

## STATUS OF THE BURROWING OWL IN NORTH DAKOTA

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**ABSTRACT.**—The Western Burrowing Owl (*Athene cunicularia hypugaea*) was among breeding birds characteristic of North Dakota's vast presettlement mixed-grass prairie, but now seems rare or absent in much of its former breeding range in the state. We assessed the Burrowing Owl's current breeding range in North Dakota and quantified occurrence of the owl where it was most common 15–30 yr ago: the Missouri Coteau and adjoining Drift Plain in central and northwestern North Dakota, and black-tailed prairie dog (*Cynomys ludovicianus*) colonies in southwestern North Dakota. Burrowing Owls were detected at 23–60% of prairie dog colonies surveyed during 1994–99 ( $N = 25$ –89 colonies surveyed/yr), which was lower than that reported for the owl at prairie dog colonies across most other states in the Great Plains. During 1995–98, we annually detected 0–3 owl pairs/100 km<sup>2</sup> on a 20% sample of a 840-km<sup>2</sup> survey area in each of central and northwestern North Dakota. In 1998, we also searched intensively for Burrowing Owls within 0.5 km of nest-sites that had been occupied in northwestern North Dakota for at least one yr during 1976–87; we detected an owl at only one (3%) of 38 such areas. East and north of the Missouri River in North Dakota, breeding Burrowing Owls have changed from fairly common or uncommon to rare in the best potential habitat that remains and have disappeared from the eastern one-third of the state; populations apparently fell sharply during the last 5–15 yr. In southwestern North Dakota, the owl's current population trend is unclear but probably is tied closely to prairie dog abundance, which may still be declining.

**KEY WORDS:** *Burrowing Owl*; *Athene cunicularia hypugaea*; *breeding range*; *breeding population trends*; *Great Plains*; *mixed-grass prairie*; *nesting habitat*; *North Dakota*.

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Estado del Búho Cavador en Dakota del norte

**RESUMEN.**—El Búho Cavador Occidental (*Athene cunicularia hypugaea*) estaba entre las aves reproductoras características de las vastas praderas de gramíneas mixtas pre- asentamiento en Dakota del Norte, pero ahora parece raro o ausente en la mayoría de su antiguo rango de reproducción en el estado. Nosotros evaluamos el rango reproductivo actual del búho cavador en Dakota del Norte y cuantificamos la ocurrencia de búhos donde este fue mas común 15–30 años atrás en las planicies del Missouri y el plano de drenaje adyacente en el centro y Noroeste de Dakota del Norte, y en colonias de perros de la pradera de cola negra (*Cynomys ludovicianus*) en el sur occidente de Dakota del Norte. Los Búhos Cavadores fueron detectados en 23–60% de las colonias de perros de la pradera estudiadas durante 1994–99 ( $N$

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= 25–89 Colonias estudiadas/año) las cuales fueron mas bajas que lo reportado para el búho en colonias de perros de la pradera a través de la mayoría de otros estados en las Grandes Llanuras. Durante 1995–98, detectamos anualmente 0–3 parejas de búhos/100 km<sup>2</sup> en un 20% de muestra en cada área de estudio de 840-km<sup>2</sup> del centro y Noroeste de Dakota del Norte. Además en 1998, buscamos intensivamente a los Búhos Cavadores dentro de 0.5 km de los sitios nido que habían sido ocupados en el Noroeste de Dakota del Norte por lo menos un año durante 1976–87; detectamos un búho en solo una (3%) de 38 de tales áreas. En el este y norte del río Missouri en Dakota del Norte, las parejas reproductoras de búhos han cambiado de medianamente comunes o poco comunes a raras en el mejor hábitat potencial que permanece y han desaparecido del tercio oriental del estado; aparentemente las poblaciones cayeron abruptamente durante los últimos 5–15 años. En el sudoeste de Dakota del Norte, la actual tendencia poblacional de los búhos no es clara pero probablemente esta estrechamente ligada a la abundancia de perros de la pradera, la cual puede estar aun en declive.

