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SHORT COMMUNICATIONS

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DISTRIBUTION OF THE FLORIDA BURROWING OWL: THE POTENTIAL IMPORTANCE OF NONURBAN AREAS

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KEY WORDS: *Burrowing Owl*; Athene cunicularia; *distribution*; *Florida*; *landowner*; *survey*.

The Florida Burrowing Owl (*Athene cunicularia floridana*) is considered a ''Bird of Conservation Concern'' by the U.S. Fish and Wildlife Service (USFWS 2003) and a ''Species of Special Concern'' by the Florida Fish and Wildlife Conservation Commission (FWC), yet relatively little information is available about its critical ecological characteristics including statewide distribution, population size, breeding and post-breeding habitats, dispersal, and immigration. Of potential importance are perceived behavioral differences (Stevenson and Anderson 1994, Mrykalo 2005) between populations of Florida Burrowing Owls residing in urban/suburban environments, such as vacant or developed residential lots, airports, golf courses, and ball fields (hereafter ''urban''), and those nesting in more rural environments, such as grazed pastures, natural prairies, and hay or sod farms (''nonurban''). Thus, research undertaken on Florida Burrowing Owls (hereafter simply Burrowing Owls, unless noting differences between this and another distinct subspecies, the Western Burrowing Owl, *A. c. hypugaea*) in urban environments may not be directly applicable to populations in nonurban areas, where significantly less research has been completed (USFWS 2003, Mrykalo 2005) and where legal protections are less clear (FWC 2004).

Burrowing Owls in urban settings face a variety of serious threats (Millsap and Bear 1988, Haug et al. 1993, Millsap and Bear 2000, USFWS 2003) that may make areas such as vacant lots relatively unfavorable for long-term persistence (Millsap 1996). Due to Florida's high population growth rate (23.5% from 1990 to 2000, U.S. Census Bureau 2001), most vacant lots face development, and when an area's overall lot development exceeds critical thresholds, Burrowing Owl populations may decline (Wesemann 1986, Millsap and Bear 2000). The trend toward rapid development of remaining vacant lots in active breeding areas such as Marco Island (N. Ritchie pers. comm.) may jeopardize the Burrowing Owl's long-term stability in urban environments.

The majority of known populations of Burrowing Owls occur in the state's southern coastal regions, primarily in urban sections of Lee, Collier, Dade, and Broward counties (Bowen 2000). Emigration to these coastal areas may represent a relatively recent range expansion, as Burrowing Owls historically were most common within the interior dry prairie ecosystems of central Florida (Palmer 1896, Ligon 1963, Courser 1979). Prime breeding habitat consisted of short, grassy ground cover and well-drained sandy soils suitable for burrow construction and maintenance (Palmer 1896, Haug et al. 1993, USFWS 2003). However, the current status of Burrowing Owls in nonurban areas is unknown (Mrykalo 2005), as researchers face difficulty accessing remote and privately owned lands (Mueller 2006). Although considerable effort has been spent studying localized, urban populations of Burrowing Owls (e.g., Courser 1976, Wesemann 1986, Millsap and Bear 2000), similar monitoring efforts for nonurban populations have been lacking, despite calls to expand them (USFWS 2003). The limited number and extent of nonurban Burrowing Owl surveys may result in population underestimation in such areas and preclude potential conservation opportunities. The goal of our study was to improve knowledge about the overall distribution of the subspecies, with special emphasis on nonurban areas.

METHODS

We compiled a Geographic Information Systems (GIS) spatial database of Burrowing Owl breeding sites from historic observation databases and our own records, classifying breeding sites as either urban or nonurban using ancillary attribute information in the databases (Mueller 2006). Primary point sources included: a digital database of Bowen's full 1999 statewide breeding census (pers. comm.); the Florida Natural Areas Inventory's (FNAI) database of rare animal observations (FNAI 2005); the FWC's

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''Wildlife Observations'' database (2005) and our own existing breeding site records. We obtained Florida's Breeding Bird Atlas (BBA) survey data, which consisted of a list of roughly rectangular 3 × 5 km ''blocks,'' each of which was reported by BBA surveyors to contain at least one Burrowing Owl somewhere within the block between 1986–1991 (FWC 2003). We also communicated with private landowners, other researchers, and various agencies and organizations to solicit observation data and to educate landowners (Mueller et al. 2005, Mueller 2006). Each point record in the compiled database contained latitude and longitude coordinates as well as any available descriptive information such as observer, date, number of burrows, number of young and adult Burrowing Owls, site directions, and reported land use.

