

## Western Burrowing Owl

(*Athene cunicularia hypugaea*)

### Legal Status

*Federal:* Species of Conservation Concern (USFWS Regions 1, 2, and 6) (USFWS 2002).

*State:* Species of Special Concern.



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*Global and State Conservation Status:* G4S2: Global Rank, G4 = Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors; State Rank, S2 = Imperiled: Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.

*Recovery Plan:* None.

### Species Description and Life History

Western burrowing owls (*Athene cunicularia hypugaea*) inhabit much of the western United States and southern interior of western Canada (Haug *et al.* 1993). They are unique among the North American owls in that they nest and roost in burrows. This small owl stands about 22.86 cm (9 inches) tall. The sexes are similar (although females are often slightly darker than males) with distinct oval facial ruff, white eyebrows, yellow eyes, and long stilt-like legs. Wings are relatively long (51-61 cm [20-24 inches]) and somewhat rounded. The owl is sandy colored with pale white spots on the head, back, and upperparts of the wings and white-to-cream with barring on the breast and belly (Haug *et al.* 1993).

### Seasonal Patterns

Burrowing owls are resident in northern California. The breeding season (defined as from pair bonding to fledging) generally occurs from February to August with peak activity occurring from April through July (Haug *et al.* 1993). Pairs may be resident at breeding sites throughout the year or migrate out of the breeding area during the non-nesting season. Some individual birds only winter in the region. Thus, the demographics of this species in the region are relatively dynamic. Burrowing owls have a strong affinity for previously occupied nesting and wintering habitats. They often return to burrows used in previous years, especially if they had been reproductively successful (Lutz and Plumpton 1999). Additionally, burrowing owls often return as breeding adults to the general area in which they were born. For these reasons, efforts that enhance productivity help to ensure continued use of burrows and territories.

Migration patterns vary among burrowing owls. As noted above, in northern California burrowing owls are generally year-round residents although some may migrate from or migrate to other regions during winter. Those burrowing owls that do migrate often return to the same nesting territories in successive years.

### *Reproduction*

Adults begin pair bonding and courtship in February through March. Following pair formation, a nest is established in the natal burrow and females lay a clutch of 6 to 11 eggs. Average clutch size is 7-9. Eggs are incubated entirely by female for a period of between 28 and 30 days. During this time, the female is provisioned with food by the male. Following hatching, the young remain in the natal burrow for 2 to 4 weeks after which they begin to emerge from the burrow and can be observed roosting at the burrow entrance. The female begins hunting as young become less dependent. Adults also often relocate chicks to satellite burrows presumably to reduce the risk of predation (Desmond and Savidge 1998) and possibly to avoid nest parasites (Dechant *et al.* 2003). After approximately 44 days, young leave the natal burrow and by 49-56 days begin to hunt live insects. On average, three to five young fledge, but fledging rates can range from a single chick to as many as eight or nine (Lutz and Plumpton 1999). During this time, the juveniles expand their range and may find cover in the satellite burrow. The juveniles continue to be provisioned by the adults until mid-September when they molt into adult plumage and begin to disperse (Landry 1979). King and Belthoff (2001) report that dispersing young use satellite burrows in the vicinity of their natal burrows for about two months after hatching before departing the natal area.

### *Home Range/Territory Size*

Few valid measures of territory or home range size of burrowing owls have been published; home range has not often been measured directly (e.g., via telemetry studies), and is highly subject to observer bias or equipment effect. Accordingly, caution is warranted when interpreting home range estimates. Gervais *et al.* (unpublished 2000 report) estimated that the mean minimum convex polygon (MCP) home range estimates for 22 burrowing owls in Fresno and Kings Counties, California was 1.89 km<sup>2</sup> (467 acres). Haug and Oliphant (1990) estimated that the mean MCP for six owls in Saskatchewan was 2.41 km<sup>2</sup> (595 acres).

In Colorado, Plumpton and Lutz (D. Plumpton pers. comm.) recorded densities of nesting Burrowing Owls that ranged from 21 to 34 pairs on roughly 9.06 km<sup>2</sup> (2,240 acres) of available habitat (i.e., .43 and .26 km<sup>2</sup> [106 and 65 acres]/pair, respectively). Thomsen (1971) estimated territory size based on nearest-neighbor distances between nest burrows, producing a result of six pairs of owls averaging 0.008 km<sup>2</sup>, with a range of between 0.0004 to 0.016 km<sup>2</sup> (1.98 acres, range: 0.1 to 4.0 acres). The preceding values demonstrate the disparity among studies, the different values attained when using different methods of estimating abundance, and the risk in relying on the results of a single study.

