

TECHNICAL NOTES

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Burrowing Owl Nest Box Specifications & Habitat Management

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All of the following information on Burrowing owls is taken from Burrowing Owl Behaviour and Biology Fact Sheet 3, Saskatchewan Environment and Resource Management and NATURE Saskatchewan.

Introduction

Burrowing owls (*Athene cunicularia*) are found in the open, well-drained grasslands, steppes, deserts, prairies and agricultural lands throughout North and South America. Across the prairies, this owl once nested in ground squirrel or badger burrows in vast expanses of unbroken prairie sod. More recently, over most of its range, it has either disappeared or has been confined to remaining patches of prairie land, including road allowances, railway rights-of-way, farmyards and unplowed pastures.

Burrowing owls are small raptors or birds of prey. They look like short fat owls on stilts. They have a typical “owl” head with large yellow eyes, relatively large wings, a short tail and long thin legs. Burrowing owls exhibit a mottled pattern of dark and light brown with white spots. The underparts are pale brown to white. Most of the time, males are indistinguishable from females. However, in the spring the male is more likely to be visible because the female is below ground laying or incubating eggs. The extra time that males spend above ground, and hence extra exposure to the sun, bleaches their plumage to a lighter color than females. Once incubation is complete, females spend more time above ground, and their plumage bleaches to the same color as the males.

The burrowing owl is about the same size as a robin and weighs between 125 and 185 grams (4.5 to 6.5 ounces). Breeding begins at one year of age. The oldest known owl in North America in the wild is eight years old (determined from band returns), and the oldest known bird in captivity is 15 years.

Life-Cycle of the Burrowing Owl

Burrowing owls arrive on the prairies around the third week of April. Males select a nest burrow and try to attract a female by calling *coo coooo*, and by establishing prey caches consisting primarily of small mammals such as mice and voles. These spring time caches usually contain the largest number of prey items. In 1997, when meadow voles were extremely abundant, a cache from one nest contained 218 prey items.

Once the pair is established, the owls modify the burrow and line the tunnel and chamber with dried manure. The absorbent qualities of the manure help to protect nests from flooding.

Egg laying occurs between late April and late May, shortly after pair bonds are established. The female lays on average 9 eggs (range 6 to 11 eggs) laying one egg every 36 hours. Females that begin laying later in the season typically have smaller clutch sizes.

Once the fourth or fifth egg is laid, females begin incubation. Males do not incubate. Eggs hatch after about 26 to 30 days of incubation. The first 4 or 5 eggs hatch on the same day. Subsequent eggs hatch between 2 to 6 days later, resulting in age differences among the nestlings. If there are natural food shortages, the youngest chicks in the nest may die or are killed by their siblings or parents, and are used as food.

Initially, hatchlings are “helpless,” relying entirely on their parents for warmth and food. However, development occurs rapidly. Young are first seen at the entrance of the burrow between 2 to 3 weeks after hatching. They begin to move to nearby burrows at about 25 days, and can fly at about 50 days of age. The juveniles become relatively independent of the adults between 60 to 70 days after hatching.

Burrowing owls migrate south from early September to mid-October. Migration occurs primarily at night. Further research will provide information on owl habits along migration and in wintering areas.

Habitat Requirements for Burrowing Owls

Three key characteristics of burrowing owl nesting habitat are: availability of burrows, short or grazed vegetation, and wide-open spaces. In Saskatchewan, most of the burrow sites are located on lacustrine (old glacial lake bottom), solonchic (hardpan or claypan), saline (high in soluble salts) and alluvium (deposited where flowing water enters a water body through past glacial activity or in present day river systems) soils that have few rocks. These same soils are excellent for farming. Owls rely on burrowing mammals for their burrows. They will nest in Richardson’s ground squirrel (gopher) and black-tailed prairie dog burrows, badger excavations, and occasionally fox dens. Grass height is more important than grass species composition. Grasses kept short by climatic conditions; grazing, haying, mowing or burning are preferred.

Burrowing owls exhibit strong site fidelity, and often return to the same nesting areas over consecutive years. From one breeding season to the next, adult males show the strongest site fidelity, followed by adult females, juvenile males and juvenile females.

Burrowing owls require more than an open area surrounded by short vegetation and with adequate nest burrows. They also need enough permanent cover and tall vegetation within their home range to support a sufficient population of small mammals and other prey. During the day, owls forage mostly on insects close to the burrow. At night, however, when the majority of foraging occurs, the owls fly to locations with larger small mammal (deer mice, meadow voles) abundance. These habitats more often include uncultivated fields; ungrazed areas, wet meadows/riparian areas and roadsides than seeded fields and heavily grazed pastures. During the nesting period, males do the majority of the hunting.

