



Current Status, Distribution, and Conservation of the Burrowing Owl (*Speotyto cunicularia*) in Midwestern and Western North America

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Abstract.—The Burrowing Owl (*Speotyto cunicularia*) inhabits open prairie grassland habitat in the midwestern and western US and Canada. For several years now, numbers of this species in North America have been declining at an alarming rate. Currently, Burrowing Owls are listed as endangered in Canada and threatened in Mexico. In the United States, the Burrowing Owl was listed as a Candidate 2 species by the USFWS until 1996, but currently is not formally a listed species. However, Burrowing Owls are listed as either endangered, threatened, or a species of special concern in virtually every state/province in which it occurs in midwestern and western North America. Habitat destruction/alteration, with a subsequent increase in mammalian predation has played a major role in the decline of populations. Exposure to large amounts of pesticides and other human-related disturbances have also played a role in their decline. Burrowing Owls rely on colonial sciurid towns as an integral part of their preferred habitat, but black-tailed prairie dog (*Cynomys ludovicianus*) populations have been reduced over 98 percent since 1900. These important components of the North American prairie ecosystem are significant and highly coevolved systems where resident species such as Burrowing Owls rely to a significant extent on the other species in the system. I suggest that Burrowing Owls serve as a model sentinel species of the health of the midwestern and western grassland ecosystems and that proactive conservation measures and changes in policy are necessary for the continued existence of populations of Burrowing Owls.

The Burrowing Owl (*Speotyto cunicularia*) is an inhabitant of the prairie grassland ecosystem of midwestern and western North America. This particular ecosystem is considered by many to be at greatest risk of human perturbation. This species has experienced both local and regional population declines and as a result it is listed in virtually all states and provinces in which it occurs. Specifically, the subspecies *S. c. hypugea*, the western Burrowing Owl, is the taxon of Burrowing Owl listed in midwestern and western North America.

The objectives of this paper are to present the current population status, distribution, and

conservation status of the Burrowing Owl in midwestern and western North America. In addition, a further objective is to review current conservation measures taken for Burrowing Owls and to suggest future research and conservation needs for this species.

Population trends presented here are derived from 30 years of Breeding Bird Count (BBS) data (Sauer *et al.* 1996a) and Christmas Bird Count (CBC) data (Sauer *et al.* 1996b). BBS data are from 1966-1994 and CBC data are from 1959-1988. Avian population counts such as the BBS and CBC generally are now acknowledged to be useful indicators of patterns of avian biogeography and population trends. The BBS and CBC data allow analysis of distribution and abundance of avian species during the breeding season (late spring) and during early winter, respectively. In addition, these long-term databases probably are more reliable for the highly diurnal and relatively

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easy to count Burrowing Owl than for most other raptor species. Although these databases are invaluable as tools to estimate population numbers and trends, there are certain pitfalls associated with their use (see Butcher 1990 and Droege 1990 for details on uses of BBS and CBC data, respectively).

POPULATION STATUS/DISTRIBUTION

The Burrowing Owl occurs from the southern portions of western Canada through the western United States and Mexico through Central America and into South America south to southern Argentina (Haug *et al.* 1993). Disjunct populations occur in Florida and adjacent Caribbean Islands. In Canada, Burrowing Owls occur in Manitoba, Saskatchewan, Alberta, and British Columbia (fig. 1). In the United States, Burrowing Owls occur from western Minnesota and Iowa to south to Texas and west from Washington through California (fig. 1).

