

Western Burrowing Owl (*Athene cunicularia hypugaea*)

Status

State: Species of Special Concern

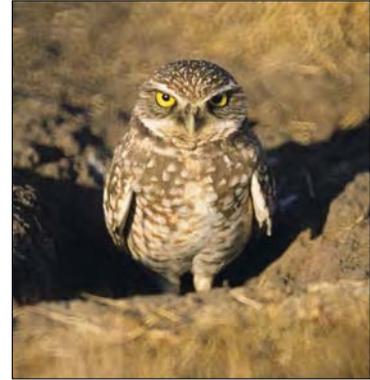
Federal: None

Population Trend

Global: Declining

State: Declining

Within Inventory Area: Unknown



Data Characterization

The location database for the western burrowing owl within the inventory area includes 17 data records dated from 1989 to 2000. Of these records, 13 were documented within the past 10 years; of these, 5 are of high precision and may be accurately located within the inventory area. Approximately 1 of these high precision records is located within developed areas. The remainder of the records occur within nonnative annual grassland habitats, or adjacent to roads or irrigation canals in agricultural fields.

The California Department of Fish and Game has recently been petitioned to list the western burrowing owl as endangered or threatened under the State Endangered Species Act. A large amount of peer-reviewed literature is available for the western burrowing owl. This species is declining throughout its range; therefore, most of the research studies emphasize nest site selection, passive relocation, use of artificial burrows, reproductive success, dispersal, and foraging behavior. Common management efforts employed to conserve existing burrowing owl colonies include prevention of all disturbance during the nesting season, installation of permanent artificial burrows, and management of the vegetation around the burrows by mowing or controlled grazing.

Range

The western burrowing owl, the western race of the burrowing owl, is found throughout western North America, west of the Mississippi River and south into Mexico. Other burrowing owl races occur in arid, open habitats from the provinces of southern and southwestern Canada to southern Florida and South America (Haug et al. 1993).

In California the range of western burrowing owl extends through the lowlands south and west from north central California to Mexico, with small, scattered populations occurring in the Great Basin and the desert regions of the southwestern part of the state (DeSante et al. 1996). Burrowing Owls are absent from the coast north of Sonoma County and from high mountain areas such as the Sierra Nevada and the ranges extending east from Santa Barbara to San Bernardino. Burrowing Owl populations have been greatly reduced or extirpated

from the San Francisco Bay Area (Trulio 1997) and along the California coast to Los Angeles. They have also apparently disappeared from the Coachella Valley. The remaining major population densities of Burrowing Owls in California are in the Central and Imperial Valleys (DeSante et al. 1996).

The western burrowing owl is distributed over most of the Central Valley. Suitable foraging and breeding habitat for burrowing owl, such as grasslands, vernal pool grasslands, fallow agricultural fields, and open oak woodlands occur throughout most of the Central Valley and are represented in the inventory area. The potential to extend owl habitat use into suitable areas is limited by land management practices that reduce ground squirrel populations, thereby limiting the number of suitable owl nesting burrows.

Occurrences within the ECCC HCP/NCCP Inventory Area

The western burrowing owl occurs in the southeast portion of the inventory area (Glover pers. comm.) and likely occurs in potential habitat throughout other portions of the inventory area. Potential habitat is defined as habitat that could support burrowing owls, based on a general classification of land cover types (e.g., grassland, vernal pool grassland, grassland pasture) developed for the HCP/NCCP. Because a comprehensive survey for the burrowing owl has not been conducted in the inventory area, neither the current population size nor the locations of all occurrences are known.

Biology

Habitat

Burrowing owls require habitat with 3 basic attributes: open, well-drained terrain; short, sparse vegetation; and underground burrows or burrow facsimiles (Klute et al. 2003). During the breeding season, they may also need enough permanent cover and taller vegetation within their foraging range to provide them with sufficient prey, such as small mammals (Wellicome 1997). Burrowing owls occupy grasslands, deserts, sagebrush scrub, agricultural areas (including pastures and untilled margins of cropland), earthen levees and berms, coastal uplands, and urban vacant lots, as well as the margins of airports, golf courses, and roads.

Burrowing owls select sites that support short vegetation, even bare soil, presumably because they can easily see over it. However, they will tolerate tall vegetation if it is sparse. Owls will perch on raised burrow mounds or other topographic relief, such as rocks, tall plants, fence posts, and debris piles, to attain good visibility (Haug et al. 1993).