[Traducción de Victor Vanegas y César Márquez]

The Western Burrowing Owl (*Athene cunicularia hypugaea*) was among avifauna characteristic of the northern Great Plains (Coues 1874, Stewart 1975), but its population has declined substantially, at least in parts of the region. It recently has been extirpated from Manitoba and a widespread, severe decline in Saskatchewan continues unabated (Wellcome and Haug 1995, De Smet 1997). The estimated population in Alberta has been nearly halved since 1978 (Wellcome 1997). In the Dakotas, Nebraska, eastern Montana, and eastern Wyoming, its population status is less well-known. Little effort has been made to monitor these Burrowing Owl populations, although many resource personnel suspect the owl is declining and consider it as a “watch” or Special Concern Species (Marti and Marks 1989, Martell 1991). Assessments of population trends in these states are needed to gauge the extent of the regional decline suggested by data from Canada, and to help identify contributing factors and appropriate conservation actions.

Our goal was to evaluate the status of the Burrowing Owl in North Dakota. Specific objectives were to: (1) determine abundance and population trend in areas that appear to offer the best remaining habitat for this species in the state, (2) determine land-use changes and occurrence of the owl at nesting areas occupied during 1976–87 in northwestern North Dakota, and (3) summarize historical and other information on the distribution and abundance of Burrowing Owls in North Dakota and on changes in the species' habitat.

#### STUDY AREAS AND METHODS

North and east of the Missouri River in North Dakota, Burrowing Owls mainly inhabit grazed, native prairie within colonies of Richardson's ground squirrels (*Spermophilus richardsonii*; Stewart 1975:157, Konrad and Gilmer 1984). To survey Burrowing Owl abundance in this region, we selected two areas where nest records and

published works during the 1970s and 1980s suggested the owl was most likely to be found (Stewart 1975:157, Konrad and Gilmer 1984, Price et al. 1995:92, U.S. Fish Wildl. Serv. [FWS] unpubl. data): western Divide County and central Kidder County, in extreme northwestern and central North Dakota, respectively (Fig. 1). The topography of Divide County (3650 km<sup>2</sup>) is mostly rolling, with loamy soils derived from glacial till. Before the 1900s, the county was mixed-grass prairie but now only about 20% of the original native prairie remains (Nat. Resour. Conserv. Serv. and FWS unpubl. land cover data), and, typically, this is grazed by cattle on an annual basis. Cropland (mostly small grains) covers 67% of the county. The rest is mainly wetlands (8%), and hay land and pasture planted with tame (i.e., nonnative) grasses and forbs (4%). Kidder County (3705 km<sup>2</sup>) has much more native prairie (50%) and less cropland (32%) than Divide County. Most of the rest of Kidder County is wetland (14%), and tame hay land and tame pasture (3%). A glacial outwash plain, characterized by sandy loam soils, covers most of

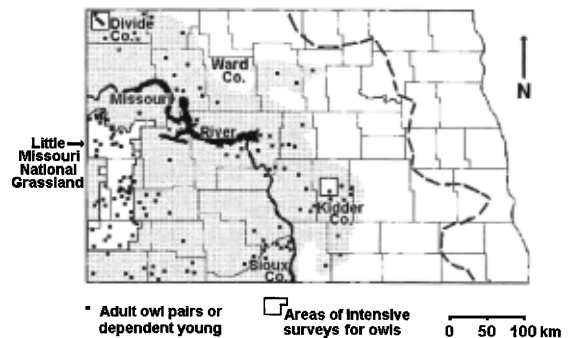


Figure 1. Breeding range of the Western Burrowing Owl in North Dakota. Stippled area is current range (1990s), based on intensive surveys (survey areas indicated) plus records of pairs and adults with dependent young solicited from resource personnel and public (black dots). Approximate eastern limit of breeding range during the 1950s through early 1970s (dashed line) is based on records in Stewart (1975:158). The historical (pre-1880s) breeding range comprised nearly the entire state.