### *Foraging Behavior and Diet*

Burrowing owls are active day and night and will hunt throughout the 24-hour day, but are mainly crepuscular, hunting mostly at dusk and dawn, and are less active in the peak of the day. They tend to hunt insects in daylight and small mammals at night. They usually hunt by walking, running, hopping along the ground, flying from a perch, hovering, and fly-catching in mid air.

Burrowing owls tend to be opportunistic feeders. Large arthropods, mainly beetles and grasshoppers, comprise a large portion of their diet. In addition, small mammals, especially mice and voles (*Microtus*, *Peromyscus*, and *Mus* spp.) are also important food items. Other prey animals include reptiles and amphibians, young cottontail rabbits, bats, and birds, such as sparrows and horned larks. Consumption of insects increases during the breeding season (Zarn 1974, Tyler 1983, Thompson and Anderson 1988, John and Romanow 1993, Green *et al.* 1993, Plumpton and Lutz 1993). Productivity may increase in proportion to the amount of mice and voles in the diet (D. Plumpton, unpublished data).

As with most raptors, burrowing owls select foraging areas based on prey availability as well as prey abundance. Prey availability (the ability of a raptor to detect prey) decreases with increasing vegetative cover and thus foraging habitat suitability decreases with increasing grass height or vegetative density.

### **Habitat Requirements and Ecology**

Burrowing owls are found in open, dry grasslands, agricultural and range lands, and desert habitats often associated with burrowing animals (Klute *et al.* 2003). They also occupy golf courses, airports, road and levee embankments, and other disturbed sites where there is sufficient friable soil for burrows (Haug *et al.* 1993). Because they typically use the burrows created by other species, particularly the California ground squirrel (*Spermophilus beecheyi*), presence of these species is usually a key indicator of potential occurrence of burrowing owl (Gervais *et al.* 2008).

### *Nesting*

In northern California, most nest sites occur in abandoned ground squirrel burrows; however, other mammal burrows and various artificial sites, such as culverts, pipes, rock piles, and artificially-constructed burrows are also used (Gervais *et al.* 2008). Burrowing owls generally select sites in relatively sandy habitats that allow for modification of burrows and maximize drainage. In addition to providing nesting, roosting, and escape burrows, ground squirrels improve habitats for burrowing owls in other ways. Burrowing owls favor areas with short, sparse vegetation (Coulombe 1971, Haug and Oliphant 1990, Plumpton and Lutz 1993b) to facilitate viewing and hunting, which is typical around active sciurid colonies. Additionally, burrowing owls may select areas with a high density of burrows (Plumpton and Lutz 1993b). Typical habitats are treeless, with

minimal shrub cover and woody plant encroachment, and have low vertical density of vegetation and low foliage height diversity (Plumpton and Lutz 1993b). While occupied burrows are sometimes found in flat landscapes – often in elevated mounds created by burrowing activity, they are also commonly found on hillsides, levee slopes, or other vertical cuts, probably to facilitate drainage and maximize visibility. Nest sites are also often associated with nearby perches, including stand pipes, fences, or other low structures.

Optimal nesting locations are within an open landscape with level to gently sloping topography, sparse or low grassland or pasture cover, and a high density of burrows.

Burrowing Owls are tolerant of human-altered open spaces, such as areas surrounding airports, golf courses, and military lands where burrows are readily adopted (Thomsen 1971, Gervais et al. 2008). Burrowing owls may select areas adjacent to unimproved and improved roads (Brenckle 1936, Ratcliff 1986); a modest volume of vehicle traffic does not appear to significantly affect behaviors or reproductive success (Plumpton and Lutz 1993c). In the South San Francisco Bay region, in the Sacramento area, and in several locations in and around the City of Davis, Burrowing Owls nest and winter in highly human-affected environments and can adjust to most types of human activity if habitats remain in a suitable condition.

