

Burrowing Owls

in Saskatchewan

Living and Surviving on a Changing Prairie Landscape

A Burrowing What?



Saskatchewan Burrowing Owl
Interpretive Center

Haven't heard of the Burrowing Owl (*Athene cunicularia*)? Maybe you've heard of a Ground Owl, Howdy Owl, Prairie Bobber, Rattlesnake Owl, Billy Owl, or Cuckoo Owl — all common names for the Burrowing Owl.

Burrowing Owls are small birds of prey that look like short, plump owls on stilts. They have a typical "owl" head with large yellow eyes surrounded by discs of feathers, large wings relative to their body, and a short tail. Their legs are long, thin, and bare, lacking a feather covering. While many species of owl are large, solitary birds that live in trees and hunt at night, the Burrowing Owl is a small bird that lives on open prairie grasslands, where it nests underground in abandoned burrows and searches for prey both during the day and at night. The larger Short-eared Owl (*Asio flammeus*) is sometimes mistaken for a Burrowing Owl, but unlike the Burrowing Owl it nests directly on the ground, rather than in a burrow.

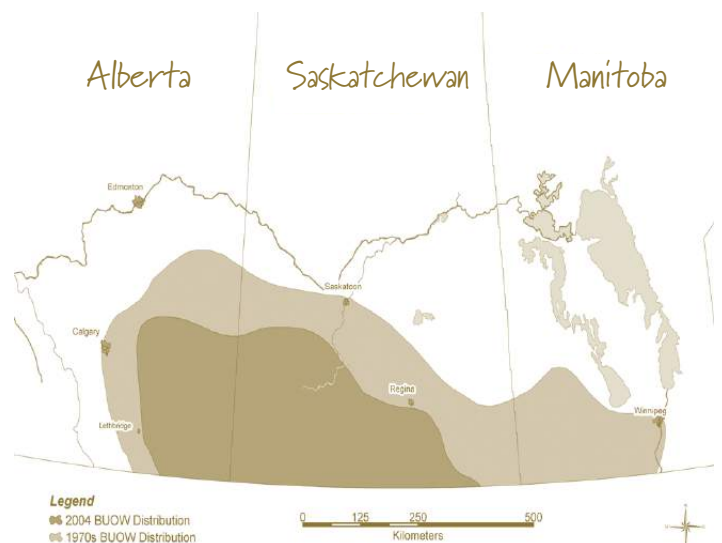
Slightly larger than a robin, a Burrowing Owl weighs between 125 and 185 grams (0.28-0.41 lbs) and stands about 19 cm (9 inches) tall. The Burrowing Owl's plumage is a mottled pattern of dark and light brown with white spots, and underparts that are pale brown to white. Juveniles have a solid buffy-coloured chest. In the spring, the male is more likely to be visible because the female is underground laying or incubating eggs. Males are naturally a lighter colour than females, and become even lighter due to the bleaching affects of the sun.

In the wild, Burrowing Owls live an average of 3 to 4 years. The oldest recorded wild Burrowing Owl in North America was eight years old (determined from band returns), and the oldest known bird in captivity was 15 years old.

Where Burrowing Owls Occur

Burrowing Owls are found in open, well-drained grasslands, steppes, deserts, and agricultural lands throughout North and South America. Across the prairies, this owl once nested in vast expanses of unbroken prairie sod. More recently, over most of its range, the Burrowing Owl has either disappeared or is largely confined to remaining patches of grassland, including pastures, road allowances, railway rights-of-way, and farmyards.

The Canadian grasslands are the northern limit of the Burrowing Owl's range. Fifty years ago, owls nested across the prairies from Lethbridge, Alberta in the west to Winnipeg, Manitoba, in the east and north to Saskatoon; it also nested in the grasslands of interior British Columbia. This distribution has shrunk significantly and owls now are extirpated (no longer occur) in the northern parts of their former range in Alberta and Saskatchewan, and were completely extirpated in Manitoba and British Columbia. However, there have been Burrowing Owl occurrences in Manitoba in 2006 and 2007 and reintroduction efforts are underway in British Columbia and have shown some success. In the 1970s, the Burrowing Owl range covered approximately 331,400 km²; in 2004, the range had shrunk to approximately 162, 275 km², a loss of about 51% over 30 years.



Do I Hear a Burrowing Owl?

During the spring, males can be heard repeatedly uttering a doleful "coo-cooo", primarily to attract females. Young Burrowing Owls often make a noise like the rattling hiss of a rattlesnake's tail to discourage predators from entering their burrow. Burrowing Owls also make a series of clucks, chatters and screams while defending their nest from predators, as well as other unique sounds during mating that are rarely heard by humans.

Habitat Suitable for Nesting

Burrowing Owls choose a place to nest, and are more likely to successfully raise a family, where there is:

1. an open area with short (grazed or mowed) vegetation
2. an abundance of burrows
3. a wetland(s) or water

Most burrow sites are located in softer soils that are old glacial lake bottoms and have few rocks. Some of these same soils are also excellent for farming. Because Burrowing Owls cannot dig their own burrows, they rely on burrowing mammals for their nest and roost burrows. They will nest in badger excavations, Richardson's ground squirrel (gopher) and black-tailed prairie dog burrows, and occasionally fox dens. Grass height is more important when choosing a nest site than grass species composition; grasses kept short by grazing, mowing, haying, climatic conditions or burning are preferred.