Kidder County (Bluemle 1977). Annual precipitation for Divide and Kidder counties averages 33 and 43 cm, respectively.

In each of western Divide County and central Kidder County, we selected a 840-km<sup>2</sup> study block based on township boundaries (three townships  $\times$  three townships; Fig. 1). Within the blocks, 252 quarter-section (65-ha) plots were randomly selected for a 20% survey of each block. Nesting Burrowing Owls in nearby southern Saskatchewan are not found on 65-ha survey plots with  $<4$  ha of grassland cover (E. Wiltse unpubl. data). Therefore, we calculated crude density two ways: (1) we assumed no nesting Burrowing Owls inhabited plots with  $<4$  ha of grassland cover and entered zero owls observed for such plots in the database, then used all plots ( $N = 252$ ) as a basis for density estimate; (2) we only used plots with suitable habitat ( $\geq 4$  ha grassland cover;  $N = 118$ ) as a basis for density estimate. Croplands enrolled in the federal Conservation Reserve Program (CRP) are seldom used by nesting Burrowing Owls (Johnson and Schwartz 1993) probably because they are covered with much taller ( $>50$  cm), denser vegetation than that used by the owl for nest sites (Dechant et al. 1999). Thus, we considered CRP to be qualitatively similar to cropland (i.e., unsuitable for the owl).

Our protocol for surveying Burrowing Owls followed that used by Shyry et al. (2001) in Alberta, except that we used a single observer and centered our 65-ha survey plots on section lines, which were open to public travel. Surveys were conducted in early to mid-morning (0600–1100 H CST), during spring (late April–early May) or summer (July–early August), 1995–98. Surveys were not conducted when winds exceeded 20 km/hr, when temperatures were more than 29°C, or when rain prevailed. A vantage point, usually the highest point near the plot center, was used so that most, or all, of a plot could be viewed from one location. Each plot was observed for 5 min, using 10  $\times$  40 binoculars and a 20 $\times$  spotting scope. A recording of a male Burrowing Owl's primary courtship call was then broadcast in the four cardinal directions for 5 min (Haug and Didiuk 1993), using a Johnny Stewart Wildlife Caller (model #MS512). Observations continued another 5 min after broadcasting ceased. Thus, total observation time at each plot was 15 min. Parts of some survey plots were not visible due to topography; we estimated the area that was not visible on each plot and subtracted it from the total ha searched (J.K. Schmutz unpubl. data).

In addition to these surveys over broad areas of Divide and Kidder counties, we intensively searched for Burrowing Owls in specific areas of northwestern North Dakota where FWS personnel had earlier noted nests incidental to other work (5–18 owl nests recorded/yr, 1976–87 [FWS–Crosby, ND unpubl. data]). We searched for Burrowing Owls at these historical nesting areas (i.e., within 0.5 km of the original nest sites) during mid-May through June 1998. Our sample was limited to 38 mutually exclusive nesting areas for which precise nest-site locations were available: 35 were in Divide County and three were in adjacent Burke County. In each nesting area, we traversed parallel transects spaced every 50 m throughout all habitats except cropland and CRP land, investigating all potential burrows and perch sites for Burrowing Owl

sign (e.g., pellets, whitewash). An index of Richardson's ground squirrel abundance was obtained by tallying numbers of active burrows within 10 m of either side of each transect. We also measured change in native prairie area (ha) in each historical nesting area during the past ca. 25 yr by comparing current (1998) area to that on aerial photographs (1:7900) taken in 1969. We used a paired  $t$ -test to evaluate the ca. 25-yr change in native prairie area, and Spearman rank correlation to examine the relationship between the ground squirrel index and ha of native prairie in historical nesting areas during late spring 1998.