Because Burrowing Owls may return to breeding sites used in previous years (Haug and Oliphant 1990), we attempted field-verification of selected nonurban breeding site records between May–August 2005 to estimate current status. Field-verification efforts focused on the most recent and comprehensive database—Bowen's May–August 1999 survey of 946 recorded breeding sites, 50 of which Bowen (2000) classified as other than urban (''agricultural''). We also visited several of our own known nonurban sites, as well as some selected nonurban sites from the FWC and FNAI database records with the most precise, usable location information. Because of its coarse nature, the BBA ''block'' data did not provide sufficient location information for direct field visits. Our field investigations spanned 19 counties (Fig. 1).

We followed a systematic survey protocol (further detailed in Mueller 2006) to search for Burrowing Owls and/or burrows. Survey efforts focused on, but were not restricted to, areas with documented historic presence. We relied primarily on usable site coordinates and/or ancillary information from the historic databases. We also gathered and used other relevant information such as aerial imagery and GIS road data to produce precise maps of historic sites, and employed county property appraiser records to help identify and contact landowners prior to visits, occasionally receiving direct field assistance from them but at the least obtaining property access permission. When explicit property access permission was not granted, surveys were conducted from the closest public property, often along roadsides. From the approximate historic burrow location, we spent at least 20 min on foot performing a thorough visual search for owls and burrows using 8× 32 magnification binoculars and a Bushnell spotting scope (20× magnification). We also reduced vehicle speed to 20 mph and looked for perched owls while traveling to and from historically used areas. We attempted to distinguish juveniles from adults, and differentiated between Burrowing Owl and other types of animal burrows using standard criteria. We classified Burrowing Owl burrows as either ''active'' or ''inactive'' based on evidence of feathers, droppings, insect parts or pellets, and by the amount of debris, such as cobwebs or vegetative litter covering the tunnel entrance. We defined a ''site'' as a single nesting location with a distinct burrow or group of primary and satellite burrows shared by just one or two family groups. We recorded coordinates using a Garmin 76 GPS receiver (Garmin International, Olathe, KS U.S.A.). We documented apparent land use, vegetation, flood status, and directions for each new field site database record.

RESULTS

The three major historic databases (Bowen 2000, FWC 2005, FNAI 2005) contained 86 unique site records (i.e., records not replicated among databases) that we classified as nonurban (Table 1). Many of the 291 BBA ''block'' records appeared to occur in remote areas far from intense urban development, but the BBA database lacked the ancillary data used in the other databases to help distinguish nonurban records. We selected 17 of 36 unique nonurban records present in the FWC and FNAI databases for field visitation based on the quality and precision of coordinates or site directions. We found no Burrowing Owls or clearly active burrows at those sites, although we detected two inactive burrows.

Bowen's database (pers. comm.) contained 50 site records (5.3%) classified as other than urban/suburban. We successfully visited 42 of these ''agricultural'' sites, but landowners denied us access to the other eight sites. We detected Burrowing Owls or clearly active burrows at six of 42 sites (14.3%). This number increased to 12 (28.6%) when we included previously undocumented nonurban breeding sites we discovered within 2 km of the historic site coordinates. We found all six of these new sites on grazed pasture. In addition, we selected 20 of Bowen's urban records for visitation, based on suspected misclassification or proximity to other historic nonurban records. Several of these 20 visited ''urban'' records actually fit our definition of ''nonurban'' (Mueller 2006) and seven (35%) were still active. Thus, at the 19 active Bowen sites (seven urban and 12 nonurban), we observed a total of 70 Burrowing Owls and 41 active burrows, with another 32 burrows judged to be inactive at time of observation.

Fellow researchers provided access to three large, nonurban colonies (each with several distinct sites) in Manatee and Hillsborough counties, with a total of 54 Burrowing Owls using about 42 active primary and satellite burrows (Mrykalo 2005, Nixon 2007). Communications with private landowners and public agencies led us to two new active nonurban sites. We suspected Burrowing Owl presence within the last year for seven other sites, but we considered only those with clear signs of current use to be active. In total, we visited 94 sites in 19 counties and detected 135 Burrowing Owls, 96 active burrows, and 53 inactive burrows (exact county breakdown given in Mueller 2006).

