Managing California's grassland ecosystems for *Athene cunicularia hypugaea*

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Burrowing owls (*Athene cunicularia*) are grassland specialists that occupy shrub, grassland, and desert habitats and are increasingly found in human-modified environments and urban open spaces (Rosenberg et al. 2007; Wilkerson and Siegel 2010). Nesting, roosting, and foraging primarily occur on landscapes characterized by short, low-density vegetation, conditions historically satisfied by the presence of native perennial grasses (Klute et al. 2003; Rosenberg et al. 2009). Although there are two subspecies found in North America, only the western burrowing owl (*Athene cunicularia hypugaea*), hereinafter referred to as burrowing owl, inhabits California (Shuford and Gardali 2008).

Western burrowing owl (*Athene cunicularia hypugaea*) in Antioch, CA *Photo: Heather Artis*

Considered the most historically important habitat for burrowing owls in the state (Rosenberg et al. 2007), California native grasslands have been described as one of the most endangered ecosystems in the United States (Noss et al. 1995) as they have been reduced from 22 million acres to 2 million acres since the 1700s (Stromberg and Kephart 1996).

Because this small grassland raptor does not generally dig its own burrow, the burrowing owl is typically found in close proximity to colonizing fossorial (burrowing) mammals such as the California ground squirrel (*Spermophilus beecheyi*), but burrowing owls also capitalize on the abandoned burrows of foxes, coyotes, and badgers (Rosenberg et al. 2007; Trulio 1995).

With the advent of intense agricultural processes, urbanization, and widespread control and eradication of burrowing mammals over the last 150 years (Trulio 1995), the burrowing owl, North America's only raptor to nest underground (Trulio and Chromczak 2007), has witnessed significant declines as historic critical habitats have been converted for anthropogenic purposes (Trulio 1995; Wilkerson and Siegel 2010). The burrowing owl is a California Species of Special Concern (as designated by the California Department of Fish and Game), and recent surveys have shown a 36 percent population decline in the Imperial Valley (Imperial Irrigation District 2010) and a 28 percent decline in the San Francisco Bay–Delta region (Wilkerson and Siegel 2010).

A critical component of managing grasslands for burrowing owls is the availability of natural burrows (Dechant et al. 1999). As such, restoring, maintaining, and increasing populations of fossorial mammals through translocations, reductions in lethal control measures, and landowner education programs are required (Klute et al. 2003). In cases where burrowing mammals cannot be reestablished, artificial burrows may be used as a means to increase burrowing owls on human-disturbed sites (Barclay 2008; Trulio 1995).

Ultimately, the preservation and restoration of native grassland communities are essential for the conservation of the species (Klute et al. 2003). Although large, contiguous grasslands are recommended as a means for sustaining the state's population (Klute et al. 2003), small, fragmented parcels maintained as suitable burrowing owl habitat have proven successful in supporting local urban colonies (Artis, pers. comm. 2010).

Considering less than 10 percent of native perennial grasslands remain in California (Dell et al. 2007), historic burrowing owl habitat is now predominantly comprised of nonnative vegetation that grows taller than native vegetation species (D'Antonio et al. 2000; Menke 1992; Rosenberg et al. 2009; Solomeshch and Barbour 2006) and is rendering this habitat unsuitable (Rosenberg et al. 2009). These dense, exotic grasses restrict nesting and foraging abilities of resident and migratory burrowing owls (Dechant et al. 1999; Rosenberg et al. 2009).

However, nonnative dominated grassland systems can be maintained as suitable short-grass habitat structures through

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mowing, grazing, and prescribed burning (Menke 1992; Rosenberg et al. 2009). If properly managed, these strategies can even ease the competitive edge of exotic flora and thus aid the return of native grasses (Menke 1992; Rosenberg et al. 2009). Mowing has been used as a tool to control the height, growth, and seed production of grasses for burrowing owl conservation (Dechant et al. 1999; Klute et al. 2003; Rosenberg et al. 2009). Depending on the dominant grass species, strategically timed mowing can be implemented when grasses have flowered but not yet produced seeds (Menke 1992). Mowing throughout the February 1 to August 31 breeding season (CDFG 1995) with some restrictions to coincide with the typical emergence of chicks in May through June, have proven effective in enhancing nest sites and have shown no apparent adverse effects to burrowing owls and their chicks (Rosenberg et al. 2009).

Prescribed burning prior to the dropping of seeds has been used as a method to control nonnative grasses and more recently has been explored as a means to maintain suitable burrowing owl habitat (Rosenberg et al. 2009; USFWS 2004). Late spring prescribed burnings reduce exotic annual plant seed production, seedbank size, and annual plant density and increase the establishment of perennial grass seedlings (Menke 1992). According to Rosenberg et al. (2009), there were no detected negative effects to burrowing owls and chicks, and habitat appeared to have improved as a result of prescribed burning in regard to density of native grasses and biodiversity. The U.S. Geological Survey reported similar observations in Oregon with burrowing owls nesting in previously unused habitat recently subjected to burning (Dechant et al. 1999), and the U.S. Fish and Wildlife Service found a reduction in nonnative annual grass cover and creation of high-quality nesting and foraging habitat in Alameda County (USFWS 2004).

Grazing has also been a viable management technique in the creation and restoration of burrowing owl habitat (Dechant et al. 1999; Klute et al. 2003; Rosenberg et al. 2009). Excessively grazed grasslands result in a low vegetative structure that increases visibility, and provides high-quality foraging and nesting habitat for burrowing owls (Dechant et al. 1999; Rosenberg et al. 2009). When performed during the dormant season, prescribed, infrequent, high-intensity spring or summer grazing restores and increases the abundance of native grasses through the removal of thatch and dead stem bases, and promotes nutrient recycling as trampling by ungulates increases the rate by which plant material comes into contact with decomposers (Menke 1992). Burrowing owls prefer grazed grasslands (Dechant et al. 1999; Klute et al. 2003), and such systems have supported high-density owl populations in the San Joaquin Valley (Rosenberg et al. 2009).

Mowing does not eliminate dry plant material that may shade or limit emerging tillers and native plants (Menke 1992; Rosenberg et al. 2009); frequent grazing can result in habitat degradation (Dell et al. 2007); and prescribed burning has inherent risks and is the most costly tool for grassland habitat management (USFWS 2004). Therefore, combining strategies to maintain and restore burrowing owl habitat may prove useful.

Carefully grazed and mowed native- and exotic plant–dominated grasslands have provided optimal breeding and foraging habitat across the burrowing owl's range, including California, Colorado, Montana, Nebraska, North Dakota, South Dakota, and Wyoming (Dechant et al. 1999).

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Over the last 10 years Scott Artis has been in the field of molecular and cellular biology at the research, application, and management levels. Since 2008 he has been actively advocating and working for the conservation of western burrowing owls in California and is the Founding Director of the Burrowing Owl Conservation Network. Scott holds degrees in microbiology, molecular biology, and fisheries and wildlife science, has a masters certificate in environmental resource management, and is pursuing a masters degree in environmental science and policy.

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