West and south of the Missouri River in North Dakota, nesting Burrowing Owls inhabit mainly black-tailed prairie dog (*Cynomys ludovicianus*) colonies (Stewart 1975:157). In this southwestern region of the state, we searched for Burrowing Owls at prairie dog colonies within the Little Missouri National Grassland (LMNG), a 8620-km<sup>2</sup> expanse of rolling mixed-grass prairie and rugged badlands in Billings, Slope, Golden Valley, and McKenzie counties (Fig. 1). About 62% of the area within the LMNG boundary is public (87% USDA Forest Service–National Grassland, 8% state-owned, 5% National Park Service). Roughly 80% of the area is native prairie that is used chiefly for livestock grazing. Other land uses include dryland farming (small grains), hay production, oil production, and a 280-km<sup>2</sup> national park. The Little Missouri River drainage is the dominant topographic feature. Prairie dog colonies ( $<1\%$  of area;  $\bar{x}$  area = 10.9 ha, range = 0.1–86.0 ha,  $N = 96$ ; USDA For. Serv. unpubl. data) typically are on broad expanses of gently sloping, clay-loam soils. Many are surrounded by sparsely vegetated, steep slopes of clay, scoria, and shale that is characteristic of North Dakota's Badlands (Bluemle 1977). Vegetation within prairie dog colonies typically is closely cropped, dry mixed-grass prairie. Nearly all prairie dog colonies we surveyed were on public lands. Mean annual precipitation in the area is ca. 36 cm.

Several surveys for Burrowing Owls were conducted in southwestern North Dakota during the 1990s, including those by other investigators (Table 1). During 1996, we repeated an early-May search that was originally conducted on prairie dog colonies in 1991 by De Smet et al. (1992). We also randomly selected 10 of the colonies that were occupied in 1991 (De Smet et al. 1992) and annually surveyed each for Burrowing Owls during early July 1995–98. In July 1999, we surveyed nearly all prairie dog colonies within LMNG. Each prairie dog colony was viewed with binoculars and a spotting scope for 0.5–2.0 hr. We viewed from remote vantage points outside the colony to avoid disturbing owls. Recorded calls of Burrowing Owls were not used. We surveyed owls on prairie dog colonies during suitable mornings (i.e., wind  $<20$  km/hr, temperature  $<30^\circ\text{C}$ , no fog or precipitation). We sometimes also surveyed owls in late evenings.

To augment our information on the Burrowing Owl's breeding range in North Dakota, we used mail, e-mail, telephone, and field contacts during 1995–99 to query university staff, resource personnel, birders, ranchers, and others familiar with the species. We sought current (1990s) records of territorial owl pairs or adults with dependent young in each county and year. A poster campaign and mail-in form also was used under auspices of

a state nongame wildlife program to encourage volunteers to report observations of nests and owls.

#### RESULTS AND DISCUSSION

**Northwestern North Dakota.** We detected few or no Burrowing Owls in surveys of western Divide County (Table 1). The maximum annual density observed was 3.2 pairs/100 km<sup>2</sup> or roughly three pairs/township, recorded during a spring survey (1998; the maximum estimated density, based on total ha of suitable habitat, was 7.2 pairs/100 km<sup>2</sup>). This low density was similar to that recently noted 50 km northwest of Divide County near Weyburn (E. Wiltse unpubl. data), which is part of the large region of Saskatchewan where the owl has declined severely (Wellicome and Haug 1995).

Stewart (1975) considered Burrowing Owls to be fairly common on the northwestern Drift Plain, which extends through Divide County. During 1976–87, FWS staff also noted many Burrowing Owl nest sites incidental to their work in Divide and two adjacent counties (Table 1). However, during the late 1980s–1990s, Burrowing Owl abundance declined sharply in the area; each year, Burrowing Owl pairs were seldom observed, even though observers changed little and efforts to locate the owls increased.