Burrowing Owls in the Food Web

The burrowing owl is a generalist predator. Anything that moves and is small enough to catch is fair game. Insects, mice, voles, young ground squirrels, toads, snakes, salamanders and small birds have all been found cached at the burrow. However, owls generally hunt prey that is most available. Early in spring, mice and voles are an important component of their diet. Later in the summer, grasshoppers become more available and are particularly important for fledglings learning to hunt on their own.

Burrowing owls have many predators. There are predators that eat eggs, nestlings or adult females in the burrow during the nesting period. These include American badgers, red foxes, striped skunks, least and long-tailed weasels, raccoons, prairie rattlesnakes and bull snakes. Although badgers are a major predator, their digging activity is essential in creating nest sites and escape cover.

Other predators prey on older nestlings and adults above ground. These include coyotes, domestic dogs and cats, and raptors (Swainson’s hawks, ferruginous hawks, red-tailed hawks, great horned owls, northern harriers, short-eared owls and prairie falcons).

Limiting Factors

Factors, which increase mortality, decrease productivity or reduce habitat quality, can limit burrowing owl populations. Factors related to human activities are important to consider because these are ultimately the factors that can be addressed to reverse the population decline.

1. Habitat loss

Unfortunately, the same land that burrowing owls favor is also favored for farming. The conversion of grassland to cropland has been substantial in the last century. Little of the native prairie remains throughout most of North America.

2. Habitat fragmentation and degradation

Fragmented patches have replaced large expanses of pasture. Habitat fragmentation likely affects movement of individuals between sites, thus affecting pairing and dispersal.

Many predators are thriving on the prairies (red fox, coyote, and striped skunk). Fragmented patches of grassland make it easier for predators to search for and find burrowing owls and their nests. Also, some avian predator populations have increased along with the increase in trees on the prairies, a result of fire suppression and planting. Red-tail hawks, not typically thought of as a prairie raptor, are now commonly found within the burrowing owl's range.

3. Fewer burrow providers

In many areas, burrowing mammals such as badgers and ground squirrels are not tolerated. Elimination of burrowing mammals results in fewer burrows for the owls. It is possible that some owls are mistakenly shot in attempts to control for fossorial (burrowing) mammals. These accidents are probably infrequent, but any loss of owls likely has an impact on the population because owl numbers are very low.

4. Collision with vehicles

A number of burrowing owls are killed as a result of collisions with vehicles. Operation Burrowing Owl (OBO) is trying to reduce this problem. Upon a landowner's request, OBO will provide signs that warn motorists to reduce speed at sites where nests are located close to the road.

5. Pesticides

Pesticides can affect the population by causing mortality, reducing productivity, decreasing availability of prey, or by reducing the number of burrowing mammals.

The liquid formulation of carbofuran, controlling for grasshoppers, was shown to have a significant impact on survival and reproductive success of burrowing owls. During a study, nests within 50 meters (165 feet) of a field being sprayed with carbofuran fledged half as many young, and had a 50% reduction in the proportion of pairs successfully raising one or more young relative to control nests. Food availability may also be decreased by the application of carbofuran.

In 1995, liquid carbofuran was de-registered as a grasshopper control on cereals, headlands, pastures, roadsides and alfalfa. Regulations have reduced the application rate when used on canola, mustard and sunflowers. These changes, along with an existing 250 M (825 feet) buffer zone around burrowing owl nests, reduces its toxic effects on the owls.

Poisoning ground squirrels with strychnine may negatively affect burrowing owls. By reducing the number of available burrows for the owls and by eliminating an alternative food source for owl predators, sites formerly suitable for nesting may become less suitable. Research is needed on the effects on burrowing owls of all pesticides being used in the United States and Mexico.

6. Mortality on migration and in wintering areas

Burrowing owl survival may also be influenced by conditions experienced along migration routes and in wintering areas. A similar conversion of prairie to farmland, as has occurred in breeding areas, has possibly reduced the food supply and increased mortality from predators. Because burrowing owls were often found in prairie dog colonies, the extensive eradication of prairie dogs in both the United States and Mexico has likely reduced the quality of habitat for burrowing owls during migration and in wintering areas.

Over-winter mortality is difficult to measure for migratory species that do not return to the same location each year. It is usually estimated based on banded birds returning to the breeding grounds. Mortality is overestimated if nest fidelity is not 100% because birds leaving the study area are counted as dead.