DISCUSSION

Many factors hindered successful detection of Burrowing Owls in nonurban areas. Most historic site records (Table 1) come from the relatively large urban Burrowing Owl populations along Florida's southern coastal areas. The BBA blocks suggested extensive nonurban historic presence, but their coarse scale excluded direct visitation. Similarly, most of the 36 unique FWC/FNAI nonurban records provided insufficient location information for successful verification. The inherent limitations of roadside surveys (Conway and Simon 2003) may reduce or entirely

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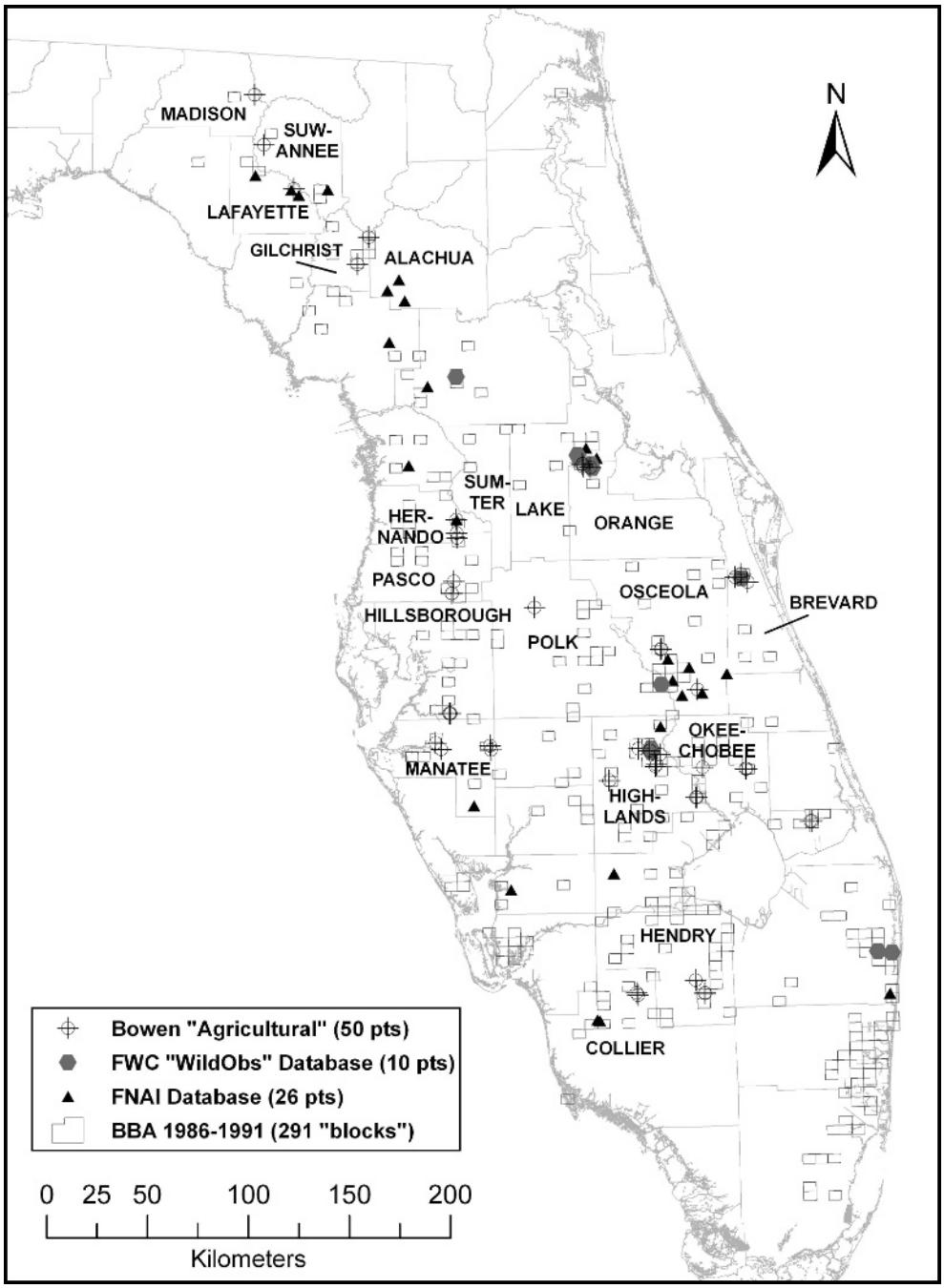


Figure 1. Distribution of historic observation records of Burrowing Owls in Florida, from major databases. All points represent only nonurban records, but the Breeding Bird Atlas ''blocks'' lacked ancillary data and do not distinguish urban from nonurban. We visited sites in the 19 labeled counties (see Mueller 2006 for county-specific results).