During 1998, we were able to detect Burrowing Owls at only 3% of historical nesting areas surveyed in northwestern North Dakota (Table 1). Nest-site fidelity is variable in migratory populations of Burrowing Owls, and abundance is likely underestimated by surveys that focus on previously-used nest sites (Rich 1984). This potential bias was minimized in our study, however, because we searched up to 0.5 km from nest sites. Also, nest sites may be more likely to be reused after several years of nonuse (Rich 1984). Absence from historical nesting areas was consistent with the low abundance evident from our random survey of western Divide County and the scarcity of incidental observations in the area since the mid-1980s. A decline in Burrowing Owl abundance in western Divide County may stem from recent loss of grassland habitat and associated burrowing rodents. Indeed, native prairie within 0.5 km of historical Burrowing Owl nest sites declined an average of 33% since the 1960s (1969 vs. 1998 [ $\bar{x} \pm \text{SE}$ ]:  $15.5 \pm 2.5$  ha vs.  $9.5 \pm 2.2$  ha; paired  $t = 3.00$ ,  $df = 37$ ,  $P = 0.006$  after data were log-transformed to meet normality assumption). This change was due to conversion to cropland. We detected active Richardson's ground

squirrel burrows at 11 (29%) historical nesting areas in 1998. Nearly all ground squirrel burrows were in heavily-grazed native prairie; the number of burrows and area (ha) of native prairie within 0.5 km were correlated ( $r_s = 0.62$ ,  $P = 0.002$ ,  $N = 24$ ). Although breeding habitat available to Burrowing Owls has declined in western Divide County, we observed what appeared to be suitable but unoccupied habitat at historical nesting areas and elsewhere, as noted in the prairie region of Canada (Wedgwood 1976, Wellicome and Haug 1995).

**Central North Dakota.** Breeding Burrowing Owls were fairly common in the mid-1980s in parts of Ward County in north-central North Dakota (Fig. 1), but have disappeared since (Table 1). We were unable to find any Burrowing Owls during an intensive survey of central Kidder County in July 1998, even though the species was fairly common in the area in the late 1970s (Table 1). As in northwestern North Dakota, a decline in numbers of the owl was evident in Kidder County since the mid-1980s (Table 1). Timing of these population changes parallels that of the steep decline of Burrowing Owls in Saskatchewan (Wellicome and Haug 1995).

**Southwestern North Dakota.** De Smet et al. (1992) detected Burrowing Owls at nearly one-half of active prairie dog colonies surveyed within LMNG during early-May 1991 (Table 1), but they believed owl presence was underestimated due to cold, windy, snowy weather at the time of the survey. In May 1996, we found owls at about one-fourth of the same prairie dog colonies surveyed by De Smet et al. (1992), although many of the colonies no longer existed or were no longer active (i.e., used by prairie dogs). Considering active colonies alone ( $N = 23$  in 1996), Burrowing Owl occurrence was fairly similar between the two surveys (45% and 39%, respectively).

Other surveys of Burrowing Owls in southwestern North Dakota were conducted after May (Table 1). These may not be directly comparable to May surveys due to temporal changes that influence the species' detectability (e.g., some owl pairs fail in nesting and may abandon nest sites by early summer). Among surveys during summer, Burrowing Owl occurrence was highest during July (1999) surveys (Table 1), probably because owls with recently emerged young tend to be conspicuous at that time of year. Regardless, Burrowing Owls were detected on up to approximately one-half of prairie dog colonies surveyed in spring or summer by

Table 1. Population status and breeding range of the Burrowing Owl in North Dakota: a summary of relevant historical and current (1990s) information.