Burrowing Owls require more than simply an open area of short vegetation with adequate nest burrows and nearby wetlands. They also need permanent cover and tall, undisturbed vegetation within their home range that would support a sufficient population of small mammals and other prey. These habitats used for foraging include uncultivated fields, ungrazed areas, wet meadows or riparian areas, and roadside ditches.

Feeding Habits of the Owl

The Burrowing Owl is known as a generalist predator — this means that any moving animal small enough to catch is fair game. Insects, mice, voles, young ground squirrels, toads, snakes, salamanders and small birds have all been found cached (stored) at the nest burrow. Usually owls hunt prey that is most readily available. Early in spring, mice and voles are an important component of their diet. Later in the summer, grasshoppers become more abundant and are particularly important for young owls learning to hunt on their own.

The Burrowing Owl hunts in several ways including hunting from a perch such as a mound or fence post, hovering above the ground before pouncing on prey, running after insects, and using its feet to catch insects in mid-air. With young owls to feed in the summer, Burrowing Owls hunt around the clock and are most active during dusk and dawn. During its winter stay in the southwestern United States and in Mexico, it is a "nocturnal" owl, becoming active mainly during the night after spending the day in its burrow.

Did you know?

A Burrowing Owl family can eat 1,800 rodents and 7,000 insects, mostly grasshoppers, during a single summer.

Burrowing Owls in Grasslands National Park

In contrast to Burrowing Owls located in other parts of Canada where owls nest in ground squirrel (gopher) and badger holes, the owls in Grasslands National Park and adjacent ranches nest in black-tailed prairie dog towns. The owl population has been monitored since 1998, and in 2004 a record 47 nesting pairs were found nesting in the park. Since 2004, the population in Grasslands National Park has been declining and in 2008 there were only 20 nesting pairs.



G. Tosh

Burrowing Owls are Prey Too!

Burrowing Owls have many predators. Some eat the eggs, nestlings (chicks) or adult females in the burrow during the nesting period. These include American badgers, red foxes, striped skunks, least and long-tailed weasels, raccoons, rattlesnakes, and bull snakes. Although badgers are a destructive predator, they are also important to the owls as their digging activity creates nest sites and escape cover.

Other predators prey on older nestlings and adults above ground. These include coyotes, domestic dogs and cats, hawks (Swainson's, Ferruginous, and Red-tailed Hawks, and Northern Harriers) and other raptors (Great Horned and Short-Eared Owls, and Prairie Falcons).



R. Poulin

The Life Cycle of the Burrowing Owl

Spring Return and Pairing Up

Burrowing Owls that journey to summer breeding grounds in Canada begin their spring migration in late February and early March, leaving from Texas and Mexico. The owls often disperse widely from one breeding season to the next; however, about one third of owls return to their same nesting area over consecutive years. Adult males show the strongest site fidelity, followed by adult females, juvenile males and juvenile females.



Did you know?

Using aluminum leg bands, researchers found that a second year female nesting in southern Saskatchewan in July 2003, had been nesting in April of that year in Arizona, where she was banded. She moved 1,850 km within 20 days or less to re-nest, likely a record.

Burrowing Owls breed in their first year, at 10 months of age. Males arrive on the prairies between the second week of April and the first week of May to select a nest burrow and territory. Females arrive a week or two later, when males then try to attract a mate by calling “coo-coooo”, and establishing prey caches consisting primarily of small mammals which are stored in the burrow. These springtime caches usually contain a larger number of prey items than at other times. In 1997, when meadow voles were extremely abundant across the prairies, a cache from one nest contained 218 prey items.

Once the pair is established, the owls modify the nest burrow by lining the tunnel and chamber with dried manure. The absorbent qualities of the manure help to protect nests from flooding. The smell of the manure is thought to mask the smell of owls in the nest, fooling predators. The owls may also line the burrow with grass and fur.



Saskatchewan Environment

Egg Laying

Egg laying occurs between late April and late May, shortly after pairs are established. The female usually lays between 6 and 12 eggs, averaging about 9 eggs,



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and laying one egg every 36 hours (1.5 days). The eggs are bright white, about the size of a cotton ball and round to oblong in shape.



D. Todd

The first 4 or 5 eggs laid hatch on the same day with subsequent eggs hatching between 2 to 6 days later (asynchronous hatching). This results in age and size differences among the nestlings. If there are food shortages, the youngest chicks may die or be killed by their siblings or parents for food.

Incubation and Hatching

Once the first 4 or 5 eggs have been laid, the female begins incubation and the male provides all her food while she incubates. Eggs hatch about 4 weeks (26 to 30 days) later.

Hatching to Fledging

Hatchlings (newly hatched owls) rely entirely on their parents for warmth and food. However, chicks grow and develop feathers rapidly, and are first seen at the entrance of the nest burrow, in juvenile plumage, between 2 to 3 weeks after hatching. They begin moving to nearby burrows at about 3.5 weeks (25 days), and can fly at about 7 weeks (50 days) of age. The juveniles become relatively independent of the adults, and are a bit like teenagers, at about 2 months (between 60 to 70 days) of age. By this time it is August and they are learning to fly (fledgling stage) and are in adult plumage.



