platforms in shallow (3–91 cm) water (Provost, 1947; Middleton, 1949; Bent, 1963; Stewart, 1975; Brininger, 1996). In northwestern Minnesota, the average vegetation height above water within 1–10 meters (m) of wetland nests was 126 cm (Brininger, 1996), and water depths within 1–10 m of wetland nests ranged from 8 to 65 cm (Brininger, 1996; Azure, 1998). In another Minnesota study, average vegetation values from 70 sampling points within seven American Bittern territories were 97-cm phanerophyte (graminoids, forbs, or shrubs greater than 40 cm tall that were present each year) height, 8.9 percent vegetation coverage, 114 stems per square meter (m<sup>2</sup>) grass density, 17.1 stems per m<sup>2</sup> phanerophyte density, and 4 stems per m<sup>2</sup> forb density (Hanowski and Niemi, 1988). In a northwestern Iowa study of restored wetlands ranging in age from 1 to 4 years, American Bitterns nested in 2- and 4-year-old restored wetlands (VanRees-Siewert, 1993; VanRees-Siewert and Dinsmore, 1996).

Within uplands, American Bitterns nest in grasslands and shrublands (Duebber and Lokemoen, 1977; Knapton, 1979; Kantrud and Higgins, 1992; Svedarsky, 1992a, 1992b). In Manitoba, Montana, North Dakota, and South Dakota, American Bitterns nested in mid-to-tall (30–99 cm), dense, idle grasslands with high effective vegetation height (average

maximum height of the leaf canopy), vertical visual obstruction, and litter cover (Kantrud and Higgins, 1992). American Bitterns avoided nesting in areas where vegetation height or 100-percent vertical visual obstruction values were <30 cm or where the total cover contained >10 percent dead vegetation. In North Dakota and South Dakota, nests were partially or completely concealed by vegetation on the sides and partially or completely exposed on top; no nests were found in cover <30 cm tall (Duebber and Lokemoen, 1977). In grassland habitats in northwestern Minnesota, nest-site selection decreased nearly 35 percent with every 10-cm increase in vegetation height (Lor, 2007). In wetland habitats, however, the probability of encountering an American Bittern nest increased with an increase in the percentage of dead vegetation and an increase in vegetation density (Lor, 2007). Duebber and Lokemoen (1977) and Kantrud and Higgins (1992) reported that dominant plant species around nests were smooth brome (*Bromus inermis*), wheatgrass (formerly *Agropyron* spp.), alfalfa (*Medicago sativa*), and big bluestem (*Andropogon gerardii*). In northwestern Minnesota, dominant plant species around grassland nests were smooth brome, reed canary grass, timothy (*Phleum pratense*), reedtop (*Agrostis gigantea*), quackgrass (*Elymus repens*), switchgrass (*Panicum virgatum*), sweetclover (*Melilotus* spp.), and big bluestem (Svedarsky, 1992a, 1992b; Brininger, 1996; Azure, 1998; Lor, 2007). An American Bittern pair nested successfully in an interstate road right-of-way in south-central North Dakota (Oetting and Cassel, 1971). In Saskatchewan, nests were located in hayfields and dense western snowberry (*Symphoricarpos occidentalis*) 80–100 m from water (Knapton, 1979). Two nests in a Minnesota wet meadow were located 61 and 107 m from water (Vesall, 1940). In Manitoba, adult behaviors that were indicative of breeding (presence of territorial males or breeding pairs, nest-building activity, egg laying, incubating, or distraction displays) were recorded in native grassland and hayland but not in cropland or woodland (Jones, 1994).

Within a wetland, foraging American Bitterns prefer sites close to small (<0.4 hectares [ha]) water openings and with a high percentage of live cover (Lor, 2007). During molt in Minnesota, American Bitterns moved away from their breeding territories to isolated areas, such as islands (Brininger, 1996). In northwestern Minnesota, Azure (1998) documented molting American Bitterns in dense stands of cattail.