| AREA                                | DATA TYPE  | YEARS                   | COMMENTS AND CONCLUSIONS REGARDING BURROWING OWLS  | SOURCE                               |
|-------------------------------------|--|-------------------------|--|--------------------------------------|
| Statewide                           | Literature review  | late 1800s              | Breeding in nearly all of the state  | Stewart 1975:157                     |
|                                     | Reports from experts and general public; surveys   | 1950s to early 1970s    | Breeding in all but eastern one-fifth of the state   | Stewart 1975:158                     |
|                                     | Reports from experts and general public; surveys   | 1990s                   | Breeding limited to approximately western one-half of state (see Fig. 1)   | This study                           |
|                                     | North American Breeding Bird Survey  | 1966–79                 | No clear population trend in state   | J.R. Sauer et al. public comm.       |
|                                     | North American Breeding Bird Survey  | 1980–96                 | Declining 10% per year in state  | J.R. Sauer et al. public comm.       |
|                                     | Statewide survey of breeding birds   | 1967, 1992–93           | Detected each year on 2% of 128 randomly selected, 65-ha survey plots  | Igl et al. 1999                      |
| North-central (Ward County)         | County breeding bird atlas   | mid-1980s               | Breeding confirmed on 11 of 57 townships; owls associated with heavily-grazed, mixed-grass prairie               | G. Berkey and R. Martin unpubl. data |
|                                     | Searches for the owl where documented in mid-1980s county bird atlas, and other likely habitat (i.e., grazed prairie)                                  | 1990s                   | Zero owl pairs detected in county, even though most habitat where owls were observed in mid-1980s appears intact | G. Berkey and R. Martin unpubl. data |
| South-central (Kidder County)       | Surveys and reports  | 1950s to early 1970s    | Fairly common in Kidder County outwash plain   | Stewart 1975:157                     |
|                                     | Observations incidental to general survey of breeding raptors  | 1977–79                 | Found 45 nests on Missouri Coteau especially Kidder Co. outwash plain  | Konrad and Gilmer 1984               |
|                                     | Searches every 1–2 yr in nesting areas documented by Konrad and Gilmer (1984), and in other likely habitat (e.g., heavily-grazed, mixed-grass prairie) | late-1980s to mid-1990s | Burrowing Owls increasingly rare, difficult to find during the 1990s   | P. Konrad unpubl. data               |
|                                     | Intensive surveys  | 1998                    | Zero owl pairs on 168 km <sup>2</sup> of Kidder County outwash plain (July)                                      | This study                           |
| Northwestern (mainly Divide County) | Surveys and reports  | 1950s to early 1970s    | Fairly common in northwestern Drift Plain  | Stewart 1975:157                     |
|                                     | Incidental observations  | 1976–87                 | Five to 18 nest-sites noted annually   | unpubl. data <sup>a</sup>            |
|                                     | Incidental observations  | 1990s                   | Zero to two nest-sites noted annually  | unpubl. data <sup>a</sup>            |
|                                     | Survey of areas within 0.5 km of nest-sites used ≥1 yr during 1976–87  | 1998                    | Detected owls at one of 38 (3%) of the historical (1976–87) nesting areas  | This study                           |
|                                     | Intensive surveys  | 1995–98                 | 0–3 owl pairs/100 km <sup>2</sup> , western Divide County (May and July)   | This study                           |

Table 1. Continued.

| AREA         | DATA TYPE   | YEARS                   | COMMENTS AND CONCLUSIONS REGARDING BURROWING OWLS  | SOURCE   |
|--------------|---|-------------------------|--|--|
| Southwestern | Literature review   | late 1800s, early 1900s | Strong affinity for prairie dog towns; common there  | Stewart 1975:157   |
|              | Surveys and reports   | 1950s to early 1980s    | Uncommon to fairly common locally in much of area  | Stewart 1975:157, Seabloom et al. 1978; J.P. Ward, L.R. Hanebury, and R.L. Phillips unpubl. data |
|              | Survey of owls on prairie dog towns                                     | 1991                    | 45% occurrence on 33 towns on LMNG, <sup>b</sup> in May (poor survey weather)                              | De Smet et al. 1992  |
|              | Survey of owls on prairie dog towns                                     | 1994                    | 28% occurrence on 25 towns, Billings County portion of LMNG, June–August                                   | Davidson et al. 1995   |
|              | Resurvey of owls on prairie dog towns surveyed by De Smet et al. (1992) | 1996                    | 27% occurrence on 33 towns on LMNG, May (10 of the towns no longer existed or were unused by prairie dogs) | This study   |
|              | Survey of owls on prairie dog towns                                     | 1998                    | 23% occurrence on 62 towns, LMNG, August (late survey date)  | Sidle et al. 2001  |
|              | Survey of owls on prairie dog towns                                     | 1999                    | 49% occurrence on 89 towns, LMNG, July   | This study   |
|              | Survey of owls on prairie dog towns                                     | 1999                    | 60% occurrence on 10 towns in northern Sioux County, July  | K. Haas unpubl. data   |

<sup>a</sup> U.S. Fish Wildl. Serv. unpubl. data files, Crosby, North Dakota.

