

**A Species Action Plan for the
Florida Burrowing Owl
*Athene cunicularia floridana***

**Final Draft
November 1, 2013**



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FLORIDA BURROWING OWL ACTION PLAN TEAM

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EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) developed this plan in response to the determination that the Florida burrowing owl (*Athene cunicularia floridana*) be listed as Threatened on the Florida Endangered and Threatened Species List. The goal of this plan is to improve the conservation status of the Florida burrowing owl to a point that the species can be removed from the Florida Endangered and Threatened Species List.

Objectives are to: 1) maintain a stable or increasing population trend for the Florida burrowing owl within 10 years; 2) determine if Florida burrowing owls exist as 1 or more populations, and assess and monitor the status of the existing population(s); 3) protect and manage burrowing owl habitat to ensure long-term population viability; 4) minimize impacts of development and other land-use conversion on burrowing owls; and 5) expand awareness and shared responsibility among stakeholders and partners to manage and protect burrowing owls and their habitat. Priority conservation actions that will promote the objectives of this plan include developing a current population size estimate and a mechanism to monitor population trends. Given loss of habitat and indications of population decline, immediate action should be taken to verify population status and, if confirmed, to address threats to the species. Activities may include creating partnerships with local governments, developing conservation guidelines, and improving enforcement of rules protecting owls and their burrows.

This plan details the actions necessary to improve the conservation status of the Florida burrowing owl. A summary of this plan will be included in the Imperiled Species Management Plan (ISMP), in satisfaction of the management plan requirements in Chapter 68A-27, Florida Administrative Code, Rules Relating to Endangered or Threatened Species. The ISMP will address comprehensive management needs for 60 of Florida's imperiled species and will include an implementation plan; rule recommendations; permitting standards and exempt activities; anticipated economic, ecological, and social impacts; projected costs of implementation and identification of funding sources; and a revision schedule.

The imperiled species management planning process relies heavily on stakeholder input and partner support. Successful management of the Florida burrowing owl through implementation of this plan requires the cooperation of local, state, and federal governmental agencies; non-governmental organizations; business and industrial interests; universities and researchers; and the public. This level of involvement and support is also critical to the successful implementation of the ISMP. Any significant changes to this plan will be made with the continued involvement of stakeholders.

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GLOSSARY OF TERMS AND ACRONYMS

Annual Recruitment: Annual recruitment is the process by which young are added to the fall population by reproduction from adults in the spring population.

ARC: Acquisition and Restoration Council. A 10-member group with representatives from 4 state agencies, 4 appointees of the Governor, 1 appointee by the Florida Fish and Wildlife Conservation Commission (FWC), and 1 appointee by the Commissioner of Agriculture and Consumer Services. ARC has responsibility for the evaluation, selection, and ranking of state land acquisition projects as well as the review of management plans and land uses for all state-owned conservation lands.

BBA2: The Breeding Bird Atlas II. A project coordinated by the Florida Ornithological Society.

BRG: Biological review group, a group of taxa experts convened to assess the biological status of taxa using criteria specified in Rule 68A-27.001, Florida Administrative Code, and following the protocols in the Guidelines for Application of the International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

BSR: Biological status review report, the summary of the biological review group's findings. Includes an FWC staff recommendation on whether or not the species status meets the listing criteria in Rule 68A-27.001, F.A.C. These criteria, based on IUCN criteria and IUCN guidelines, are used to help decide if a species should be added or removed from the Florida Endangered and Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

DISTANCE Sampling Techniques: A method to obtain a reliable estimate of density of objects while accounting for differences in detection probability caused by such factors as differences in observer ability, habitat make-up, and time of day.

DNA: Deoxyribonucleic acid

F.A.C.: Florida Administrative Code. The Department of State's Administrative Code, Register and Laws Section is the filing point for rules promulgated by state regulatory agencies. Agency rulemaking is governed by Chapter 120, Florida Statutes, the Administrative Procedures Act. Rules are published in the Florida Administrative Code.

F.S.: Florida Statutes

FWC: The Florida Fish and Wildlife Conservation Commission, the state agency constitutionally mandated to protect and manage Florida's native wildlife resources.

FWRI: The Florida Fish and Wildlife Research Institute, the fish and wildlife research branch of the FWC.

GIS: Geographic Information System

HSC: Habitat and Species Conservation, the species conservation and habitat management division of the FWC.

ISMP: Imperiled Species Management Plan

IUCN: International Union for Conservation of Nature, a professional global conservation network.