Maps of average count and percent change/year for Burrowing Owls from BBS data are

shown in figure 2. The BBS data indicate that there has been an overall decrease of 0.6 percent/year in Burrowing Owl numbers in North America and 0.5 percent/year in the US (table 1). For both North America and the US, however, the trends from 1966-1979 were a 1.6 percent and 1.8 percent increase in numbers and the trend from 1980-1994 was a 2.1 percent and 2.0 percent increase in numbers, respectively. In the Central Region of North America, there was a 2.8 percent/year decrease overall, a 2.3 percent/year increase from 1966-1979 and 0.5 percent/year decrease from 1980-1994 (table 1). In this region, significant recent (from 1966-1979 to 1980-1994) declines were seen in North Dakota, New Mexico, Nebraska, and Texas (table 1). Significant declines over shorter periods of time have been seen in west-central Kansas, adjacent portions of Oklahoma and Nebraska, western portions of the Texas panhandle, the Trans-Pecos region of Texas, and southern New Mexico (Haug *et al.* 1993). Significant increases were seen in Colorado and South Dakota. In the Western Region of North America, there was a 4.6 percent/year increase overall, a 1.3 percent

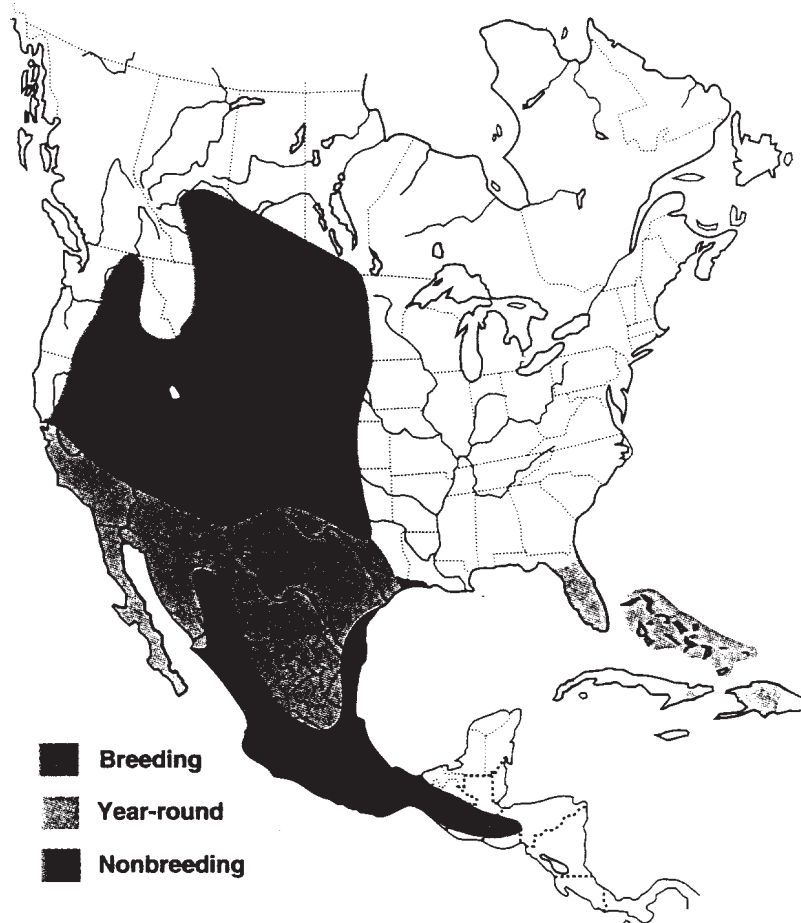


Figure 1.—Range map of the Burrowing Owl (*Speotyto cunicularia*) in North America (map from Haug *et al.* 1993).