<sup>b</sup> LMNG = Little Missouri National Grassland, a 8620-km<sup>2</sup> expanse of mostly publicly-owned prairie and badlands, covering most of Billings, Slope, and McKenzie counties and eastern Golden Valley County.

us or others in southwestern North Dakota. In contrast, Sidle et al. (2001) observed Burrowing Owls at >90% of active prairie dog colonies on National Grasslands from South Dakota to Texas during summer 1998. We are uncertain why Burrowing Owls occur relatively infrequently at prairie dog colonies in North Dakota. We lack historical occurrence data of the same type for comparison; we have only notes and nest records that indicate Burrowing Owls were uncommon to fairly common locally in southwestern North Dakota, as recently as the early 1980s (Table 1). Perhaps Burrowing Owls simply occur less frequently in prairie dog colonies that are relatively far from the center of the owl's breeding range in western North America.

Ten prairie dog colonies occupied by Burrowing Owls in 1991 (De Smet et al. 1992) were randomly

selected by us for yearly searches during July 1995–98. We found 5–7 of the colonies occupied annually; all but one colony was occupied in at least 1 of 4 yr. This small sample suggests that, in southwestern North Dakota, active prairie dog colonies used recently (<5 yr) by Burrowing Owls are more likely to be reoccupied by the species than prairie dog colonies chosen at random. Consistency in occupancy of prairie dog colonies may relate directly to colony size, as do numbers of owls in Nebraska (Desmond and Savidge 1996). Furthermore, Burrowing Owls at small (<35 ha) colonies in southwestern North Dakota seem less secretive than owls on larger colonies, perhaps because the former are infrequently disturbed by humans; shooters of prairie dogs tend to overlook small colonies (S. Gomes and C. Grondahl pers. observ.).

The current population trend of Burrowing Owls in southwestern North Dakota is unclear but likely tied with that of black-tailed prairie dogs. Prairie dog colonies are largely restricted to two major grasslands: LMNG (including some colonies on nearby national park, state, and private lands) and extensive tribal lands in Sioux County (Fig. 1). Remaining landscapes in the southwestern region are dominated by cropland and have few prairie dog colonies, which are mostly isolated on grassland fragments. During 1939–72 the total area of prairie dog colonies on 5100 km<sup>2</sup> of LMNG and associated public and private lands declined 93% (5512 ha to 403 ha; Bishop and Culbertson 1976). Prairie dog colonies currently occupy only 0.2% of 4616 km<sup>2</sup> of federal National Grassland within LMNG, even though habitat models suggest 71% of the land is suitable for prairie dog colonies (USDA For. Serv. unpubl. data). Remaining colonies in southwestern North Dakota are mostly small (<35 ha) and may support poorer reproductive success per Burrowing Owl pair than larger colonies because, as prairie dog colonies become increasingly isolated and fragmented, Burrowing Owls experience increased predation risk and their numbers decline (Desmond et al. 2000). Prairie dogs were added to the North Dakota list of noxious pests in 1995, requiring private landowners to try to eradicate prairie dogs on their lands (North Dakota Century Code 63–01.1–02, subsection 12). However, new management plans for LMNG may lead to substantial overall increases in prairie dog colony area.

**State-wide: Breeding Range and Habitat.** No territorial pairs of Burrowing Owls have been reported from approximately the eastern one-half of North Dakota since the 1980s (Fig. 1). In the late-1800s, Burrowing Owls nested throughout the state, and they persisted as breeding birds through much of eastern North Dakota as recently as a quarter-century ago (Table 1). A range contraction in eastern North Dakota is consistent with the extirpation of Burrowing Owls from adjacent Manitoba and Minnesota (De Smet 1997, Martell et al. 2001). The contraction also agrees with our evidence of declining Burrowing Owl populations within selected counties east of the Missouri River.