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Flying South

Fall migration begins late August to mid-October and occurs primarily at night. Owls travel 100 to 300 km per night during migration (this has been determined by attaching radio transmitters to some owls). Most Burrowing Owls that breed in Canada migrate 2,500 to 3,500 km to southern Texas and central Mexico, arriving at their wintering grounds in November.

A Population Decline

Since the advent of modern agricultural practices, there has been a noticeable decline in Burrowing Owl numbers across the prairies. It is estimated that only 500 to 800 pairs now nest in Saskatchewan. The population has declined a dramatic 94% since the late 1980s in Saskatchewan, as determined by the Operation Burrowing Owl program (1988-2008). This is an average decline rate of 12% per year. A similar decline has occurred in Alberta, and many areas in the United States are also reporting declines.



B. Jeffery

Legal Status and Recovery Plan

In 1975, biologists conducted surveys across the prairies to determine the status of the Burrowing Owl in Canada. Because numbers were surprisingly low, the Burrowing Owl was listed as Threatened in 1979 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A Threatened designation means there is a possibility that the species could become endangered if factors causing the decline are not addressed. In 1995, with numbers of owls continuing to decline, the owl was uplisted to an Endangered status. Today, there is the real possibility that Burrowing Owls may disappear (become Extirpated) from the prairies and Canada in the near future unless conditions for their survival become more favourable.

Saskatchewan listed the Burrowing Owl as Endangered in 1999 under the provincial *Wildlife Act, 1998 Species at Risk Regulations*. The regulations of the provincial *Wildlife Act* apply to provincial and private lands and prohibit the destruction of the nest burrow. The Burrowing Owl is also listed as Endangered under the federal *Species at Risk Act* and is legally protected on federal lands from activities such as capture, harassment, trade, and killing, and its nest burrows are protected from destruction during the breeding season. In the future, protection will come into place for Burrowing Owl 'critical habitat' (habitat essential to the survival of the species), but this is in the process of being defined. In 2007, partial critical habitat was identified in prairie dog habitat.

A National Recovery Plan for the Burrowing Owl was approved in 1995. The Recovery Strategy was updated in 2002 with the objective of increasing Burrowing Owl populations in Canada to a self-sustaining level. The Recovery Strategy has set a goal to maintain a stable or increasing owl population averaging 3,000 pairs across the prairies (currently estimated at 500 to 800 pairs).

There are seven objectives to achieving this goal:

1. Identify factors associated with annual population changes.
2. Identify and implement protocols that lessen factors affecting population declines.
3. Maintain, increase, and enhance breeding and foraging habitat.
4. Optimize nesting success, fledging rate, and survival on Canadian breeding grounds.
5. Re-establish wild breeding populations of Burrowing Owls within their historical range in British Columbia and their 1993 range in Manitoba.
6. Encourage management, conservation, and research on Burrowing Owls, and the habitats they use, during all seasons in the United States and Mexico.
7. Engage, support, and communicate with land holders and land managers about actions to improve Burrowing Owl populations and habitat in their local areas.

Research needs are identified in the Recovery Plan and research results, in turn, guide Burrowing Owl recovery activities, that include voluntary stewardship programs, banding programs, habitat enhancement activities, and additional research.

Limiting Factors: Why Are Burrowing Owls Declining?

Populations are limited by factors that decrease survival of eggs and young (productivity) or increase mortality. Low productivity and high juvenile mortality (death of birds in their first year before breeding) are crucial factors that have been identified through research as driving the Burrowing Owl population decline. Low productivity since the 1990s and earlier is well documented, but juvenile mortality rate is less understood due to unknown dispersal of juveniles. The owl's decline is undoubtedly related to habitat loss, fragmentation and change. Human activities are important to consider because these are ultimately the factors that can be addressed to reverse the population decline.

1. Habitat loss, fragmentation and change

The same land that Burrowing Owls favour for nesting is also favoured for crop production. As a result, the substantial conversion of grassland to cropland in the last century has greatly affected the owl. Less than 20% of native (unploughed) prairie remains in Saskatchewan, with less than 2% remaining in some of the more arable areas. Between 2003 and 2006, nesting success was 10% higher in native prairie than in areas with non-native vegetation.

Fragmented patches, caused by cultivated fields, roads, shelterbelts and shrubby habitat, have replaced large expanses of pasture in many areas. Habitat fragmentation makes it easier for predators to find Burrowing Owls and their nests, increasing predator impact on nests and young. The installation of predator-proof nest boxes significantly reduced nest depredation by mammalian predators. Habitat fragmentation also limits movement of owls between sites, thus affecting pairing and dispersal. Young owls in fragmented areas stay closer to their nests and move less frequently than young owls in large areas of grassland; this could affect their ability to survive. Fragmentation may also affect Burrowing Owl prey by limiting the frequency and extent of prey population outbreaks.

Habitat change has favoured many predators like the red fox, coyote, raccoon and striped skunk; these are thriving on the prairies because of agricultural practices and the extirpation of wolves over the past century. Some avian predator populations like the Red-tailed hawk have increased because of the increase in fences, utility poles, shelterbelts, and lone trees, along with fire suppression. Factors favouring predators have impacted owl populations as predation is the main cause of adult and juvenile mortality on Canadian breeding grounds and in wintering areas.