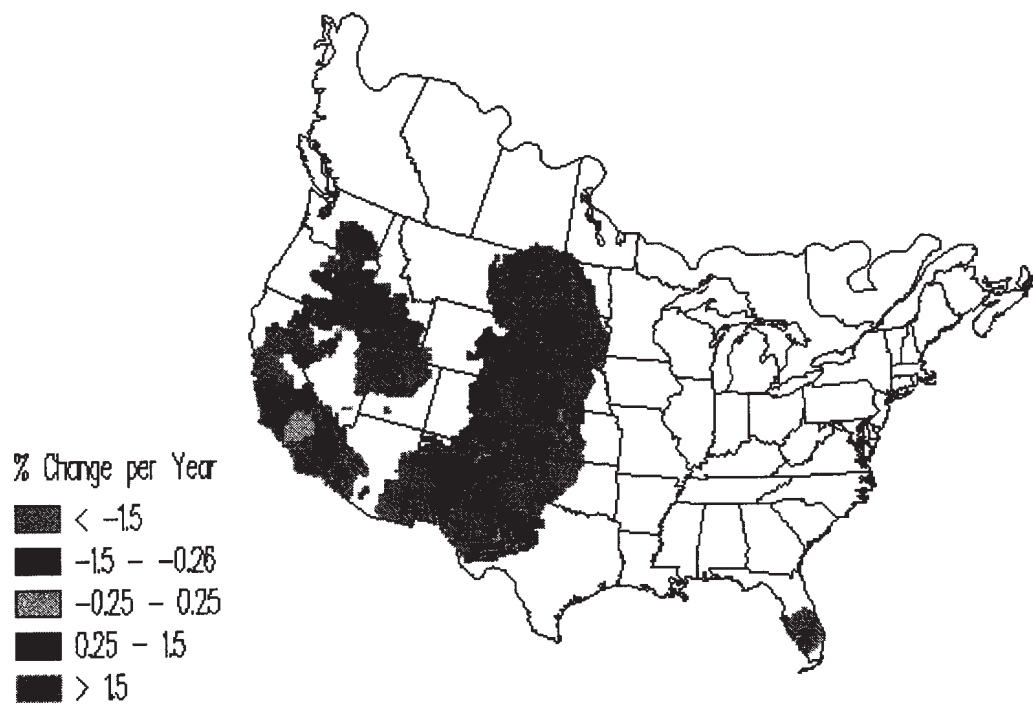
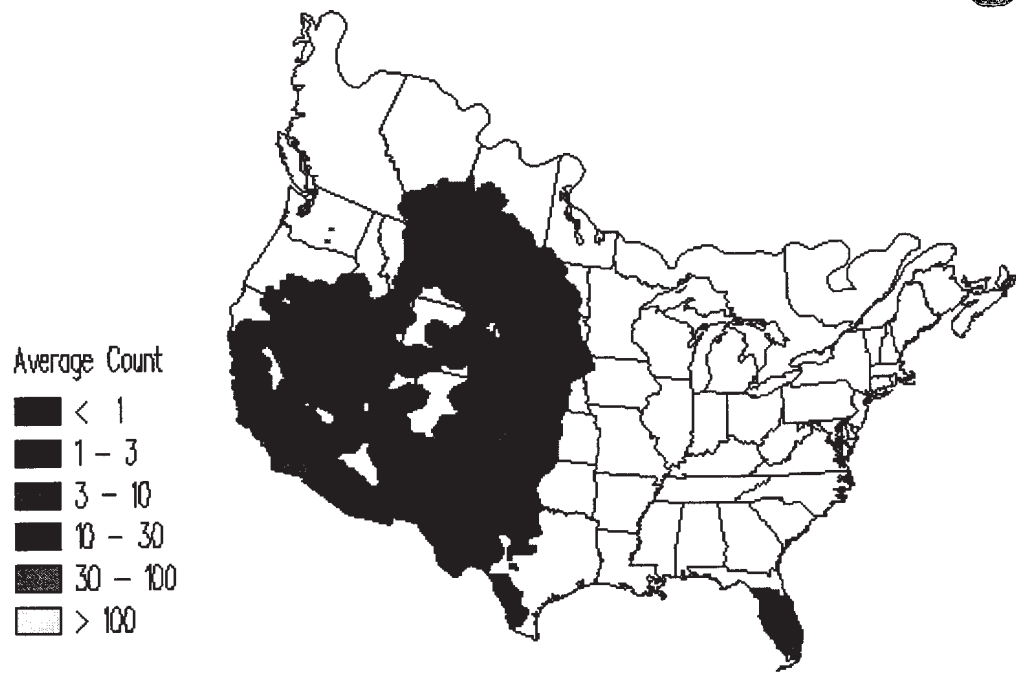


Figure 2.—Maps of average count and percent change per year for Burrowing Owls (*Speotyto cunicularia*) from Breeding Bird Survey data (1966-1994; from Sauer et al. 1996a).