According to data from the North American Breeding Bird Survey (BBS), Burrowing Owls exhibited no clear population trend in North Dakota during 1966–79, but the species declined at an average rate of 10% per yr during 1980–96 (route-

regression analysis,  $P < 0.01$ ; Sauer et al. 1997). However, these trends should be interpreted cautiously because the species was detected rarely on BBS routes ( $\bar{x} = 0.2$  detection/route/yr; 1980–96). In the Northern Great Plains region, BBS data suggest Burrowing Owls are declining in the Glaciated Missouri Plateau physiographic region (approximates the Missouri Coteau; 1980–96;  $P = 0.03$ ), but not in the Great Plains Roughlands (south and west of the Missouri River;  $P = 0.44$ ).

A recent decline in Burrowing Owls east of the Missouri River might be explained, in part, by reduced abundance of Richardson's ground squirrels. The rodent prefers open native prairie that is grazed short (Jones et al. 1983:138). This species was fairly common and widespread in central Kidder County 15–20 yr ago (P. Konrad pers. comm.), but during July 1998 we seldom observed Richardson's ground squirrels, their burrows, or native prairie that was grazed short. We suspect habitat appropriate for nesting Burrowing Owls has decreased in Kidder County due to above-average annual precipitation since 1993 (National Weather Service data) and decreased sheep ranching. Although numbers of cattle in Kidder County have remained relatively constant since the late 1960s (72 000  $\pm$  7000 head), numbers of sheep have declined during the same time period (20 000 head in the late-1960s to 8000–10 000 since the mid-1970s; North Dakota Agric. Stat. Serv., Fargo unpubl. data).

In North Dakota Burrowing Owls depend on mixed-grass prairie, which dominated the pre-settlement landscape. About 75% of this native habitat has been converted to other land uses, mainly cropland (Samson and Knopf 1994, D. Lenz, North Dakota Nat. Heritage Pgm., Bismarck, ND unpubl. data). Losses have been particularly great in the Drift Plain, the largest physiographic subregion in North Dakota. Native prairie continues to decline in quality and quantity due to conversion and fragmentation impacts and to invasion by introduced and woody vegetation (Samson and Knopf 1994). Widespread establishment of tame grass-forb cover on croplands under CRP fails to mitigate these losses for nesting Burrowing Owls and several other grassland bird species, although some grassland bird species significantly benefit from CRP (Johnson and Schwartz 1993). North Dakota has more National Wildlife Refuges than any other state, but Burrowing Owls no longer nest on these lands (FWS unpubl. data), probably because refuge man-

agement practices generally favor cover (grasses, forbs, and low shrubs) that is taller and denser than that preferred by the owl (Murphy 1993). Moreover, alterations in prairie landscapes contribute significantly to changes in the composition and distribution of predators that may negatively affect grassland bird species (Sargeant et al. 1993), including Burrowing Owls. Avian predation on Burrowing Owls seems particularly exacerbated by widespread increases in trees due to shelterbelt planting and fire suppression (Clayton and Schmutz 1999).

Although the Burrowing Owl has become rare in most of North Dakota, the species' status has received surprisingly little previous attention. This probably stems from a lack of consensus among biologists across the Great Plains that results from inadequate monitoring. Foremost is the reliance on BBS data, which indicate no clear population trend for Burrowing Owls in the central and northern Great Plains states (approximates FWS Region 6; Sauer et al. 1997). Using this methodology, the trend data may be statistically valid but biologically irrelevant for a species so thinly scattered and difficult to detect throughout its breeding range. Range contractions, however, generally indicate population declines (Wilcove and Terborgh 1984, Krebs 1994). Our data extend the range contraction recently indicated for Burrowing Owls in Canada's prairie region (Wellicome and Haug 1995, De Smet 1997). In North Dakota, the species' status designation is "watch" (declines in distribution and abundance are suspected but unconfirmed; Anonymous 1986). Review of this status designation seems warranted.

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