For more information, contact:

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Saskatchewan Environment and Resource Management
Fish and Wildlife Branch
4th Floor, 3211 Albert Street
Regina, SK S4S 5W6
Tel: (306) 787-2314 Fax: (306) 787-9544

Moose Jaw Exhibition Burrowing Owl Interpretive Centre
Box 1467
250 Thatcher Drive
Moose Jaw, SK S6H 4R3
Tel: (306) 692-2723 Fax: (306) 692-2762



Construction & Installation for a Burrowing Owl Nest Box

In order to improve the success of the nest box, it is a good idea to speak with someone (local fish & wildlife personnel) who has installed burrowing owl nest boxes in the past.

The Artificial Nest Box for Burrowing Owls

The nest box is made out of six inch weeping tile for the tunnel, a wooden box for the nesting chamber, a “predator proof” grate on the bottom and a series of buckets on top of the nest chamber for maintenance. The nest box gives young burrowing owls almost complete protection from predators and its durability offers the owls a nesting location year after year.

Nest boxes are useful for providing alternative nest sites in an area currently or recently supporting nesting owls. By installing boxes to provide more nesting sites, it is sometimes possible to entice more owls to nest in a particular area. Because the boxes are permanent, the owls are more likely to return to the same site in future years. Nest boxes provide excellent protection from predators such as badgers, coyotes and foxes and may increase local owl

populations by increasing the survival rate of the young birds. Nest boxes have not been successful at enticing owls to nest in an area where they have not nested within the past few years.

Installing nest boxes may also be used when relocating owl nests away from “high-disturbance “ zones or areas destined for construction. This technique has shown some success but any relocation can cause abandonment and should only be used when absolutely necessary.

Nest boxes also help biologists by allowing easy access for monitoring nest success and to capture owls for leg banding. Burrowing owls are a protected species throughout the majority of their range and ***special permits are required to handle or disturb the owls in any way.***

When to install nest boxes in Washington State

Nest boxes can be installed into natural nests during the non-breeding season (October through March). Installing nest boxes where there is currently no natural burrow can be done at any time of the year, but once owls have selected a nest site (usually by the end of April) they are not likely to switch burrows until possibly the next year. ***Only install nest boxes during the non-breeding season.***

Based on a knowledge of owl behavior, experienced biologists may install nest boxes just prior to egg-laying (no later than April). Eggs can be present as early as mid-April and very careful digging is required. Even if eggs are not destroyed due to digging, female owls often abandon their nests if their eggs have been disturbed. If a female goes down the burrow instead of flying away when approached, she is very likely to be on eggs. This is a risky time to install nest boxes and should be avoided if possible. ***Installing nest boxes just prior to egg-laying should only be attempted by biologists experienced with burrowing owls.***

Nest box dimensions

¾” ***untreated*** plywood
sides (4 pieces)- 16” X 14”
top (1) – 16 ¾” X 16 ¾”
Expanded-metal grate (½” mesh)
bottom (1) – 16 ¾” X 16 ¾”

Materials Required to Build One Nest Box (*cut material to size before assembly and installation*):

- one 16 ¾” X 16 ¾” X ¾” construction-grade plywood (***untreated***);
- four 16” X 14” X ¾” construction-grade plywood (***untreated***);
- two five gallon plastic pails (with wire handles);
- sixteen 1 ¼” woodscrews;
- four 3/8” flat washers;
- three metal 1” angle brackets;
- three ½” bolts and nuts;
- one 5’ to 10’ length of 6” – diameter weeping tile;
- one 16 ¾” X 16 ¾” expanded-metal grate (½” mesh); and
- water.

Tools Required for Field Assembly and Installation

- screwdriver or drill with appropriate bits;
- approximately 3/8” and 5/32” wood drill bits;
- cordless jigsaw (minimum 9.6 volt) with wood cutting and plastic cutting blades;
- drainage spade (for removing sod);
- digging shovel;
- heavy-duty garden rake;
- long-handled garden trowel;

- large tarp (light-colored material is best);
- large felt-tipped marker; and
- a knife (for cutting weeping tile).

Assembly Instructions

Making the lid for the top of the box:

- cut the bottom off of one of the buckets, approximately four inches up from the bottom;
- trace the circumference of the bottomless bucket on to the top piece of wood with the marker (roughly in the center of the wood);
- with the marker, draw another circle approximately ½ inch inside the trace circle, this will be the size of the lid;
- at a point on the inside circle, drill a 3/8 inch hole to serve as the starting point for the jigsaw (this will later serve as an alignment mark for placing the lid on the box in the correct position);
- cut out the lid with the jigsaw set at a 30 degree angle (so that the top of the lid will be wider than the bottom);
- from the remaining piece of plastic, cut off of the bottom of the bucket, cut a rectangular strip five to six inches long and one to one and a half inches wide to use as the handle for the lid, and;
- Using two ¾ inch woodscrews, attach plastic handle to lid, leaving enough space between the center of handle and the lid to get at least one finger under the handle.