Table 1.—Population trend (percent change/year) based on breeding bird survey data for the Burrowing Owl (*Speotyto cunicularia*) in North America (1966-1994) (Sauer et al. 1996a).

Area	Population trend (N)		
	(1966-1994)	(1966-1979)	(1980-1994)
North America	-0.6 (245)	+1.6 (121)	+2.1 (175)
United States	-0.5 (238)	+1.8 (116)	+2.0 (173)
Central Region	-2.8 (128)	+2.3 (66)	-0.5 (96)
Western Region	+4.6 (109)*	+1.3 (51)	+4.2 (74)*
California	+5.3 (32)*	-2.3 (20)	+6.3 (22)*
Colorado	-3.8 (25)	-7.1 (9)	+4.7 (23)
Nebraska	+6.0 (15)	+25.5 (8)*	-2.0 (10)
New Mexico	-0.6 (22)	-4.1 (6)*	-1.6 (18)
North Dakota	+4.2 (16)	+11.2 (8)	-9.9 (13)*
South Dakota	-5.8 (19)	+5.6 (15)	+10.1 (9)
Texas	-1.4 (22)	+18.9 (14)	-8.0 (17)

* = significant population trend

increase from 1966-1979 and a 4.2 percent increase from 1980-1994 (table 1). However, data from this region is less complete than that from the Central Region and is made up mainly from California. In this region, significant increases were seen in California. However, it is known that Burrowing Owls were extirpated from British Columbia by 1980 (Haug *et al.* 1993). In California, a survey by DeSante and Ruhlen (1995) has shown that there has been approximately a 50 percent decline in numbers in the State over the last 10 years. However, significant increases over shorter periods of time have been seen in the lower Sonoran Desert, lower Colorado River Valley in western Arizona and adjacent California, and the interior valley of California (Haug *et al.* 1993).

The CBC data are more limited for Burrowing Owls since northern populations move south for the winter. Burrowing Owls are known to winter primarily in California, Arizona, New Mexico, Texas, Louisiana, and Florida (fig. 3). Overall, available data indicate a significant decrease of about 0.6 percent/year (table 2). California showed a significant decreasing trend (1.2 percent/year), while Arizona and Texas showed slight increasing trends (table 2). However, overall CBC data for Burrowing Owls suggest a decline in numbers since the mid-1970's. A similar analysis of Burrowing Owl wintering numbers using CBC data found comparable overall trends in numbers in the United States, although analysis including Florida resulted in a slightly positive overall trend and analysis of the limited CBC data

from Mexico indicated that Mexican populations were decreasing slightly as well (James and Ethier 1989).

REASONS FOR DECLINE

It is clear that the number one reason for the overall decline of Burrowing Owls is the destruction and alteration of their habitat. This has come about largely due to development of grasslands into agricultural croplands and through destruction of prairie dog towns. As long ago as the 1930's, it was recognized that intensive cultivation of grasslands and native prairies was the major factor in declining Burrowing Owl populations (Bent 1938). Burrowing Owls strongly prefer open grassland habitat with colonial sciurid populations, and since 1900, black-tailed prairie dog (*Cynomys ludovicianus*) populations have been reduced more than 98 percent. In addition to direct destruction of prairie dog towns, the shooting of prairie dogs and sylvatic plague have decimated prairie dog populations in many areas. The remaining prairie dog towns are generally highly fragmented and suboptimal nesting and foraging habitat. This has led to a scarcity of suitable nesting burrows for Burrowing Owls in many locations, and may reduce chances that unpaired owls will be able to find mates. Habitat destruction and alteration has also led to indirect negative impacts on Burrowing Owls, including an increased frequency of mammalian predators (White 1994). Such mammalian species as coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), gray foxes (*Urocyon*