The most important habitat consideration for the western burrowing owl is the availability of underground burrows throughout their life cycle. Although the owls nest and roost in these burrows, they do not (contrary to their name) create them. Rather, the owls rely on other animals to dig their burrows. Throughout

their range, they use burrows excavated by fossorial (i.e., digging) mammals or reptiles, including prairie dogs, ground squirrels, badgers, skunks, armadillos, woodchucks, foxes, coyotes, and gopher tortoises (Karalus and Eckert 1987). Where the number and availability of natural burrows is limited (e.g., where burrows have been destroyed or ground squirrels eradicated), owls will occupy drainage culverts, cavities under piles of rubble, discarded pipe, and other tunnel-like structures (Haug et al. 1993).

For western burrowing owls, what constitutes an isolated habitat patch and the minimum size of a viable patch of habitat (i.e., habitat capable of sustaining a population over a long time period) are not well documented. These parameters are affected by habitat quality, the juxtaposition of the site relative to other suitable habitat, surrounding land uses, and prey availability. Burrowing owls have been observed in small (i.e., 1 acre) lots nearly surrounded by development, and owls will fly through urban areas to forage in nearby areas. However, the type and minimum extent of development that constitutes a movement barrier between occupied patches and nearby foraging areas are not known.

It is assumed that corridors between small habitats and other suitable areas would partly offset the insular effects of small or isolated habitats on owl populations by increasing foraging potential and facilitating dispersal or colonization. The size and dimensions of corridors that would be adequate to facilitate movements of burrowing owls between suitable habitats has not been studied. Also, these requirements probably vary with the distance between suitable habitats, surrounding land uses, and the type and quality of habitat within the corridor.

Foraging Requirements

This opportunistic feeder will consume arthropods, small mammals, birds, amphibians, and reptiles. Insects are often taken during the day, while small mammals are taken at night. In California, crickets and meadow voles were found to be the most common food items (Thomsen 1971). In urban areas, burrowing owls are often attracted to street lights, where insect prey congregates.

Owls have been detected foraging out to 1 mile from their burrows (Johnson pers. comm.). Inter-nest distances, which indicate the limit of an owl's territory, have been found to average between 61 and 214 meters (198 and 695 feet) (Thomsen 1971, Haug and Oliphant 1990). Nocturnal foraging can occur up to several kilometers away from the burrow, and owls concentrate their hunting uncultivated fields, ungrazed areas, and other habitats with an abundance of small mammals (Haug and Oliphant 1990).

Reproduction

Burrowing owls in California typically begin pair formation and courtship in February or early March, when adult males attempt to attract a mate. Like other owls, western burrowing owls breed once per year in an extended reproductive period, during which most adults mate monogamously. Both sexes reach sexual

maturity at 1 year of age. Clutch sizes vary, and the number of eggs laid is proportionate to prey abundance (the more prey that is available, the more eggs owls tend to lay). Clutches in museum collections in the western United States contain 1 to 11 eggs (Murray 1976). The incubation period is 28–30 days. The female performs all the incubation and brooding and is believed to remain continually in the burrow while the male does all the hunting. The young fledge at 44 days but remain near the burrow and join the adults in foraging flights at dusk (Rosenberg et al. 1998). Additional information on reproductive behavior is described below in “Behavior.”

There is little information on lifetime reproductive success (Haug 1993). Females supplemented with food will have higher reproductive success than females without supplemented food, which may explain poor reproductive success in areas with low-quality foraging habitat (Wellicome 1997). Depending on assumptions about migration, the probability that juvenile burrowing owls will survive to 1 year of age (the age of first breeding) has been estimated between 0.23 and 0.93, and annual adult survivorship between 0.42 and 0.93 (Johnson 1997).

Demography

The maximum life span recorded for a banded bird in the wild is about 8.5 years (Rosenberg et al. 1998). Collisions with vehicles are the most common cause of mortality in this species (Haug et al. 1993). Other sources of owl mortality include disease, exposure, and human activity around nests (digging or disking) (Johnson 1992). Predators of Burrowing Owls include Prairie Falcon (*Falco mexicanus*), Red-tailed Hawk (*Buteo jamaicensis*), Swainson’s Hawk (*Buteo swainsoni*), Ferruginous Hawk (*Buteo regalis*), Northern Harrier (*Circus cyaneus*), Golden Eagle (*Aquila chrysaetos*), coyote (*Canis latrans*), and domestic dogs and cats. Many owls are killed at night by traffic when flying low over roads. Attempts to exterminate rodents by the use of poisons may also kill Burrowing Owls (Rosenberg et al. 1998).