Putting the sides and metal grate together:

- with a marker, trace the outer circumference of the weeping tile (approximately six inches) on to the center of one of the side pieces;
- at a point on this line, drill a 3/8 inch hole to serve as the starting point for the jigsaw;
- With the jigsaw set at 90 degrees (straight cut), cut along this line. This will be the junction where the weeping tile enters the nest box. Save the “scrap”, circular piece of wood that results to make the collar that will be set inside the weeping tile;
- Trim the circular piece of scrap wood so that it fits inside the weeping tile. Cut out a 3-½ inch hole in the center of this piece. This collar will be placed inside the weeping tile to prevent medium-size mammalian predators from entering the nest box; and

- Assemble the sides of the box with 1 ¼ inch woodscrews, attach metal grate to the bottom of the box with ¾ inch woodscrews and 3/8 inch washers, then attach the top with 1 ¼ inch woodscrews.

Putting the bucket(s) over the lid:

- Drill three holes in the side of the bottomless bucket, equidistant from each other. These holes should be situated so the metal brackets, when affixed to the outside of the bucket through these holes, will sit flush with the bottom of the bucket;
- affix brackets to the bottomless bucket through these holes with ½ inch nuts and bolts (nuts and brackets on the outside of the bucket);
- center bottomless bucket over the lid on the top, screw brackets to top with ¾ inch woodscrews;
- Place the second bucket inside the bottomless bucket. With a marker, trace a line on the second bucket one to one and a half inches above the top-lip of the bottomless bucket. With a jigsaw, cut the second bucket at this line; and
- Approximately one inch from the top, drill two 5/32-inch holes on opposite sides of the second bucket. Replace the wire handle into these holes.

Time to complete installation is one to three hours, depending on soil conditions. If you are installing a nest box in a location that did not have natural burrows, be aware of the following points:

- Make wise decisions as the location of your nest box. Observe the habitat(s) in which owls regularly nest, avoid hazards of low-lying areas, trees and roads. Make sure there is an area close by that provides ample mice, such as an area with tall grass (crop fields are not very good hunting grounds);

- Make sure you install the entrance at a gentle slope. Entrances that are too steep tend to fill in quickly with dirt when it rains;
- Use excess dirt to create a mound in front of the entrance; and
- The tunnel should be six to ten feet long, sloping from the surface to about 1.5 meters (four to five feet) deep where it joins the box. It should have at least one sharp (30 degree) turn and should have a slight rise in elevation before attaching to the nest box.

Installing a nest box into an existing burrow:

- Try to save sod when installing a nest box. Remove the sod in blocks and try to include as much root material as possible. Placing dirt and sod on a tarp may help keep the area tidy (black tarps tend to get very hot in the sun and may burn the grass beneath them);
- Start digging about one meter (three feet) back from the entrance, leaving the entrance and mound intact. Owls are more likely to accept a nest box if the entrance appears natural, this also makes the entrance less likely to be trampled by livestock;
- It is easier to dig small sections of tunnel at a time. Cut out approximately 0.5 meters (two feet) of sod in the direction that the tunnel appears to head. Dig down to the tunnel (usually two or three feet) before cutting out the next patch of sod and digging more of the tunnel. This allows you to accurately follow the turns of the tunnel while removing the minimal amount of sod and soil;
- Once the nesting chamber is reached, cut out a sod patch slightly larger than the nest box circumference. Then dig out a square hole over the nest chamber, making sure the hole is deep enough so the level of the top bucket, when on the nest box, is at least one or two inches below the surface of the ground;
- Place nest box (with buckets) into the hole so it is sitting as level as possible, the side with the circular hole facing the tunnel. Slide the weeping tile into the side hole so, about two or three inches of weeping tile are inside the nest box;
- With a knife, cut the other end of the weeping tile to a length that will allow the weeping tile to sit snugly inside the natural entrance to the burrow;
- Attach collar to the inside of the weeping tile with three ¾-inch woodscrews. The

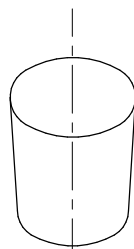
collar should be located about three feet inside the end of the weeping tile that faces the entrance;