## Area Requirements and Landscape Associations

American Bitterns prefer wetlands that are medium to large in size, ranging from 3 to >1,000 ha (Brown and Dinsmore, 1986; Daub, 1993; Hay, 2006; Baschuk and others, 2012). Of 96 wetlands in the Prairie Pothole Region of North Dakota and South Dakota in which American Bitterns were observed, average wetland size was 13.5 ha (Igl and others, 2017). Seven wetlands used by American Bitterns for nesting

in northern Minnesota ranged from 1 to 100 ha and averaged 36.7 ha (Hanowski and Niemi, 1986). In semipermanent wetlands in South Dakota, American Bittern occurrence was positively related to wetland area (Naugle and others, 2001). Similarly, in southern Manitoba, American Bitterns were more likely to occur in wetlands >1,000 ha than in smaller wetlands (Hay, 2006), but see Johnson (2001) for a review of the passive sampling issues in studies of wetland and grassland birds.

Brininger (1996) reported that home ranges of radio-marked male and female American Bitterns in northwestern Minnesota averaged 415 and 337 ha, respectively. Also in northwestern Minnesota, Azure (1998) reported that the average home-range size of 20 radio-marked male American Bitterns was 127 ha. Average size of the core-use area (defined as the area of the home range in which American Bitterns were located 50 percent of the time) was 25 ha. At the same study site, Lor (2007) recorded the average home-range size of 15 radio-marked male American Bitterns to be 109.3 ha, with an average core-use area of 18.1 ha.

In North Dakota and South Dakota, landscape composition within 800 m of the 96 wetlands in which American Bitterns were observed was 56 percent grassland, 22 percent agricultural, 17 percent wetland, and 5 percent other habitats; average number of wetlands within 800 m was 22 (Igl and others, 2017). In another North Dakota study, the density and distribution of American Bitterns were correlated with the number of wetlands in the surrounding area (Niemuth and Solberg, 2003). In South Dakota, Weber (1978) concluded that the area of adjacent idle grassland was directly related to the occurrence of American Bitterns in wetlands. In another South Dakota study, the occurrence of American Bitterns within semipermanent wetlands was positively related to the percentage of the wetland area that was vegetated (Naugle, 1997; Naugle and others, 2001). In restored wetlands in Iowa, the occurrence of American Bitterns was positively associated with the total area of semipermanent wetlands within 1,500 m of the wetland center (Dault, 2001). The probability of detecting American Bitterns increased with distance from the nearest road (Dault, 2001). In northwestern Iowa, a significant positive relationship was found between the age of restored wetlands and the occurrence of American Bitterns (VanRees-Siewert, 1993; VanRees-Siewert and Dinsmore, 1996). In Manitoba, Hay (2006) evaluated models that predicted American Bittern presence at three scales. At the 50-m scale, American Bittern presence was associated with areas that had significantly less water than unused sites, whereas at the 500-m scale, American Bitterns were associated with sites that had more water and wet meadow than did unused areas. At the 5-kilometer scale, American Bitterns selected areas that had a higher proportion of marsh and tall shrubs than unused areas.

## Brood Parasitism by Cowbirds and Other Species

The American Bittern is an unsuitable host of the Brown-headed Cowbird (*Molothrus ater*), and no known records of brood parasitism exist (Shaffer and others, 2019). In Iowa, two Redhead (*Aythya americana*) eggs deposited in an American Bittern nest hatched, but the Redhead ducklings died soon after hatching (Low, 1940). Peck and James (1983) summarized information from 199 American Bittern nests in Ontario, including two American Bittern nests that each contained five American Bittern eggs and one Ruddy Duck (*Oxyura jamaicensis*) egg.