Dispersal

Burrowing Owls tend to be resident where food sources are stable and available year-round. They disperse or migrate south in areas where food becomes seasonally scarce. In northern California, owls migrate south during September and October. Southern California populations are not migratory. In resident populations, nest-site fidelity is common, with many adults renesting each year in their previous year’s burrow; young from the previous year often establish nest sites near (<300 m) their natal sites (Rosenberg et al. 1998). Burrowing Owls in migratory populations also often reneest in the same burrow, particularly if the previous year’s breeding was successful (Belthoff and King 1997). Other birds in the same population may move to burrows near their previous year’s burrow.

The spatial requirements of burrowing owls are not well understood. Breeding pairs of western burrowing owls may require a minimum of 6.5 acres of

contiguous grassland of high foraging quality to persist (California Department of Fish and Game 1995). However, burrowing owl pairs have been observed in isolated habitat patches as small as 1 acre. An area this size does not support the foraging requirements of most burrowing owls, and individuals occurring at sites this small must forage offsite. Reproductive success and long-term persistence in small and isolated habitats are unknown. Although the relationship between habitat area and population viability of this species is not well documented, small and isolated habitat patches are not likely to sustain high reproductive success or long-term persistence (see “Threats” below).

Behavior

During the breeding season, burrowing owls spend most of their time within 50 to 100 meters (162 to 325 feet) of their nest or satellite burrows (Haug and Oliphant 1990). During the day, they forage in the vicinity of the natal burrow, where they find it easy to prey on insects in low, open vegetation. Burrowing owls will nest in loose colonies, although owls display intraspecific territoriality immediately around nest burrow (Haug et al. 1993).

Burrowing owls in California typically begin pair formation and courtship in February or early March, when adult males attempt to attract a mate. Loud “coo-cooing” at dusk indicates that this stage of the breeding cycle has begun. Beginning in April, eggs are laid at least 1 day apart and are incubated by both adults for about 3 to 4 weeks. Young owlets are brooded underground for another 3 to 4 weeks, at the end of which they may sometimes be seen at the burrow entrance in their natal-down plumage. Nestlings emerge asynchronously and tentatively in early June. They gradually become bolder, eventually spending more time outside, near the burrow entrance. During this period, nestlings can range widely on foot, even before they can fly. The adults guard their brood tenaciously, attacking intruders if provoked. Older nestlings or fledglings may move to nearby satellite burrows as the natal burrow becomes crowded.

Ecological Relationships

Western burrowing owls most commonly live in burrows created by California ground squirrels (*Spermophilus beecheyi*). Accordingly, the quality of burrowing owl habitat in the inventory area is closely and positively related to the occurrence and population health of ground squirrels in an area. Burrowing owls and ground squirrels can co-inhabit the same burrow system (Johnson pers. comm.), but the frequency with which this occurs has not been measured, and underground interactions have not been studied. Burrowing owls may compete incidentally with other predators such as coyote, other owls and hawks, skunks, weasels, and badgers for rodents and a variety of insects. (Rosenberg et al. 1998).

Threats

An immediate threat to the burrowing owl is the conversion of grassland habitat to urban and agricultural uses, and the loss of suitable agricultural lands to development. Equally important is the loss of fossorial rodents, such as prairie dogs and ground squirrels, across much of the owl's historical habitat. Eradication programs have decimated populations of these rodents and have in turn disrupted the ecological relationships on which owls depend—because western burrowing owls need other animals to dig their burrows, the loss of fossorial rodents limits the extent of year-round owl habitat.

Another cause of population declines is thought to be pesticide use (especially organophosphates in southern Canada), but evidence does not clearly indicate that other contaminants are reducing populations (Gervais et al. 1997). Habitat fragmentation (Remsen 1978) probably increases foraging distances, making hunting less efficient and potentially reducing reproductive success. Fragmentation may reduce the chances that a male owl will attract a mate and could decrease reproductive success.