3. Fewer burrow providers

In many breeding areas, burrowing mammals such as badgers and Richardson's ground squirrels (gophers) are not tolerated. Elimination of burrowing mammals results in fewer burrows available to owls for nesting and escape from predators, which ultimately affects their survival and presence in an area. Also, owls may be mistakenly shot in attempts to control burrowing mammal populations. These accidents are probably rare, but any loss of owls has an impact on the population because of low owl numbers.



R. Poulin

Nature Saskatchewan, through Operation Burrowing Owl, helps landowners enhance and restore grassland habitat in order to reduce habitat fragmentation and its detrimental effects on breeding owls.

2. Decreased food availability

The abundance of primary food items (small mammals and insects) of breeding Burrowing Owls has been adversely affected by changes on the prairies that include cultivation, loss of riparian (wet) areas and

use of pesticides.

Research throughout the 1990s showed that providing additional food at nests during the nesting period significantly increased the number of fledglings produced by owl pairs. This suggests that natural (non-supplemented) food availability is very important to nesting Burrowing Owls. Unfortunately, the number of owls surviving to migration did not increase with supplemental feeding at nests.

In 1997, the meadow vole population exploded across the prairies which was the first explosion of similar magnitude since 1969. Extremely large prey caches of voles were found at some nests. A cache from one nest contained 218 prey items. Because of the abundant prey in 1997,

Burrowing Owls likely had sufficient food to maximize egg laying and survival of young and juveniles. In the following year, there was a noticeable increase in the number of nesting pairs.

It is likely that a stable owl population depends on periodic vole and grasshopper outbreaks, as once occurred. These outbreaks are infrequent now, probably because of widespread landscape changes. The 1997 vole outbreak likely was helped by an early snow that left some crops standing and good snow cover the previous winter – conditions that provide good habitat for reproduction and survival of voles.



L. Scott

4. Collisions with vehicles

Owl collisions with vehicles is the second most common cause of Burrowing Owl mortality in Alberta and Saskatchewan, after predation. Juvenile owls are especially vulnerable because they often hunt for insects on roads. Roadside ditches are also important potential foraging habitat for both adult and juvenile owls. The number of roads on the prairies has increased over the past 50 years, and therefore current owl mortality rates may be higher now than they were in previous years.



Nature Saskatchewan

5. Pesticides

Pesticides can affect the population by causing mortality, reducing productivity, decreasing availability of prey, or by reducing the number of burrowing mammals. Research is needed on the effects on Burrowing Owls of all pesticides currently being used in Canada, the United States, and Mexico.

Earlier research on the liquid formulation of carbofuran, once used for grasshopper control, showed this pesticide to have a significant impact on survival and reproductive success of Burrowing Owls. Due to its toxic effects on the owls and other living creatures, and successful lobbying by conservation organizations such as World Wildlife Fund, liquid carbofuran was deregistered as a grasshopper control in 1995. In 1998, granular carbofuran used on canola was also deregistered in Canada.

Pesticide use can also have an indirect impact on Burrowing Owls. Poisoning ground squirrels with strychnine may negatively affect owls by reducing the number of available burrows for nesting and escaping predators, and by eliminating these prey as an alternative food source for owl predators, such as hawks and larger mammals.

Bands - Not of the Musical Variety

Banding is used to monitor movements of owls on and off breeding areas. Banded owls can provide us with information on adult and juvenile mortality, movement to and from the wintering grounds, and fidelity to and dispersal distances from previous nest sites. For juveniles, we learn about dispersal distances from the nest site after fledging.

Two types of leg bands are placed on Burrowing Owls: a uniquely numbered Canadian Wildlife Service supplied USFWS (United States Fish and Wildlife Service) aluminum band, and 1-3 coloured plastic or aluminum bands. Bands are placed in a unique combination on the legs so that individuals can be distinguished without recapturing the owl. Bands can be seen from a distance using either binoculars or a spotting scope. Banding returns and observations indicate that wearing bands does not affect survival or behaviour of the owls.

Since 2004, there have been over 2200 Burrowing Owls banded in Alberta and Saskatchewan! Researchers need your help to spot these owls when they return to the prairies to learn about owl movements since hatching or previous nesting sites. Burrowing Owls can move large distances between years. If you spot a banded Burrowing Owl, please report it to the Nature Saskatchewan HOOT-line at 1-800-667-4668.



R. Poulin

Burrowing Owl Research

Research studies help us understand the reasons for the Burrowing Owl population decline, and guide strategies to reverse this. Studies also provide a better understanding of the owl's behaviour and biology. Biologists working in Saskatchewan are leaders in research and population recovery efforts for Burrowing Owls.

To Catch an Owl

In order to band and attach a radio transmitter to an owl, one must first capture the owl. Burrowing Owls have been captured successfully in Saskatchewan with several methods including one-way door traps and bow nets.

A bow net, currently the preferred capture method, consists of two semicircular bows of light metal with netting strung loosely between them. Hinges and springs connect the two semicircles at their bases. When setting the mechanism, one half is fixed to the ground, and the other half is pulled over this stationary half and latched into place. Bait (e.g., a dead laboratory mouse) is placed in the centre of the trap with a trigger mechanism over the cage. When the owl enters to grab the bait, the trigger is released and the bow net swings over the bird enclosing it in a 'tent' of mesh.

