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Research Paper

Monk parakeet nest-site selection of electric utility structures in Texas

Janet E. Reed[a,*], Robert A. McCleery[b], Nova J. Silvy[a], Fred E. Smeins[c], Donald J. Brightsmith[d]

[a] Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258, USA
[b] Department of Wildlife Ecology and Conservation, University of Florida, 314 Newins-Ziegler Hall, Gainesville, FL 32622-0430, USA
[c] Ecosystem Science and Management, Texas A&M University, College Station, TX 77843-2138, USA
[d] Veterinary Pathobiology, Texas A&M University, College Station, TX 77843-4467, USA

HIGHLIGHTS

- Monk parakeets often build their bulky twig nests on electric utility structures.
- The nests have caused economic damage.
- There is a nesting preference for electric utility structures with flat, multi-angled surfaces.
- Monk parakeets nest on multi-angled electric stations within small fenced enclosures surrounded by large trees and other tall structures nearby.
- Modifying multi-angled electric stations may reduce monk parakeet nesting.

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ABSTRACT

Monk parakeets (*Myiopsitta monachus*) build nests of twigs and use them year-round for both breeding and roosting. In their native South American range, monk parakeets historically nested in the tallest, sturdiest trees in an area. In their North American range, monk parakeets often construct nests on anthropogenic structures, most notably electric utility structures. This nesting behavior causes economic damage. We investigated monk parakeets nesting in Dallas and Tarrant counties, Texas, United States, to identify which features and spatial scales influenced their selection of electric stations as nest sites. Examining 28 pairs of electric stations (with and without nests), we found monk parakeets selected those with flat, multiple surfaces and acute-angled construction within small fenced enclosure areas and surrounded by large canopy trees and taller anthropogenic structures within 100 m. Further analysis of land use and land cover classifications (pavement, building, canopy, grass, and water) on 3 scales (100 m, 625 m, and 1250 m) suggested the surrounding landscape had little impact on monk parakeet nest-site selection. We recommend that electric utility managers who want to prevent monk parakeets from nesting on vulnerable structures conduct a cost–benefit analysis exploring the feasibility of retrofitting or replacing existing construction style elements preferred by monk parakeets. Managers should also consider redesigning future electric station construction to reduce risk of monk parakeets nesting on new structures.

1. Introduction

Where a bird chooses to build its nest is an important decision for its reproductive success (Gill, 1990; Latif, Heath, & Rotenberry, 2012). Avian nest-site choice is often associated with structural stability (reducing destruction by inclement weather, human disturbance, etc.; Coon, Nichols, & Percival, 1981), concealment (decreasing predation risk), and proximity to usable habitat (Gill, 1990). Nest sites vary among avian taxa and occur in and on various substrates, including vegetation, cavities, ground, and anthropogenic structures (Gill, 1990). Furthermore, the placement of nests is often a function of the features surrounding the site at different spatial scales (Wiens, 1989).

Members of the parrot family (Psittacidae) are well-known cavity nesters (Forshaw, 1989). An exception is the monk parakeet (*Myiopsitta monachus*), which constructs enclosed nests of tightly

* Corresponding author. Tel.: +1 512 703 7234.
E-mail addresses: reedje@neo.tamu.edu, reedje2012@yahoo.com (J.E. Reed), ramccleery@ufl.edu (R.A. McCleery), n-silvy@tamu.edu (N.J. Silvy), f-smeins@tamu.edu (F.E. Smeins), dbrightsmith@cvm.tamu.edu (D.J. Brightsmith).

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intertwined twigs and uses them year-round for both breeding and roosting (Bucher, Martín, Martella, & Navarro, 1991; Eberhard, 1996; Forshaw, 1989; Martella & Bucher, 1993; Navarro, Martella, & Bucher, 1992). Monk parakeet nests are often joined, forming large nest structures with separate chambers for individual breeding pairs, and those nest structures are often clustered in areas, forming large colonies of many individuals (Forshaw, 1989; Goodfellow, 1977).

The monk parakeet is native to and common in the temperate to subtropical lowlands of Bolivia, Paraguay, Brazil, Uruguay, and Argentina, South America (Lever, 1987). In their native range, monk parakeets nest in open environments with good visibility, usually in a cluster of tall, sturdy structures (i.e., native and non-native trees, and anthropogenic structures) with minimal understory (Burger & Gochfeld, 2005; Eberhard, 1996; Forshaw, 1989; Humphrey & Peterson, 1978). Nonetheless, monk parakeet nests are still vulnerable to predation from a host of different predators (e.g., mammals, birds, and snakes) and their large, heavy nests can fall if not securely placed (Martín & Bucher, 1993; Spreyer & Bucher, 1998). Accordingly, it has been suggested monk parakeets select nesting sites to avoid predators and high winds (Burger & Gochfeld, 2005).

From the late 1960s until 1992, >160,000 monk parakeets were legally imported into the United States (US) as part of the pet bird trade (CITES, n.d.; Davey, Davey, & Athan, 2004). Accidental and intentional releases of monk parakeets in the continental US resulted in naturalized populations in several states, where populations exhibited exponential growth and range expansion (Neidermyer & Hickey, 1977; Pruett-Jones & Tarvin, 1998; van Bael & Pruett-Jones, 1996). By the early 1970s, monk parakeets were reported in at least 30 states (Garber, 1993; Neidermyer & Hickey, 1977; van Bael & Pruett-Jones, 1996). During the 2011–2012 Christmas Bird Count, 2482 monk parakeets were counted in the US; however, the populations were not evenly distributed, with Florida and Texas home to 68% of the monk parakeets recorded (National Audubon Society, n.d.).