The dimensions of the nest burrow vary with location, age of burrow, and the species that originally excavated it. Typical burrows constructed by ground squirrels are from 3 to 6 inches diameter and extend underground at a gradual downward slope from 3 to 10 feet with an enlarged cavity at the end of the burrow. Burrow entrances are often adorned with various objects as well as feathers and pellets. The burrow is often lined with grass or other material (Haug *et al.* 1993).

Burrowing Owls are solitary nesters or may nest in loose colonies – usually from 4 to 10 pairs (Zarn 1974); however, larger colonies have been documented. Most pairs occupy a natal burrow and at least one additional satellite burrow.

As semi-colonial raptors, colony size is indicative of habitat quality. Colony size is also positively correlated with annual site reuse by breeding Burrowing Owls; larger colonies (those with more than five nesting pairs) are more likely to persist over time, than colonies containing fewer pairs or single nesting pairs (DeSante *et al.* 1997). Nest burrow reuse by burrowing owls has been well documented (Martin 1973, Gleason 1978, Rich 1984, Plumpton and Lutz 1993b, Lutz and Plumpton 1999). Former nest sites may be more important to continued reproductive success than are mates from previous nest attempts (Plumpton and Lutz 1994). Past reproductive success may influence future site re-occupancy by burrowing owls. Female Burrowing Owls with large broods tend to return to previously occupied nest sites; while females that fail to breed or produced small broods, may change nest territories in subsequent years (Lutz and Plumpton 1999).

In general, burrowing owls show a high degree of nest site fidelity and reuse the same nesting burrows and satellite burrows for many years if left undisturbed (Haug *et al.* 1993).

### *Foraging*

Burrowing owls forage in open grasslands, pasturelands, agricultural fields and field edges, fallow fields, along the edges of roads and levees. Vegetation is low to maximize visibility and access. Short perches, such as fence posts are often used to enhance visibility. While they will defend the immediate vicinity of the nest, burrowing owls will often forage in common areas (Haug *et al.* 1993).

## **Species Distribution and Population Trends**

### *Distribution*

There are two subspecies of burrowing owls in North America (Dechant *et al.* 2003). The breeding range of *A. cucularia floridana* is restricted to Florida and adjacent islands. The breeding range of *Athene cucularia hypugaea* extends south from southern Canada throughout most of the western half of the United States and south to central Mexico. The winter range is similar to the breeding range except that most owls from the northern areas of the Great Plains and Great Basin migrate south and southern populations are resident year round (Haug *et al.* 1993).

Burrowing owls were once widespread and generally common over western North America, in treeless, well-drained grasslands, steppes, deserts, prairies, and agricultural lands (Haug *et al.* 1993). The owl's range has contracted in recent decades, and populations have been generally diminished in some areas.

In California, burrowing owls are widely distributed in suitable habitat throughout the lowland portions of the state; however occupied sites have ranged from 200 feet below sea level at Death Valley to above 12,000 feet at Dana Plateau in Yosemite (CDFG 2000, Gervais *et al.* 2008). In southern California, the species is fairly common along the Colorado River Valley (Rosenberg *et al.* 1991) and in the agricultural region of the Imperial Valley. Only small, scattered populations are thought to occur in the Great Basin and the desert regions of southern California (DeSante *et al.* 1997). Burrowing owl breeding populations have greatly declined along the California coast, including the southern coast to Los Angeles, where these owls have been eliminated from virtually all private land, and occur only in small populations on some federal lands (Trulio 1997, Garrett and Dunn 1981). Breeding populations in Central California include the southern San Francisco Bay between Alameda and Redwood City, the interior valleys and hills in the Livermore area, and the Central Valley (DeSante *et al.* 1997, Gervais *et al.* 2008).

### *Population Trends*

Overall population trend throughout the subspecies' North American range is reportedly declining. James (1993) reports that 54% of the areas sampled reported declining burrowing owl populations. Breeding Bird Surveys (BBS) conducted between 1980 and 1989 also report significant declines in many areas (Haug *et al.* 1993).

Burrowing owl was formerly common or abundant throughout much of California, but a decline noticeable by the 1940s (Grinnell and Miller 1944) has continued to the present time. The decline has been almost universal throughout California. Conversion of grasslands and pasturelands to incompatible crop types and the destruction of ground squirrel colonies have been the main factors causing the decline of the burrowing owl population (Zarn 1974, Gervais *et al.* 2008). Assimilation of poisons applied to ground squirrel colonies also affects borrowing population levels (Gervais *et al.* 2008).