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Table 1. Primary sources of historic Florida Burrowing Owl site records, with number of unreplicated records by type, as obtained in 2005 from Bowen (pers. comm.), Florida Fish and Wildlife Conservation Commission (FWC 2005), and Florida Natural Areas Inventory (FNAI 2005).

	BOWEN	FWC	FNAI
Urban records	896	66	17
Nonurban records	50	10	26
% Nonurban	**5.3%**	**13.2%**	**60.5%**

prevent observations in remote areas with few public roads. For example, one newly discovered colony of over 20 Burrowing Owls was found about 400 m inland and out of sight of the public road next to which Bowen's (2000) observation of just two Burrowing Owls was made. This and many other nonurban sites could only be observed with landowner permission, and restricted property access was a constraint of both our study and Bowen's (2000). Bowen's recent statewide census database (pers. comm.) provided detailed site directions and accurate GPS coordinates that allowed precise relocation of some historic burrows. The redetection rate for historic Bowen (2000) sites nearly doubled when new sites within 2 km were included.

The most frequently observed land use at nonurban sites we visited was improved pasture. Grazing can maintain short vegetation height, an important habitat characteristic for breeding Burrowing Owls (Stevenson and Anderson 1994, USFWS 2003). Although grazing is generally viewed as unfavorable for wildlife (e.g., Noss 1994) and research is needed to quantify the effects of livestock on Burrowing Owls, moderately grazed lands may be preferable to more intensive development and are even actively selected by another Florida raptor, the Crested Caracara (*Caracara cheriway*; Morrison and Humphrey 2001).

Current Florida Burrowing Owl regulations (FWC 2004) and status assessments (USFWS 2003) focus almost exclusively on urban populations. Given the many threats and the ever-decreasing availability of vacant lots in urban areas, an increased emphasis on the potential importance of nonurban areas for the subspecies' overall conservation seems critical. Population viability analyses (PVAs) conducted by Bowen (2000) may have reduced management and research application in nonurban areas, because Bowen's results indicated that there is a >50% probability of extinction over 100 yr for ''island'' populations containing <5 adults. Although it is true that small, isolated populations often do not persist, modifying PVAs to account for the effects of immigration—even at minor levels—can drastically alter results (e.g., Stacey and Taper 1992). Bowen's (2000) PVAs assumed no immigration into these small populations, but this assumption may be invalid given Burrowing Owls' ability for long-distance travel (e.g., Sykes 1974). The analyses also assume observation of all individuals in each ''island'' population, an assumption which may not be met in nonurban areas where visibility is reduced. Thus, the potential importance of relatively small nonurban populations should not be discounted based solely on these PVA results.

We recommend updating observation databases with more frequent and extensive surveys of the large expanses of prairie and pasture lands throughout Florida's interior, particularly near areas with historic presence. However, given limited monitoring and enforcement resources and the obstacle of private property access, the need for improving landowner cooperation is clear. Doing so requires addressing landowners' property rights concerns, increasing knowledge through educational efforts, and implementing innovative habitat preservation strategies, such as conservation easements.

DISTRIBUCIÓN DE *ATHENE CUNICULARIA FLORIDANA*: IMPORTANCIA POTENCIAL DE ÁREAS NO URBANAS

RESUMEN.—Se conoce relativamente poco sobre las características ecológicas críticas para *Athene cunicularia floridana*, particularmente para las poblaciones de áreas remotas no urbanas. Investigamos la distribución actual a nivel del estado de Florida y el estatus de las poblaciones no urbanas de *A. c. floridana*. Recopilamos y evaluamos varias bases de datos de observaciones históricas y realizamos visitas de campo a 19 condados para investigar los informes de presencia de la especie y actualizar las bases de datos históricas. Detectamos actividad reproductiva en 12 condados, y documentamos nuevos lugares reproductivos en ambientes no urbanos en cinco de éstos. La baja cantidad o la mala calidad de los datos históricos para ambientes no urbanos restringieron su utilidad. El acceso restringido a las propiedades privadas fue otra limitación. Sugerimos que dichos problemas pueden ser solucionados promoviendo la cooperación con los dueños de las tierras privadas y expandiendo los censos y los esfuerzos de conservación en ambientes no urbanos que podrían ser importantes para la persistencia de *A. c. floridana* a largo plazo.

[Traducción del equipo editorial]

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