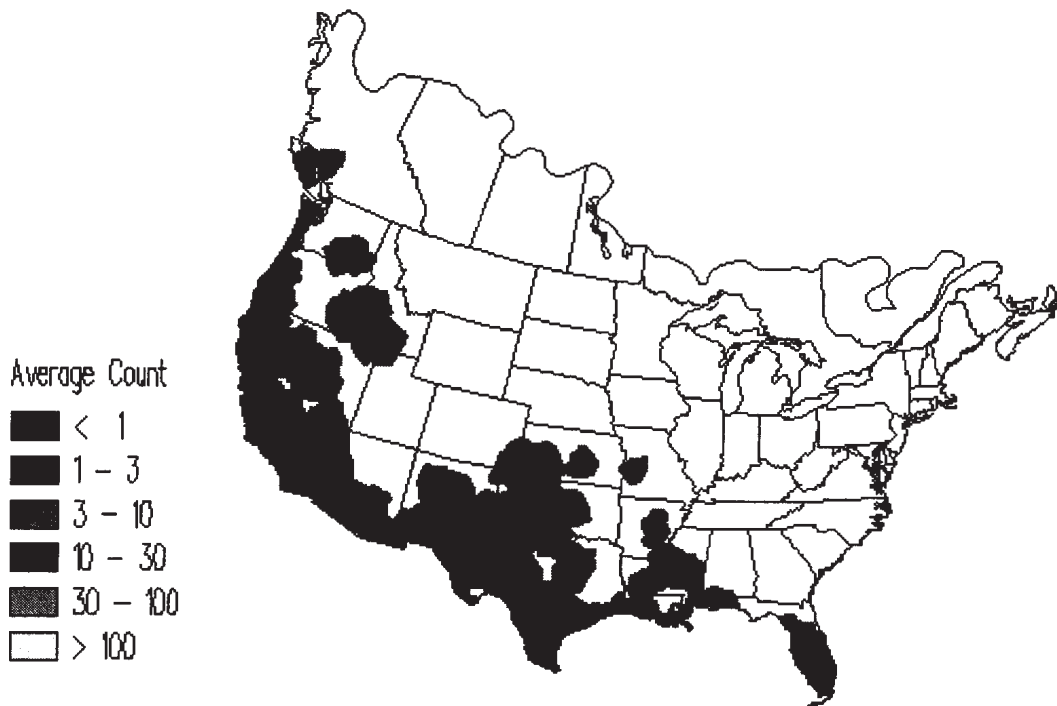


Figure 3.—Map of winter distribution of Burrowing Owls (*Speotyto cunicularia*) from Christmas Bird Count data (1959-1988; from Sauer et al. 1996b).

Table 2.—Population trend and abundance based on Christmas bird count data for the Burrowing Owl (*Speotyto cunicularia*) in North America (1959-1988; from Sauer et al. 1996b).

Area	Population trend (N)	Relative abundance
North America	-0.6 (213)*	0.12
Arizona	+0.2 (16)	0.10
California	-1.2 (97)*	0.29
Texas	+1.2 (52)	0.23

* = significant population trend

cinereoargenteus), and badgers (*Taxidea taxus*) have increased in numbers in many grassland habitats due to the widespread habitat alteration that has tended to modify habitats into early successional stages.

In addition to habitat destruction and alteration, direct mortality due to vehicle collisions and shootings have been important in population declines in some areas (Haug *et al.* 1993). In western Oklahoma, shooting was responsible for 66 percent of the known mortality (Butts 1973). Exposure to environmental

contaminants such as anti-cholinesterase (anti-ChE) insecticides has proven to negatively impact Burrowing Owl populations. For example, the carbamate insecticide carbofuran was found to result in severe reproductive effects in exposed Canadian Burrowing Owls (Fox *et al.* 1989). Anti-coagulant rodenticides (e.g., brodifacoum and other second generation (or super warfarin) compounds) and other types of rodenticides (e.g., strychnine) have been shown to cause mortality in many different owl species, even through the ingestion of as few as one poisoned prey item (Sheffield 1997). Burrowing Owls located in proximity to strychnine-coated grain used to control Richardson's ground squirrels (*Spermophilus richardsonii*) were found to have significantly decreased adult body mass and slightly decreased breeding success as compared to control owls (James *et al.* 1990). Burrowing Owls are known to scavenge dead rodents and other prey items, making them highly susceptible to secondary poisoning by insecticides and rodenticides.