Biologists wait nearby so they can retrieve the owl immediately upon capture. Owls are not harmed by these nets and are soon released once they are banded and information such as weight and physical condition is gathered.



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6. Mortality during migration and in wintering areas

Burrowing Owl survival is also affected by conditions along migration routes and in wintering areas. The extensive destruction of prairie dog colonies in the United States and Mexico, as well as agricultural practices and urbanization, undoubtedly has had a detrimental effect on Burrowing Owls that breed in Canada. The resulting habitat changes have likely increased mortality from predators and possibly reduced the food supply.

Mortality outside breeding areas is based on the return rate of banded birds, but this is difficult to measure because owls do not always return to the same location each spring and thus might not be sighted and known to be alive. Recent studies of radio-tagged owls wintering in southern Texas and central Mexico show that survival in some areas is between 17-30% over the winter. It can be estimated that about 25% of migrating Burrowing Owls survive the winter to migrate north. Additional mortality occurs on fall and spring migration.

Questions That Need Answers... And What We Are Finding

1. Can survival of eggs and young be increased?

To answer this question, biologists conducted a study from 1994-1998 to determine how owl productivity (survival of eggs and young) changes with food availability. Some owl nests were provided with additional food (supplemental feeding), including dead lab mice and quail, while other nests were not. In addition, artificial nest boxes were installed to prevent predators from destroying nests, thus creating conditions where the effects of supplemental food on productivity could be assessed as a stand-alone issue.

This study showed that owl productivity could be significantly increased using supplemental feeding and predator-proof nest boxes. In most years, it appears there is not sufficient prey available to provide enough food to maximize the number of young fledged. Nests that were given additional food produced an average of 7 to 8 fledglings, whereas nests not receiving additional food produced about 5 fledglings.

2. What are the hunting habits of adult male owls?

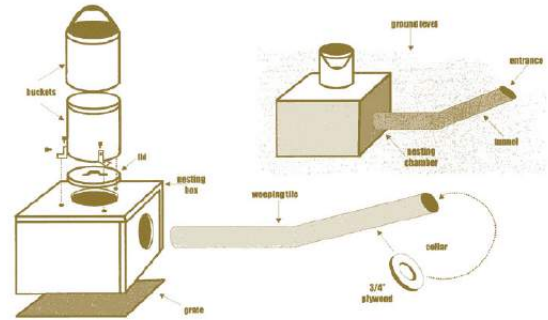
In the mid-1980s, a study of owls fitted with radio transmitters conducted near Saskatoon examined home ranges and activity patterns of male Burrowing Owls. Males hunted in areas where grasses were approximately 30 cm in height and avoided croplands and well-grazed pastures. On average, the owl's home range size was 2.4 km² (about 596 acres), and foraging occurred as far as 2.7km from the nest; however, during tracking, 95% of owls were located within 600 meters (656 yards) of the nest.

In a study in the Regina-Weyburn area in 1997, home ranges averaged substantially smaller at 0.35 km² (about 86 acres). Owls likely did not have to travel as far for food due to the high number of voles in 1997. This suggests that owls alter their foraging patterns depending on prey availability. Research on male foraging in Alberta found that average home range sizes were larger, around 3.3 km² (about 810 acres), and males hunted mostly in wetland edges with taller, denser vegetation.

Understanding home-range size and shape is essential because it will demonstrate how far Burrowing Owls are willing to fly to obtain food. These types of studies can also identify the amount of "high quality" habitat within the home range and validate the appropriateness of circular buffers for critical habitat assessment.

Artificial Nest Burrows: Prefabricated Homes

Artificial nest burrows (ANBs) are used to enhance survival of nests by reducing predation. ANBs also facilitate research studies by allowing biologists to gather information on egg-laying dates, clutch size, the onset of incubation and incubation period, hatching dates, nest success, and growth and development rates of chicks. Prey caches in ANBs indicate relative prey abundance and the identities of larger prey items.



From ground level, ANBs look the same as natural burrows. An ANB is dug into the ground so that it replaces the natural burrow, and consists of a wooden box with a hole on top and a metal grate in place of the bottom. A dirt-filled, removable bucket nested within a second bucket that is secured on the top of the box serves as a lid for the hole and provides insulation from the weather. By lifting the upper bucket, biologists have access to the nest chamber. The bottom grate stops badgers and other burrowing mammals from digging under the nest chamber and allows water to drain out of the nest. The tunnel is replaced with plastic weeping tile and is fixed with a collar, an arm's length from the entrance, to restrict access by mammalian predators such as skunks and raccoons.

Nest boxes are installed once a pair is established, but before egg laying begins, at selected occupied natural burrows. After installation, researchers line the bottom of the tunnel and nest chamber with dirt and dried shredded manure to resemble a natural owl burrow. It is important to remember that only researchers with proper permits can install ANBs for research purposes. Unless you have a permit, under *The Wild Species at Risk Regulations of The Wildlife Act* (Saskatchewan Ministry of Environment) it is prohibited to disturb a Burrowing Owl nest burrow.