Monk parakeets in the US are found predominately in urban and suburban environments (Garber, 1993; Neidermyer & Hickey, 1977; Stevenson & Anderson, 1994; Trimm, 1973), where they build their nest structures in trees and on anthropogenic structures, such as buildings, light poles, communication towers, and electric utility structures (Hyman & Pruett-Jones, 1995; Minor et al., 2012; Roscoe, Zeh, Stone, Brown, & Renkavinsky, 1973; Spreyer & Bucher, 1998). One concern surrounding the growth and range expansion of naturalized monk parakeet populations is their propensity for constructing their nest structures on electric utility structures, particularly the tall steel support towers of substations (changes the voltage levels) and switchyards (connects and disconnects lines on the power grid; hereinafter grouped as electric stations; Fig. 1). When monk parakeet nest material interferes with electric utility equipment, it can cause short circuiting or overheating, resulting in power outages, fires, and electrical service disruption to both residential and business customers (Avery, Greiner, Lindsay, Newman, & Pruett-Jones, 2002; Avery, Lindsay, Newman, Pruett-Jones, & Tillman, 2006; Pruett-Jones, Newman, Newman, & Lindsay, 2005). The economic costs of power outages caused by monk parakeet nest structures include sales revenue loss (including loss of operations for business customers), damaged equipment repair, and power restoration; plus, the cost of repeated nest structure removal (Newman et al., 2008). To illustrate, the estimated costs associated with outages caused by monk parakeet nests in south Florida during 2001 were $585K, affecting >21,000 electricity customers (Avery et al., 2002). Therefore, there is clear economic incentive to prevent monk parakeets from nesting on electric utility structures (Avery et al., 2002).

Currently, there is insufficient information about how the structural characteristics and surrounding land uses at electric stations influence monk parakeet nest-site selection at multiple scales. However, if electric utility companies hope to prevent nesting on their structures, it is important we obtain a better understanding of the structural, vegetative, and landscape variables that promote and dissuade monk parakeets from nesting on electric stations. In this manuscript, we aim to specifically (1) understand how features of the electric stations and their surrounding environment (<100 m) influence monk parakeet nest-site selection and (2) understand how different land use and land cover (LULC) classifications influence nest-site selection at three scales (100 m, 600 m, and 1250 m). Based on monk parakeet natural history, we formulated the following hypotheses: (1) monk parakeets would nest on electric stations if they were the tallest structures in the immediate vicinity; (2) monk parakeets would select electric stations with multiple flat surfaces and acute angles for nest sites to improve stability of nests (Avery et al., 2006); (3) in urban environments without sizable forest patches (i.e., Dallas/Fort Worth Metroplex), monk parakeets would select areas with more trees and canopy cover for nest twigs, food resources, shaded perches, and protective cover; and (4) as highly gregarious birds, monk parakeets would be more likely to nest on an electric station if it was close to an active colony.

2. Methods

2.1. Study area

Our study site encompassed Dallas and Tarrant counties in north central Texas, USA. Both counties are metropolitan areas with high human activity and residential, commercial, and industrial development. Human population density was 1040/km^2 for Dallas County and 809/km^2 for Tarrant County (U.S. Census Bureau, n.d.). Both counties are located in the Blackland Prairie and Oak Woods and Prairies ecoregions of Texas (Texas Parks and Wildlife, n.d.); however, human activity has severely altered the native vegetation. Dominant large canopy tree species in the two counties included native oak (*Quercus* spp.) and elm (*Ulmus* spp.), and non-native Chinaberry (*Melia azedarach*) and Chinese tallow (*Triadica sebifera*). Areas of manicured grass were dominated by non-native St. Augustine (*Stenotaphrum secundatum*) and Bermudagrass (*Cynodon dactylon*).

Monk parakeet populations have been increasing in Texas since the early 1980s (Pruett-Jones et al., 2005). Around the same time, the north Texas power utility, Oncor Electric Delivery (hereinafter called Oncor), experienced an increase of monk parakeets nesting on its electric utility structures in Dallas and Tarrant counties (D. A. Boyle, personal communication, February 17, 2010). During our research, there were 268 electric stations collectively within Dallas (n = 183) and Tarrant (n = 85) counties.

2.2. Nest-site locations

From June 2010 to August 2012, we located monk parakeet nest structures throughout Dallas and Tarrant counties using sightings provided by Oncor personnel, residents, business owners, local bird club members, ebird.org (http://ebird.org/content/ebird/), and Texbirds (http://listserv.uh.edu/archives/texbirds.html). We defined a monk parakeet nest structure as a twig structure with one or more nesting chamber attended by at least one monk parakeet (see Hyman & Pruett-Jones, 1995). We defined a monk parakeet colony as one or more nest structure on the same substrate or different substrates within 200 m of each other (see Burger & Gochfeld, 2005). When we located a nest structure, we used adaptive cluster sampling (Morrison, Block, Strickland, Collier, & Peterson, 2008) to search for additional nest structures within 200 m and considered them all part of the same colony (see Burger & Gochfeld, 2005). We used a handheld GPS unit to obtain a UTM point for each