At least two life history traits of the Burrowing Owl act to restrict rapid population recovery following mortalities. Due to their small body size and ground nesting habits, Burrowing

Owls are vulnerable to a large number of mammalian, avian, and reptilian predators. Also, they only produce one brood per year, and will re-nest only if the first nest is destroyed early in breeding (Haug *et al.* 1993).

CONSERVATION STATUS

Since 1972, the Burrowing Owl has been included on the Blue List, a list intended to provide an early warning of North American bird species undergoing population or range reductions. During the past decade, the Burrowing Owl has been listed as declining (Blue List; Tate 1986), vulnerable (Jeopardy List; USDI 1991), sensitive (Sensitive List; USDI 1992), federal threatened (Canada, COSEWIC, 1979, 1991), federal candidate 2 species (USFWS), and declining (White 1994). The federal candidate 2 species category was officially dropped by the USFWS in late 1996 (published in the 5 December 1996 Federal Register). Currently, the Burrowing Owl has no formal federal listing in the US, but is included on an informal internal list of former C2 candidate species known as "Species of Concern." Burrowing Owls are listed as federally endangered in Canada (COSEWIC 1995), and are listed as endangered in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia in Canada (table 3). Burrowing Owls are listed as a "Species of Special Concern" in almost all of the midwestern and western states of the United States (table 3). In Mexico, Burrowing Owls were listed as a federally threatened (amenazada) species in 1994 (Secretaria de Desarrollo Social de Mexico, 1994). In addition, Burrowing Owls are a CITES Appendix 2 species, which makes it illegal to transport or trade this species (or body parts) across international borders without an appropriate convention export permit.

CONSERVATION MEASURES

Several innovative approaches have been taken in order to conserve Burrowing Owl populations in the United States and Canada. The use of artificial burrows has allowed the establishment of small Burrowing Owl colonies and allows close study of nest success. Artificial perches have also been used to provide increased hunting and predator observation sites. Pesticide label restrictions now exist for carbofuran use in and around Burrowing Owl nesting areas in Canada. More drastic conservation efforts such as reintroduction programs

Table 3.—*Conservation status of the Burrowing Owl (Speotyto cunicularia) in North America by country and state/province.*

State/Province	Listing
CANADA	
Alberta	Red List (Endangered)
British Columbia	Red List (Endangered)
Manitoba	Endangered
Saskatchewan	Red List (Endangered)
UNITED STATES	
Arizona	No listing
California	Species of Special Concern
Colorado	Undetermined
Idaho	Species of Special Concern
Iowa	Endangered
Kansas	Species of Special Concern
Minnesota	Endangered
Montana	Species of Special Concern
Nebraska	Species of Special Concern
New Mexico	No listing ²
North Dakota	Watch (Species of Special Concern)
Oklahoma	Species of Special Concern
Oregon	Species of Special Concern
South Dakota	Species of Special Concern
Texas	No listing
Utah	Species of Special Concern
Washington	Species of Special Concern
Wyoming	Candidate 2 Species
MEXICO	
THREATENED	

¹ Included on informal federal list of "Species of Concern"

² Included on informal state list of "Species of Special Concern"

have been attempted with mixed results in British Columbia, Manitoba, and Minnesota. In Canada, a Burrowing Owl recovery plan and a Canadian Burrowing Owl Recovery Team are in place. In the provinces of Manitoba, Saskatchewan, and Alberta, programs to protect private lands from cultivation and reseeded practices through lease agreements (both voluntary and monetary) have been initiated. Another important conservation effort for the Burrowing Owl is mandatory mitigation of developmental impacts in and around its colonies. Relocations of Burrowing Owls have been attempted in California and Saskatchewan. Finally, public education efforts have been underway in many areas throughout the range of the Burrowing Owl. For example, Operation Burrowing Owl in



Saskatchewan has over 500 members and has acted to protect over 40,000 acres of Burrowing Owl habitat (Haug *et al.* 1993).