Video Monitoring of Owl Nests

With the advent of small infra-red-sensitive video cameras together with digital video recording systems (DVRs), it is possible to record details of behaviour while being relatively unobtrusive to the owls. Video recording allows observers to be closer to the action than would normally be possible, and to make more detailed observations by pausing and replaying frames of video. For activities focused at a central location such as a nest, DVRs are especially effective at recording behaviours 24 hours a day. Video cameras can be used to study details of foraging behaviour, determine rates of food delivery, assess the difference between male and female roles in raising young, examine daily or seasonal patterns in hunting behaviour and study other nesting behaviours.



3. Do male and female owl behaviours differ when providing prey to the nestlings?

Infrared cameras were used to record the provisioning behaviours of nesting Burrowing Owls over a 24-hour period in the Regina Plain to discover if there were differences according to sex and nest stage of these owls. These researchers found a sex-based difference in foraging behaviour where males hunt vertebrates (mainly small mammals) during crepuscular periods (at dawn and dusk), and females hunt insects during diurnal periods (during the day). Males delivered between 82% and 96% of all vertebrate prey, depending on the nesting stage. Vertebrate deliveries to the nest occurred predominately at dawn and dusk and there were few that occurred during daylight. Almost all insect prey delivered before the eggs hatched was by males but females took over the insect deliveries once they no longer had to incubate the eggs. Insects were delivered during all hours of the day but the deliveries became more frequent during the daytime.

Without the diurnal deliveries of insects, the owlets would have to endure 16 hours between dawn and dusk feedings; therefore, insects have a significant role in the survival of young Burrowing Owls.

4. What happens to young owls after they can fly and leave the nest?

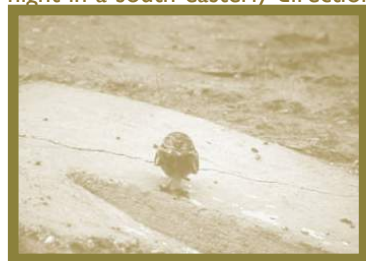
In a radio-telemetry study on the Regina Plain, owlets fitted with radio-transmitters just prior to fledging were monitored until migration. Three general patterns of juvenile dispersal were observed: (1) remaining at the nest burrow for the duration of the summer, (2) moving to a new burrow generally quite far from the nest), and remaining there until migration, and (3) moving away from the nest in stages, choosing a different burrow on a regular basis. During the study, juveniles used about 5 different burrows between the time of fledging and migration. Research also found that owls tended to migrate earlier during years with above-average food levels than in years when prey was not as abundant, indicating an earlier sufficient weight gain for the journey. Years when small mammal prey (e.g., mice and voles) was less abundant also saw an increase in hawk predation on juvenile owls. A high small mammal population, as observed with the dramatic increase in meadow voles in 1997, likely has a positive effect on juvenile survival by providing predators with an alternate prey source.

5. What are key factors influencing pre-migratory dispersal in juvenile owls?

In a radio-telemetry study in southern Saskatchewan, researchers tried to determine if body condition or landscape pattern influenced pre-migratory movements of juvenile Burrowing Owls. Owlets from both small isolated patches and large patches of grassland started dispersing around the same time. They found that owlets in good body condition and in large patches of grassland continued to move farther from their nest before migration, whereas owlets in small isolated patches of grassland moved less than 400 m from their nests before migration. Their research suggests that juvenile owls in small patches are unwilling or unable to cross cropland in a fragmented landscape. Small patches may make juvenile owls more susceptible to predators or starvation.

6. Where do owls migrate in winter, and how many return?

In 1997, 13 owls in the Moose Jaw area were fitted with radio transmitters and tracked as they left on migration. These owls flew at night in a south-easterly direction but they did not necessarily fly every night. They averaged 186 km per night and stopped during the day in areas similar to their nesting habitat. Two owls were tracked as far as Dickinson, ND. Three owls returned to Moose Jaw in the spring of 1998 with radio transmitters still attached.



G. Holroyd, Env. Canada

The first documented Canadian prairie owl found on its wintering grounds was photographed in December 1997 in southern Texas. It had been banded in Saskatchewan earlier that year. At the time, no other wintering and only nine other migrating owls had been recovered from more than 3000 Burrowing Owls banded in Canada. Radio-telemetry studies have yielded further clues about where Canadian owls winter. In December 2000 and February 2001, signals from six owls radio-tagged in prairie Canada were detected from the air; four were in southern Texas (all were owls radio-tagged in Saskatchewan) and two were in Mexico just south of the United States border (one

Keeping Track of Owls

Radio-telemetry is a valuable research tool used by biologists for a variety of purposes. It can provide information on habitat use, movements and activity, and causes and rates of mortality in breeding areas, wintering areas, and along migration routes.

How is radio-telemetry used to study Burrowing Owls? There are two pieces of equipment: a transmitter and a receiver. A battery-operated transmitter, about the size of a peanut, emits a radio signal at a designated frequency. It is worn around the owl's neck like a necklace or on its back like a backpack, and has a flexible antenna extending behind the bird's head towards its tail.

The radio receiver can select different frequencies. If it is tuned to the same frequency as the owl's transmitter, it begins to beep if the owl is in the area. A directional antenna can be attached to the receiver enabling the radio to beep louder when the antenna is pointed towards the owl. The owl can then be located by moving in the direction of the loudest beep.