- Remove the top bucket and lid and fill the nest box with fine soil (finest of the soil removed during digging will suffice) to a level that is even with the bottom of the weeping tile (the owls should not have to step up or down when going from the tunnel to the box). Add a layer of fine soil along the inside bottom of the weeping tile to create an earth surface for the owls to walk on. Replace lid and top bucket;
- With everything assembled and the top bucket in place, bury the box and tunnel using the soil removed during excavation. Be sure to fill in spaces (including the gap the gap underneath the weeping tile where it enters the box) with finer soil, padding it down as you proceed. Also be sure to fill the top bucket with soil;
- When the hole is filled with soil to the same level as the ground (after padding it down) replace the sod on top of the tunnel area and around the box area. If you want the nest to be easily accessible in the future, do not cover the bucket with sod;
- Excess dirt should be used to fill in gaps in the sod and any other dirt should be either discarded away from the borrow or used to extend the length or width (not the height) of the mound in front of the entrance;
- Water freshly laid sod generously so that it establishes quickly;
- If available, add a layer of crumbled, dry horse manure to the inside of the box and tunnel; and optional – place a few rocks on top of the bucket to prevent livestock from trampling the area.

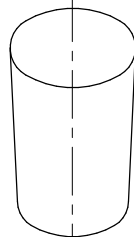
Maintenance

The only maintenance required for the nest boxes is a spring cleaning. Over the course of a winter and often with the aid of ground squirrels, nest boxes and weeping tile can be filled in with dirt. Early in the spring, after the ground has thawed but before the owls arrive, open the nest box and clean out any debris in the box and adjust the soil level to the bottom of the weeping tile. Using a long-handled garden trowel, reach into the weeping tile and remove most of the built up soil. Be sure to reach in from both ends, making sure the tunnel is clear so the have access to the nest box.

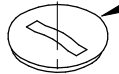
BURROWING OWL NEST BOX



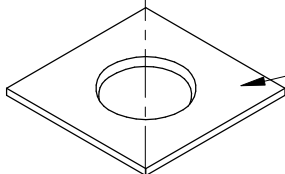
5 gallon plastic bucket with handle, placed inside other bucket. This bucket to be filled with soil and has a lid.



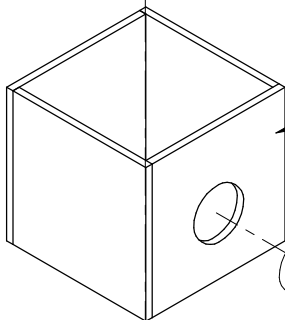
5 gallon bottomless plastic bucket attached to plywood top with (3) 1" metal angle brackets and $\frac{3}{4}$ " woodscrews. Metal angle brackets attached to bucket with (3) $\frac{1}{2}$ " nuts and bolts (nuts and brackets on outside of bottomless bucket)



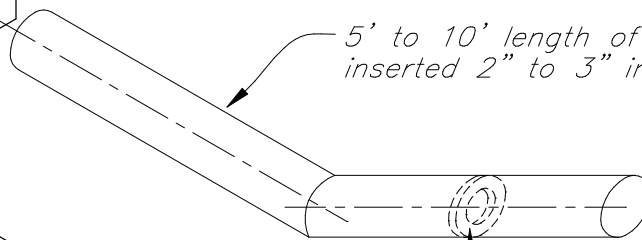
plywood lid has "left-over" plastic handle (from bottom of 5 gallon bucket) that is 5" to 6" long and 1" to 1 $\frac{1}{2}$ " wide attached to lid with (2) $\frac{3}{4}$ " woodscrews and enough space to get at least one finger under handle



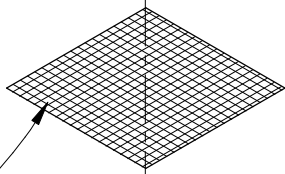
16 $\frac{3}{4}$ " x 16 $\frac{3}{4}$ " x $\frac{3}{4}$ " construction-grade plywood top (untreated), attached to box with (8) 1 $\frac{1}{4}$ " woodscrews - lid is 1" smaller in diameter than 5 gallon bucket and is beveled so that top is wider than bottom



(4) 16" x 16" x $\frac{3}{4}$ " construction-grade plywood sides (untreated) attached with (8) 1 $\frac{1}{4}$ " woodscrews



5' to 10' length of 6" ϕ weeping tile inserted 2" to 3" inside of box



16 $\frac{3}{4}$ " x 16 $\frac{3}{4}$ " expanded metal grate ($\frac{1}{2}$ " mesh) attached to the bottom of box with (4) $\frac{3}{4}$ " woodscrews and $\frac{3}{8}$ " washers

collar (cut from one side of box) attached to inside of weeping tile with (3) $\frac{3}{4}$ " woodscrews located about an arm's length inside of tile entrance