CONSERVATION RECOMMENDATIONS

The Burrowing Owl will require human assistance if it is to continue to have healthy populations in North America. Among the conservation needs of this species are the following:

1. A change of philosophy is required towards prairie dog and ground squirrel towns and grasslands in general—they should not be looked at as easily developed, weedy or problem areas but should be actively conserved as an integral part of the prairie grassland ecosystem.
2. Tighter controls should exist over grassland development and disturbances, and mitigation of impacts (direct or indirect) should be mandatory. Protection of prairie dog, ground squirrel, and selected other burrowing mammal populations and their towns as habitat should be an integral part of grassland conservation actions.
3. Continued efforts to control prairie dog and ground squirrel populations in midwestern and western North America are detrimental to Burrowing Owl populations. Pesticide use in these systems should never occur in the vicinity of active Burrowing Owl nests and all pesticide use should be closely monitored for negative impacts on Burrowing Owls.
4. The Burrowing Owl should be included as a formal candidate species in the United States. Further, adding candidate species to the list of species receiving recovery plans and active protection (including protection of habitat) should be part of the Endangered Species Act reauthorization bill in the U.S.
5. The passage of a strong, proactive Endangered Species Act reauthorization bill in the U.S. and a Canadian Endangered Species Act are crucial to Burrowing Owl conservation. In addition, affording legal protection to Burrowing Owls in Mexico is of great importance, and efforts should be made to coordinate Burrowing Owl conservation among North American countries.

6. Further research and population monitoring is necessary, including the following areas:
 - a. Continued monitoring of population numbers and trends is critically important. Volunteer data is highly valuable to this effort.
 - b. The efficacies of conservation measures currently in use require study to determine what works and what does not work. Currently, there is little quantitative information available on the success of various management strategies.
 - c. Further development of effective survey techniques.
 - d. Further analysis of migration and fate of migratory individuals is badly needed. In particular, it is not known with any certainty where Burrowing Owls winter in Mexico, Central America, or South America. We need to ascertain whether or not there are environmental problems existing in areas occupied by wintering Burrowing Owls.
 - e. Continued monitoring and assessment of the hazard of secondary poisoning from pesticides (insecticides and rodenticides) is necessary.
 - f. The impact of increased mammalian predators on nesting success of Burrowing Owls needs to be determined.

CONCLUSIONS

Although listed throughout most of their range in North America, Burrowing Owls continue to undergo mild to relatively severe local and regional population declines. The BBS data indicate an overall decreasing trend in North American Burrowing Owls, whereas the CBC data indicate a slight overall increasing trend in North America, although a significant decrease was seen in California, by far the largest wintering population of Burrowing Owls. Virtually all of the reasons for declines in Burrowing Owl populations still occur throughout most of their range. Habitat destruction and alteration probably account for much of the population decline occurring. Prairie dogs and ground squirrels continue to be actively exterminated in many areas of North America, and prairie grasslands continue to be converted for agriculture and other uses. Habitat alteration may indirectly affect Burrowing Owls through the increase in mammalian nest predators. Vehicle collisions, shooting, and exposure to environmental contaminants may

be significant sources of Burrowing Owl mortality in some areas. Many different conservation measures have been attempted in recent years in order to conserve Burrowing Owl populations in North America. Burrowing Owls serve as ideal sentinels of the health of the midwestern and western grassland ecosystem. Proactive conservation measures and changes in land use philosophy and policy are necessary for the continued existence of healthy populations of this species in the grasslands of North America.

