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## Population dynamics, dispersal and conservation of the 'Canadian' Burrowing Owl *Athene cunicularia*

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In Canada, the Burrowing Owl *Athene cunicularia* is endangered and its numbers are rapidly declining. There are less than 1000 pairs left in Canada and the number of breeding pairs declined at about 22% per year during the 1990s even though over 700 landowners voluntarily protected over 37 000 ha grassland habitat that was used by nesting owls. One of the factors implicated in the Burrowing Owl's decline is its apparent low productivity. In Canada, this owl has an average clutch size of 9 eggs but fledges only 3–5 young. A food supplementation experiment indicates that the wild food supply is inadequate for this species to reach its reproductive potential. Mortality includes: nest predation (25%) mostly by badgers; post-fledging juvenile mortality (40%), caused by raptors, coyotes, and vehicles; and post-fledging adult mortality (25%). Annual adult return rates on breeding grounds are 40–55%, but juvenile recruitment is only 6%. Other possible mortality factors are starvation, pesticides, collisions with vehicles, shooting, mortality on migration and in winter.

Burrowing Owls banded in Canada have been recovered on migration as far south as central Texas. Migration from Canada starts in September through early October. Habitats used during migration in the US are unknown, but it is assumed that they use holes for cover in the daytime. Only 2% of prairie dog *Cynomys* spp. colonies remain, likely reducing the critical habitat available to owls on migration. Five Burrowing Owl banded in Canada have now been recovered in the winter months; three in south Texas, one in Veracruz and one in Michoacan. In winter, Burrowing Owls have

been found in the coastal lowlands of Texas and Mexico, and central Mexico where Burrowing Owls are not present in summer. Also, Burrowing Owls appear less abundant in prairie dog colonies in northern Mexico in winter than in summer. Much of coastal Texas is cultivated. Studies in central Mexico and southern Texas investigated the over-winter survival and winter ecology of Burrowing Owls.

One of the factors implicated in the Burrowing Owl's decline is its apparent low recruitment. Return rates for banded birds are about 6% for hatch-year owls and 30% for breeding owls. However banding studies are limited by the ability of observers to detect bands particularly far from their study sites. Stable isotope analysis provides a new technique to investigate dispersal. We compared the stable isotope signature of breeding adults to the signature of nestlings collected across North America. Annual dispersal distance for owls was about 400 km indicating that many owls dispersed beyond the boundaries of study areas where owls are banded. Our comparison of the origin of owls breeding in the Canadian Great Plains with those in adjacent northern states indicates that net emigration of owls from Canada approximates the decline of the Canadian population. Greater international cooperation is needed if this species is to remain on the Great Plains. In an effort to promote North American cooperation to conserve this species, the Commission for environment Cooperation published the "North American Conservation Action Plan for Burrowing Owls" in 2005 (<http://www.cec.org>).