R.Fife

owl was tagged in Saskatchewan and one in Alberta). In February 2001, both owls, detected from the air, were located on the ground wintering in the states of Vera Cruz and Michoacan, Mexico.

Wintering Burrowing Owls from unknown breeding locations have been found in southern Texas and in Mexico from Sonora south of Colima and east to Puebla, Mexico City and Guadalajara. The owls use agricultural fields, as well as more open grassland country, orchards, and even thorny shrub woodlands. They often hide in burrows, culverts, or open pipes in the daytime, but sometimes sit under grass clumps and use artificial tubular roosts when they are available.

7. What are stable isotopes telling us about owl origin and movement?

New insight on owl origins and movement is being gained from stable-isotope analyses. Biologists can identify a broad geographic range from which a bird originates based on differences in hydrogen signatures in rainfall across North America, which show in owl feathers and blood when they consume water from that area. This technique has shown that winter populations in southern Texas and central Mexico contain “Canadian Owls”, although not all do and only small numbers of “Canadian Owls” have been found. The majority of owls in central Mexico appear to be migrating from the southern United States or northern Mexico. There is no indication that there is a leapfrog migration (where owls that winter the furthest south travel the furthest north to nest).

Stable-isotope analyses also indicate broad breeding dispersal from

one year to the next. Slightly less than half of the owls nesting in Saskatchewan each year hatched or bred here the previous year. In addition, about 20% of the owls (adults and young combined) will not return to Canada in a subsequent year. This high emigration rate may be a more recent phenomenon resulting from an overall continental decline in Burrowing Owl numbers causing edge populations to shrink. Added to post-breeding mortality and winter or migration mortality, it is estimated that the owls would need to produce 6.1 young per pair to sustain the current population. In Saskatchewan, they are averaging 4.5 young per pair.

8. How can we predict where owls will nest?

Conservation of high quality Burrowing Owl habitat is vital to the long-term survival of this species in Canada, and thus predicting where they might nest is important. Recent computer-generated models suggest that soil and climate are the best predictors of where these owls will establish themselves. Results also show that owls select larger grassland patches where available but only where soil and climate conditions correspond with areas that are selected by owls. Both climate and soil affect land use patterns (e.g., ranching versus cropping) and habitat structure (both locally and at the landscape level), which ultimately influence productivity of small mammals, the owl’s main prey source. Furthermore, soil characteristics also determine American Badger use, which in turn affects the number of available burrows for nesting. Burrowing Owls in Saskatchewan and Alberta select coarse-textured, sandy soils similar to soil types preferred by badgers and they avoid finer, clay-like soils. Defining suitable habitat partially based on this information allows for more effective, targeted conservation of habitat for this species.

9. What factors influence owl breeding success?

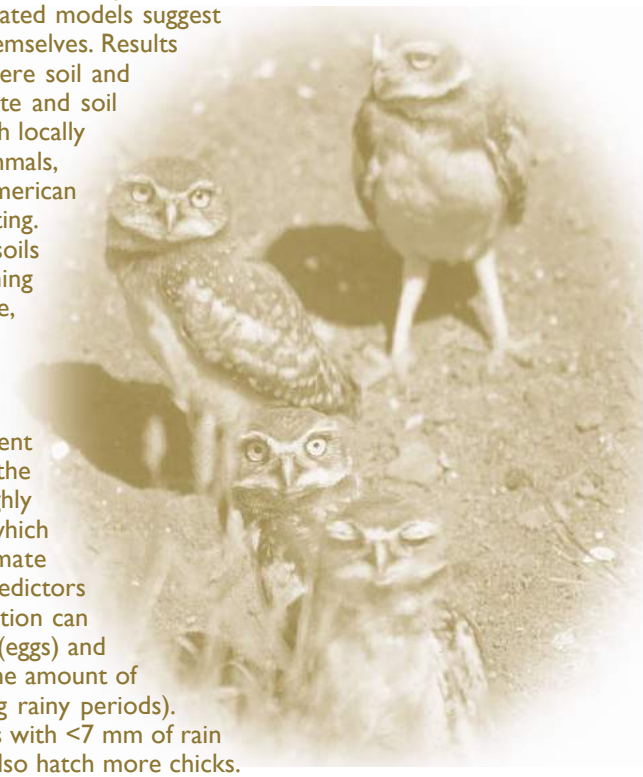
One key to increasing the Burrowing Owl population is to implement management strategies where possible that increase the number of young that survive to the following breeding season. The nesting period is often a time when owls are highly vulnerable to factors influencing mortality and thus it is important to determine which factors at this stage affect reproductive success. Although soil and climate characteristics are good predictors of habitat use (see above), they aren’t good predictors of nesting success. Instead, researchers have shown that the amount of precipitation can be the most important variable influencing nesting success. The age of the clutch (eggs) and hatch date also influence nesting success. High amounts of precipitation reduce the amount of time owls can successfully hunt (both owls and their prey are less active during rainy periods). Increased precipitation can also flood nests; however, a moderate number of days with <7 mm of rain positively impacts the number of chicks hatched. Nests that are initiated earlier also hatch more chicks.