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LITERATURE CITED

- Bent, A.C. 1938. Life histories of North American birds of prey. U.S. Nat. Mus. Bull. 170.
- Butcher, G.S. 1990. Audubon Christmas bird counts. In: Sauer, J.R.; Droege, S., eds. Survey designs and statistical methods for the estimation of avian population trends. U.S. Fish Wildlife Service, Biology Report. 90(1): 5-13.
- Butts, K.O. 1973. Life history and habitat requirements of Burrowing Owls in western Oklahoma. Stillwater, OK: Oklahoma State University. 188 p. M.S. thesis
- COSEWIC. 1995. Canadian species at risk. Report of the committee on the status of endangered wildlife in Canada. April 1995. 16 p.
- DeSante, D.F.; Ruhlen, E. 1995. A census of Burrowing Owls in California, 1991-1993. Point Reyes Station, CA: Institute for Bird Populations,
- Droege, S. 1990. The North American breeding bird survey. In: Sauer, J.R.; Droege, S., eds. Survey designs and statistical methods for the estimation of avian population trends. U.S. Fish Wildlife Service, Biology Report. 90(1): 1-4.
- Fox, G.A.; Mineau, P.; Collins, B.; James, P.C. 1989. The impact of the insecticide carbofuran (Furadan 480F) on the Burrowing Owl in Canada. Tech. Rep. Ser. 72. Ottawa, Ontario, Canada: Canadian Wildlife Service.
- Haug, E.A.; Millsap, B.A.; Martell, M.S. 1993. Burrowing Owl. In: Poole, A.; Gill, F., eds. Birds of North America, No. 61. Washington, DC: American Ornithological Union, and Philadelphia, PA: Academy of Natural Sciences. 19 p.
- James, P.C.; Ethier, T.J. 1989. Trends in the winter distribution and abundance of Burrowing Owls in North America. American Birds. 43: 1224-1225.
- James, P.C.; Fox, G.A.; Ethier, T.J. 1990. Is the operational use of strychnine to control ground squirrels detrimental to Burrowing Owls? Journal of Raptor Research. 24: 120-123.
- Sauer, J.R.; Hines, J.E.; Gough, G.; Thomas, I. Peterjohn, B.G. 1996a. The North American breeding bird survey results and analysis home page. Version 96.3. Laurel, MD: Patuxent Wildlife Research Center. <http://www.mbr.nbs.gov:80/bbs/>.
- Sauer, J.R.; Schwartz, S.; Hoover, B. 1996b. The Christmas bird count home page. Version 95.1. Center, Laurel, MD: Patuxent Wildlife Research. <http://www.mbr.nbs.gov/bbs/cbc.html>.
- Secretaria de Desarrollo Social de Mexico. 1994. Que determina las especies y subespecies de flora y fauna silvestres terrestres y acuaticas en peligro de extincion, amenazadas, raras y sujetas a proteccion especial, y que estableces especificaciones para su proteccion. Norma Oficial Mexicana NON-059-ECOL-1994. Diario de la Federacion, Mexico, 487: 2-60.
- Sheffield, S.R. 1997. Owls as biomonitors of environmental health hazards. In: Duncan, J.R.; Johnson, D.H.; Nicholls, T.H., eds. Biology and conservation of owls of the northern hemisphere: 2d international symposium; 1997 February 5-9; Winnipeg, Manitoba. Gen. Tech. Rep. NC-190. St. Paul, MN: U.S. Department of Agriculture,



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- Forest Service, North Central Forest Experiment Station: 383-398.
- Tate, J., Jr. 1986. The blue list for 1986. *American Birds*. 40: 227-236.
- U.S. Department of Interior. 1991. Endangered and threatened wildlife and plants; animal candidate review for listing, proposed rule: Part VIII. *Federal Register* 56:58804-58836.
- U.S. Department of Interior. 1992. Endangered and threatened wildlife and plants. 50 CFR 17.11 & 17.12, 29 Aug. 1992.
- White, C.M. 1994. Population trends and current status of selected western raptors. *Studies in Avian Biology*. 15: 161-172.