In urban settings, owls occurring in isolated habitats may experience frequent disturbances from adjacent land uses (e.g., habitat degradation, predation) and barriers to foraging areas. Important biotic interactions between owls and rodent populations may be disrupted because some rodent populations are sensitive to habitat area and surrounding land uses as well. For example, the availability of rodent prey may be limited in isolated habitats, and ground squirrels may abandon or be eradicated from small parcels of habitat in urban settings. Also, small and isolated occurrences are more likely to experience random local extirpation as a result of natural disturbances (Goodman 1987), and recolonization of small or isolated habitat patches is less likely than recolonization of large habitat areas.

The population of western burrowing owls in the Central Valley is threatened by conversion of habitat to urban uses and agriculture, particularly the conversion of grasslands to vineyards. Agricultural lands provide much lower quality habitat for burrowing owls than grasslands. Suitable habitat in agricultural areas is usually restricted to peripheral bands along the edges of plowed fields. These areas are often frequently disturbed and subject to loss from agricultural activities. Also, the loss of suitable agricultural land to development has reduced the extent of suitable habitat. Control of ground squirrels has reduced the extent and quality of potentially suitable burrowing owl habitat by reducing the number of suitable nesting burrows. The use of rodenticides and insecticides may have reduced prey populations, resulting in lowered survivorship and reproductive success.

Conservation and Management

In North America, the burrowing owl is experiencing population declines throughout the northern half of the Great Plains and general population increases in the northwest interior and some southwestern deserts (Klute et al. 2003). In

Canada, its numbers are rapidly declining, and, in 1995, the Committee on the Status of Endangered Wildlife in Canada listed it as endangered. In Mexico, it is officially considered threatened. The burrowing owl has disappeared from much of its historical range in California (Klute et al. 2003). Nearly 60% of California burrowing owl “colonies” that existed in the 1980s had disappeared by the early 1990s (DeSante and Ruhlen 1995, DeSante et al. 1997). In the San Francisco Bay Area and the central portion of the Central Valley (from Yolo and Sacramento Counties to Merced County), the burrowing owl population has declined by at least 65% since 1986 (DeSante pers. comm.). The primary factors cited in the decline are habitat loss, pesticides, predators, harassment, reduced burrow availability, and vehicle collisions.

Common management efforts employed to conserve existing burrowing owl colonies include prevention of all disturbance during the nesting season, installation of permanent artificial burrows, and management of the vegetation around the burrows by mowing or controlled grazing.

Modeled Species Distribution

Model Description

Assumptions

1. All annual grassland, alkali grassland, wind turbine, seasonal wetland, ruderal and turf land cover types within the inventory area were considered suitable breeding and foraging habitat for western burrowing owl.
2. All pasture and cropland land cover was considered occasional or limited use areas for western burrowing owl.

Rationale

Western burrowing owls typically occur in dry, open, shortgrass, treeless plains often associated with burrowing mammals (Haug et al. 1993). Golf courses, cemeteries, road allowances within cities, levees, and ruderal borders around agricultural fields, airports, and vacant lots in residential areas are also used for both breeding and foraging. Within the ECCC HCP/NCCP inventory area these habitats are represented by the annual grassland, alkali grassland, wind turbine, seasonal wetland, ruderal and turf land cover types.

Burrowing owls are also known to use agricultural areas occasionally when they are fallow or continually in the margins of these fields. Many patches of ruderal land-cover type less than 10 acres in size (i.e., less than the minimum mapping unit) occur within areas mapped as cropland or pasture. These small patches are suitable for burrowing owls. To account for the occasional use by owls of fallow agricultural fields, and the low density use by owls of patches of ruderal areas, we mapped habitat as “occasional or limited use” in all cropland and pasture land-cover types.

Model Results

Figure 2 shows the modeled potential habitat of the western burrowing owl within the ECCC HCP/NCCP inventory area. The habitat includes large areas of grassland and ruderal habitat throughout the inventory area, and extensive areas of occasional or limited use in cropland and pasture. Most of the available occurrence records are included within the model boundaries. Those outside the model are most likely in suitable habitat areas, but in areas smaller than the 10-acre resolution of the model. Suitable habitat smaller than 10 acres outside model boundaries (e.g., patches associated in residential areas and around airports), were not mapped and are therefore potentially under-represented. However, the model may compensate for this potential bias by conservatively estimating the amount of grassland, ruderal, cropland, and pasture habitat available to burrowing owls for breeding and foraging.

Western burrowing owls are almost certainly undersurveyed and underreported in the inventory area. Actual densities of owls may be low because of historic or current rodent control programs that reduce their prey base.

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