A census of burrowing owls from 1991 to 1993 (DeSante *et al.* 1997) estimated there were approximately 10,000 pairs of Burrowing Owls in California. Over 70 percent of the owls in California are in the Imperial Valley, an area that represents less than 2 percent of the state's landmass (Plumpton pers. comm.). Numbers have been declining for decades in several areas of the state. Owls are extinct or have been reduced to very low numbers in several parts of the state, including coastal southern California and parts of the San Francisco Bay area. The statewide census indicated there has been a 50 percent decline in numbers of owls and the number of breeding groups in some parts of the state from the 1980s to 1990s.

Although California has a significant burrowing owl population, development pressures and recent population trends suggest that the species may continue to be extirpated from large portions of its range in California during the next decade. In the San Francisco Bay area, burrowing owls are commensal with the California ground squirrel and reside in undeveloped grassland remnants amid a rapidly expanding human population. An estimated 167 nesting pairs (1.8 percent of California's population) remain (all figures as of 1991, based on DeSante *et al.* [1997]), representing a decline of approximately 50 percent since the mid 1980s. In the southern California coastal population, burrowing owls have been almost entirely extirpated from private lands and are now found only on a few undeveloped federal lands, where an estimated 260 nesting pairs (3 percent of California's population) persist. An estimated 2,224 nesting pairs exist in the Central Valley (24 percent of California's population). Burrowing owls are mostly commensal with the round-tailed ground squirrel (*Spermophilus tereticaudus*) in the Imperial Valley, where burrowing owls are almost completely relegated to irrigation canal banks and where an estimated 6,570 nesting pairs (71 percent of California's population) remain (all data from DeSante *et al.* 1997, presented also in Barclay *et al.* 1998).

### *Distribution and Population Trends in the Plan Area*

The current distribution of burrowing owls in Yolo County is localized primarily into remaining low elevation uncultivated areas, such as the grasslands along the western edge

of the Central Valley, the pasturelands in the southern panhandle, and the Yolo Bypass Wildlife Area. Other sites include some urban and semi-urban areas, particularly in and around the City of Davis, and other scattered locations associated with edges of cultivated lands.

While comprehensive surveys of the plan area have not been conducted, coordinated surveys have recently been undertaken in portions of the county. The majority of recent information is a result of these efforts, including monitoring surveys in and around the City of Davis (McNerney pers comm.), surveys conducted by the California Department of Fish and Game at the Yolo Bypass Wildlife Area; and surveys coordinated by the Burrowing Owl Preservation Society in coordination with the Institute of Bird Populations on 12 selected five square mile survey blocks in Yolo County (Wilkerson pers comm.). Additional data is gathered and reported incidentally by knowledgeable individuals from other areas of the county.

The results of these surveys and incidental reports indicate that the majority of known burrowing owl breeding locations are in the southern portion of Yolo County, centered in and around the City of Davis, the Yolo Bypass Wildlife Area, and the southern panhandle. A total of 50 breeding pairs were reported in Yolo County in 2007 (Table 1). These data represent only reported sightings from several locations in Yolo County where surveys were conducted and data were recorded and made available. This summary does not represent the total number of burrowing owl breeding pairs in the county. However, it does represent the most significant known breeding areas for burrowing owl in Yolo County.

Table 1. Breeding Season Burrowing Owl Occurrences Reported from Yolo County in 2007

Location	# breeding pairs	# unpaired singles	total # adults	# young
Davis City Limits	21	6	48	61
Yolo Bypass Refuge	19		38	60
Davis vicinity	4	4	12	
Woodland vicinity	3		6	
South panhandle	3		6	11
Total	50	10	110	132

There is evidence that the overall population in the county has declined based on severe declines or extirpations of known colonies. For example, the owl colony on the UC Davis campus had declined from 22 pairs in 1981 to one pair in 1991, then rebounded to several pairs in the late 1990s (Johnson pers. comm.). Another colony of 10 pairs documented in 1976 near the Yolo County Airport had been eliminated when the location was flooded in 1983 to create a pond (CNDDDB 2007). More recently, a small colony on the north side of Winters was displaced by grading activities in preparation of a new development project.