## Breeding-Season Phenology and Site Fidelity

American Bitterns arrive on the breeding grounds as early as mid-March, but more commonly arrive from mid-April to early May and depart for the wintering grounds from late August to early December (Bent, 1963; Knapton, 1979; Johnsgard, 1980; Lowther and others, 2009). In North Dakota, the peak breeding season extends from mid-June to late July (Stewart, 1975). In northwestern Minnesota, one female American Bittern renested after failure of the initial nest; this was the first documented case of renesting for the species (Azure, 1998; Azure and others, 2000). In the same study area, American Bitterns renested after a major flood event (Lor, 2007). Azure (1998) determined that 4 of 7 radio-marked male American Bitterns returned to their previous breeding home ranges in successive years in northwestern Minnesota; of 6 radio-marked females, none returned to their previous breeding home ranges. In the same study area, Brininger (1996) determined that 9 of 22 radio-marked adult American Bitterns returned to breeding territories occupied in previous years; no fledglings returned to their natal breeding grounds. Lor (2007) reported that 9 of 70 radio-marked males returned to their original capture sites in previous years.

## Species' Response to Management

American Bitterns avoided annually burned, mowed, heavily grazed, and tilled areas in North Dakota (Duebbert and Lokemoen, 1977; Messmer, 1985). A North Dakota study comparing idle grasslands to areas under various grazing systems determined that American Bitterns nested only in idle mixed-grass prairies (with a smooth brome and western snowberry component) and were absent from grasslands with short-duration (a system of pastures rotated through a grazing

schedule of about 1 week grazed and 1 month ungrazed, repeated throughout the season), twice-over (grazing a number of pastures twice per season, with about a 2-month rest in between grazing), and season-long (leaving livestock on the same pasture all season) grazing systems (Messmer, 1985). One nest was located in a pasture under the short-duration system, but that nest had been initiated before livestock began grazing in the area. In Minnesota, American Bitterns nested in upland hayland and in unmanaged northern wildrice (*Zizania palustris*) paddies; dominant vegetation within 1 m of nests consisted of wheatgrass and reed canary grass (Azure, 1998). In grassland fields enrolled in the Conservation Reserve Program in South Dakota, American Bitterns appeared to prefer idled strips or blocks more than mowed areas (Luttschwager and Higgins, 1992).

Baschuk and others (2012) evaluated the impact of water-level manipulations in boreal wetlands in Manitoba on densities of American Bitterns. Wetlands were either drawn down (average water depth of 30 cm) to simulate natural drawdown conditions or maintained at high water levels (average depth of 67 cm). American Bittern density was significantly higher in the wetlands with higher water levels, and models predicted that a 10-cm increase in water depth would result in a 0.15 bird per square kilometer increase.

## Management Recommendations from the Literature

Conserving or protecting wetlands may be accomplished through conservation easements, land purchases, tax incentives, management agreements, continuation of the Wetlands Reserve Program, and enforcement of wetland-protection regulations (Brown and Dinsmore, 1986; Hands and others, 1989; Daub, 1993). Conservation and management of grassland habitats, especially within wetland complexes, is critical for meeting the nesting and foraging needs of American Bitterns (Lor, 2007). Maintaining a complex of wetlands of sufficient size (wetlands 20–30 ha in size up to 180 ha) will provide wetland habitats at various stages of water conditions, levels, and permanency (Brown and Dinsmore, 1986; Hands and others, 1989; Niemuth and Solberg, 2003). Lowther and others (2009) recommended that wetlands used by American Bitterns should be protected from siltation, eutrophication, chemical contamination, and other forms of pollution. A wide vegetative margin around wetlands may protect breeding habitat and deter nest predators (Daub, 1993).

Where water levels can be manipulated, Hands and others (1989) and Azure (1998) indicated that water levels should be maintained at <61 cm throughout the breeding season (April–August), but Baschuk and others (2012) advocated for providing a diverse range of water depths within wetland complexes. Complete drawdowns should be avoided before mid-August (Azure, 1998), but slow drawdowns may mimic natural wetland succession (Fredrickson and Reid, 1986). Throughout the

breeding season, including the molting period, American Bitterns need somewhat deep, stable waters to provide adequate food and protection from predators (Azure, 1998). If stock ponds are a part of a management plan, managing for growth of emergent vegetation is recommended (Weber, 1978).