How Stable Isotopes Tell Us About Bird Origins and Movement

Isotopes are forms of a chemical element that have different numbers of neutrons and therefore a different atomic mass. Stable isotopes are those that do not decay with time, and include isotopes of hydrogen, oxygen, nitrogen, carbon, and sulphur. The power of stable isotopes for the study of migratory birds hinges on two important facts.

First, ratios of stable isotopes vary in proportion to the temperature and quantity of annual precipitation, resulting in well-mapped variations corresponding to latitude across the globe.

Second, the isotopic ratios in a geographic area are reflected in the local food chains. Hence, an animal’s tissues reflect the isotopic ratios of foods consumed, and the local water and soils. A bird that migrates across geographic areas with large isotopic gradients will exhibit different isotopic concentrations in its various body tissues, and turnover rates of the isotopes will differ among tissues. Feathers are unique, however, in that they grow in a very short time and then become metabolically inert. Consequently, the isotopic content of a feather reflects the bird’s diet and the area where the feather developed. Isotopic ratios, or ‘signatures’, in the flight feathers of an adult bird captured during migration or on its breeding grounds will correspond to those of the bird’s previous area of residence.



.....Continued on page 10

In addition, these nests may be less vulnerable to predation in later stages through reduced overlap in time when predators are hunting more intensively to provide food for their offspring. Once hatching occurs, activity around the nest increases (e.g., more prey deliveries), which increases visual cues for predators.

Several habitat characteristics were found to influence breeding success (an owl pair raising at least one young to near fledging) in a 2000 study at Operation Burrowing Owl sites across southern Saskatchewan. Of numerous characteristics around each nest that were measured, three were found to significantly affect breeding success: no lone trees within sight of the nest, an abundance of additional burrows nearby (both ground squirrel (gopher) and badger holes were important), and an increase in the area covered by wetlands within 2 km of the nest. Single trees provide perches for the owls' avian predators, abundant burrows provide escape cover from predators and holes for dispersing young, and nearby wetlands provide habitat for the owls' small mammal prey.

Into the Future

A number of knowledge gaps remain to be addressed in order to more fully understand how to recover the Burrowing Owl in Canada. Information that is unknown but needed to address the recovery objectives include:

1. Understanding the processes that may affect Burrowing Owl adult and juvenile survival in areas with petroleum development;
2. Survival rates of Burrowing Owls at life stages where there currently isn't adequate data (e.g., juveniles during migration);
3. Best methods for release of captive-bred owls to establish a viable population in British Columbia;
4. Migratory routes used and winter range of "Canadian" owls;
5. Improved survey methods for both breeding and wintering populations.

The Landholder's Role

In Saskatchewan, the majority of owls nest on privately owned land. Landholder interest and cooperation are vital to Burrowing Owl research and conservation. In addition to protecting over 216,000 hectares of grassland habitat, approximately 350 Operation Burrowing Owl landholders help to monitor the owl population by annually reporting whether or not they have nesting owls and, if so, how many pairs are present. Landholders allow access onto their property, direct researchers to possible nest locations, consent to the installation of artificial nest boxes and most importantly, maintain and enhance Burrowing Owl nesting habitat. Without their help, habitat conserved for Burrowing Owls and other prairie species and knowledge gained from owl research would be greatly diminished.

Operation Burrowing Owl, initiated in 1987, is a voluntary prairie stewardship program that aims to conserve habitat for Burrowing Owls and other prairie wildlife, and conserve prairie landscape for future generations. The annual census of nesting owl pairs is important to detect changes in the owl population from year to year as well as over the long term, and to provide data on distribution and habitat changes. The census has indicated an owl population decline of 97% from 1988-2023 however, 1996, 1998, 2002 to 2004, and 2008 to 2009, 2014, 2016, 2020, and 2022 showed modest increases in the owl population compared to the preceding year.

What Can You Do to Help?

You can act to benefit the Burrowing Owl and our prairie landscape.

- If you own land with nesting Burrowing Owls or prairie habitat, join Operation Burrowing Owl or another prairie conservation program.
- Eat Canadian beef and bison – grazing keeps Burrowing Owl habitat in good shape.
- If you own pasture, maintain it in good condition – healthy grasslands mean healthy cows and prairie species.
- Be informed and learn more about nature by joining a naturalist organization such as Nature Saskatchewan or one of its local societies.
- Support sustainable agricultural practices by buying low-input (low chemical, low erosion), locally produced foods, and range-fed livestock.
- Become actively involved by volunteering your time and skills to conservation programs.
- Support conservation through monetary or in-kind donations.
- Acknowledge and commend sponsors and partners of Burrowing Owl and prairie conservation programs.
- Write letters (to governments, newspaper editors, etc.) to encourage habitat conservation and support of wildlife programs.
- Be environmentally conscientious: practice the 4R's (reduce, reuse, recycle and recover) in daily living.
- Consider keeping your cats indoors.

Thank You to our Supporters!

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*A special thank you to landholders and managers conserving wildlife
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Nature

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Nature Saskatchewan is a charitable conservation and cultural organization. We engage and inspire people to appreciate, learn about and protect Saskatchewan's natural environment. Our supporters include about 600 individual members and 16 local naturalist groups. Our vision is "Humanity in Harmony with Nature".