However, Burrowing Owls have increased or continue to be relatively stable during the last several years in other areas, such as the Mace Ranch Preserve and the Wildhouse agricultural buffer and golf course (McNerney pers. comm.) in the Davis area. Habitat

restoration efforts by the CDFG at the Yolo Bypass Wildlife Area may also be responsible for the increase in reported occurrences of owls at that location. Thus, in some areas owls appear to respond favorably to protection and restoration efforts.

### **Threats to the Species and Other Conservation Issues**

Urbanization, including residential and commercial development and infrastructure development (roads and oil, water, gas, and electrical conveyance facilities) is one of the principal causes of habitat loss for burrowing owls and is a continuing threat to remaining northern California populations. Urbanization permanently removes habitat and has led to permanent abandonment of many burrowing owl colonies in the developing portions of the Central Valley, Bay Area, and throughout the state (Gervais et al. 2008).

Burrowing owls have shown a high level of tolerance for human encroachment, degradation of native habitats, and fragmentation of habitats (Gervais et al. 2008). Owls will often continue to occupy traditional sites as long as essential habitat elements remain present and until the extent of available habitat is reduced below the species' habitat requirement thresholds. Some burrowing owls nest on the edges of agricultural areas and forage in suitable agricultural landscapes, such as recently harvested fields, alfalfa and other hay fields, irrigated pastures, and fallow fields. The conversion of these fields to incompatible crop types, such as orchards, vineyards, and other crops that are not conducive to burrowing owl foraging, reduce available foraging habitat and lead to abandonment of traditional nesting areas. Many burrowing owl nests are known to occur along the outside slope or at the toe of levees. Levee stability practices for flood control, including vegetation removal, grading, and reinforcing with rock can destroy burrowing owl nesting habitat.

Although burrowing owls are relatively tolerant of lower levels of human activity, human-related impacts such as shooting and burrow destruction adversely affect this species (Zarn 1974, Haug *et al.* 1993). Rodent control, particularly along levees and roadsides can decimate ground squirrel populations and ultimately reduce available nesting and cover habitat for burrowing owls. Artificially enhanced populations of native predators (e.g., gray foxes, coyotes) and introduced predators (e.g., red foxes, cats, dogs) near Burrowing Owl colonies can also be a significant local problem. Burrowing owls also get tangled in loose fences, abandoned wire, fishing line, rat traps, and other materials

The overall effect of population-level threats (e.g., habitat conversion or ground squirrel eradication) is of much greater concern than sources of individual mortality (e.g., shooting or vehicle collisions), as these former forces operate at a population, regional, and/or range-wide level. As obligate burrow nesters that do not excavate their own burrows, burrowing owls are largely dependent on burrowing mammals that have no legal status or protection, and are commonly and purposefully eradicated by humans. Whereas individual mortality cumulatively represents a significant number of individuals, a population that is secure and productive can offset these losses. Conversely, populations that are failing because of population-level effects cannot be sustained even

in absence of direct sources of individual mortality. In California, significant economic development pressures exist, and habitat conversion for human purposes continues to degrade the abundance and quality of owl nesting habitat (Barclay *et al.* 1998). Few provisions exist to protect habitats over time. As a result, burrowing owls appear to be declining throughout most of California.

Important conservation milestones, such as the investigation and rejection of the case for changing the status of the burrowing owl to either threatened or endangered at the state or federal levels, have been reached in recent years. Significant data gaps exist in regard to migration, dispersal from nesting sites, and other aspects of annual movements. Small body size and habit of dwelling in burrows make the burrowing owl a poor choice for study using radio-telemetry. Accordingly, much of what is known is the result of leg-banding studies that rely on visual detection or physical recapture of previously banded owls. These results are very specific to location, based on small sample sizes, and subject to observer effects. Accordingly, these data are not reliable for inference across the range of these owls, and should not be extrapolated to a specific location. Anecdotal accounts offer the most locality-specific data on dispersal, but few reliable data exist.

Burrowing owls are known to reoccupy habitats over their lifespan, if these habitats remain suitable (Rich 1984, Lutz and Plumpton 1999). Accordingly, preservation of large areas of consistently suitable habitat is the most important management and conservation option available. These habitats will include native grasslands that also support the native suite of species—including ground squirrels—that dig burrows and prey such as voles, mice, ground beetles, and grasshoppers.

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### **Personal Communication**

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