To maintain tall, dense, upland vegetation, Duebbert and Lokemoen (1977) recommended that disturbances (for example, mowing, burning, or grazing) should not occur more often than every 2–5 years. Although Messmer (1985) observed that American Bitterns nested only in idle grasslands, the twice-over deferred rotation grazing system may be the optimal grazing system in terms of providing overall bird nesting cover in managed uplands. In cropland, adoption of no-tillage or minimum-tillage practices rather than conventional-tillage practices may protect breeding habitat from mechanical disturbances during the nesting season (Kantrud and Higgins, 1992).

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**Table K1.** Measured values of vegetation structure and composition in American Bittern (*Botaurus lentiginosus*) breeding habitat by study. The parenthetical descriptors following authorship and year in the “Study” column indicate that the vegetation measurements were taken in locations or under conditions specified in the descriptor; no descriptor implies that measurements were taken within the general study area.

[cm, centimeter; %, percent; --, no data; CRP, Conservation Reserve Program; WMA, Wildlife Management Area; ≥, greater than or equal to; >, greater than; <, less than]

Study	State or province	Habitat	Management practice or treatment	Vegetation height (cm)	Vegetation height-density (cm)	Grass cover (%)	Forb cover (%)	Shrub cover (%)	Bare ground cover (%)	Litter cover (%)	Litter depth (cm)	Water depth (cm)
Azure, 1998 (nests)	Minnesota	Multiple	Multiple	144–203 <sup>a</sup>	44–99 <sup>b</sup>	--	--	--	--	--	--	31
Baschuk and others, 2012	Manitoba	Wetland	High water	--	--	--	--	--	--	--	--	67
Baschuk and others, 2012	Manitoba	Wetland	Drawn down	--	--	--	--	--	--	--	--	30
Bringer, 1996 (nests)	Minnesota, North Dakota	Wetland	--	126	--	--	--	--	--	--	--	41
Bringer, 1996 (nests)	Minnesota, North Dakota	Tame grassland (CRP), mixed-grass prairie (WMA)	--	74	--	--	--	--	--	--	--	--
Duebbert and Lokemoen, 1977 (nests)	North Dakota, South Dakota	Multiple	Idle	≥30	--	--	--	--	--	--	--	--
Hanowski and Niemi, 1986 (territories)	Minnesota	Multiple	--	134	--	--	--	--	--	--	--	10.6
Lor, 2007 (nests)	Minnesota	Wetland	--	--	--	--	--	--	--	62 <sup>c</sup>	--	--
Lor, 2007 (nests)	Minnesota	Tame grassland	--	53.9	--	--	--	--	--	--	--	--
Kantrud and Higgins, 1992 (nests)	Manitoba, Montana, North Dakota, South Dakota	Tame grassland	Idle	--	50 <sup>b</sup> , 61 <sup>d</sup>	--	--	--	--	53 <sup>c</sup>	--	--
Messmer, 1985 (nests)	North Dakota	Mixed-grass prairie	Idle	--	53 <sup>b</sup>	--	--	--	--	--	--	--
Provost, 1947 (nests)	Iowa	Wetland	--	--	--	--	--	--	--	--	--	20–33
Stewart, 1975 (nests)	North Dakota	Wetland	--	--	--	--	--	--	--	--	--	13–91
Svedarsky, 1992 (nests)	Minnesota	Tallgrass prairie, wetland	--	>60	44 <sup>b</sup>	--	--	--	--	--	--	<15

<sup>a</sup>Range of average values across study sites.

<sup>b</sup>Visual obstruction reading (Robel and others, 1970).

<sup>c</sup>Standing dead vegetation.

<sup>d</sup>Effective vegetation height.

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