IUCN Red List: (IUCN Red List of Threatened Species) An objective, global approach for evaluating the conservation status of plant and animal species, the goals of which are to: Identify and document species most in need of conservation attention if global extinction rates are to be reduced; and provide a global index of the state of change of biodiversity.

LAP: Landowner Assistance Program

Line Transect: A method of surveying to determine the abundance of an animal's population using systematic or random placement of survey lines within the animal's range. These lines are traversed by researchers and all encounters with the species of interest are recorded and then analyzed to obtain a density estimate.

Macro-habitat: A habitat of sufficient extent to provide a variety of ecological niches and variation in environment, flora, and fauna.

MBTA: Migratory Bird Treaty Act (16 U.S.C. 703–711), the federal statute that protects nearly all native birds, their eggs and nests. Specifically, the statute makes it unlawful to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird."

PIT (PIT Tag): Passive Integrated Transponder. PIT tags are an implanted tag that is used when an individual animal needs to be identified. The tag contains a series of numbers and letters that can be read by passing a "PIT tag reader" over the implanted tag.

Point Transect: Similar to a line transect except instead of traversing a line and recording animals encountered, the observer stands at a predetermined point and records all animals indicated within an area 360 degrees around that point.

Population: The total number of individuals of the taxon. Population numbers are expressed as numbers of mature individuals only (as defined by IUCN).

GLOSSARY OF TERMS AND ACRONYMS

RAD: Restriction Site Associated DNA Markers. RAD tags or markers are a type of [genetic marker](#) that are useful for association mapping, [Quantitative Trait Loci-mapping](#), [population genetics](#), ecological genetics and evolution. The use of RAD markers for genetic mapping is often called RAD mapping. An important aspect of RAD markers and mapping is the process of isolating RAD tags, which are the DNA sequences that immediately flank each instance of a particular restriction site of a [restriction enzyme](#) throughout the genome. Once RAD tags have been isolated, they can be used to identify and genotype DNA sequence polymorphisms mainly in form of [single nucleotide polymorphisms](#). Polymorphisms that are identified and genotyped by isolating and analyzing RAD tags are referred to as RAD markers.

Rural: Includes all areas not classified as urban areas.

Stable Isotope Measurements/Ratios: Ratios of various isotopes of elements such as carbon in individual animals. These ratios are used to assess and compare habitat use and migratory connectivity of groups/populations of those animals.

Subspecies: A biological classification that represents a race or variety of a species.

Take: As defined in Rule 68A-27.001(4), F.A.C., “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such conduct.”

Urban: Areas of high-density development including cities, large towns, and suburban areas.

INTRODUCTION

Biological Background

The Florida burrowing owl (*Athene cunicularia floridana*) is geographically distinct from those (*A. c. hypugaea*) occurring in the western United States and is unique among North American burrowing owls in that it is the only burrowing owl to exist east of the Mississippi River (Haug et al. 1993). The Florida subspecies occurs primarily in peninsular Florida although isolated pairs and small colonies have been found as far west as Eglin Air Force Base and as far south as the Dry Tortugas. Its distribution is localized and patchy, especially in the northern part of its range (Figure 1).

Appearance

The burrowing owl is a small bird averaging 23 cm (9 in) in height with a mean wingspan of 26 cm (21 in). The burrowing owl spends most of its time on the ground, where its sandy brown plumage provides camouflage from potential predators. The burrowing owl lacks the ear tufts of more familiar woodland owls. Bright yellow eyes, sometimes with black mottling, and a white chin accent the face. Unusually long legs provide additional height for a better view from a typical ground-level perch.

Habitat

Burrowing owls inhabit open-type habitats that offer short groundcover. Historically, these habitat requirements were met by native dry prairies that covered much of central Florida; however, due to human development in natural areas there has been a range expansion into north and south Florida. More recently, burrowing owls have turned to pastures, agricultural fields, golf courses, airports, schools, and vacant lots in residential areas as most native open habitats have been converted by humans to these new uses.

Behavior

Burrowing owls live as single breeding pairs or in loose colonies consisting of 2 or more families. Unlike most owls, burrowing owls are active during both day and night. During the day, they are usually seen standing erect at the mouth of their burrow or on a nearby post. When disturbed, the owl bobs in agitation and utters a chattering or clucking call. In flight, burrowing owls typically undulate as if they are flying an invisible obstacle course. They also can hover in midair, a technique effective for capturing food.

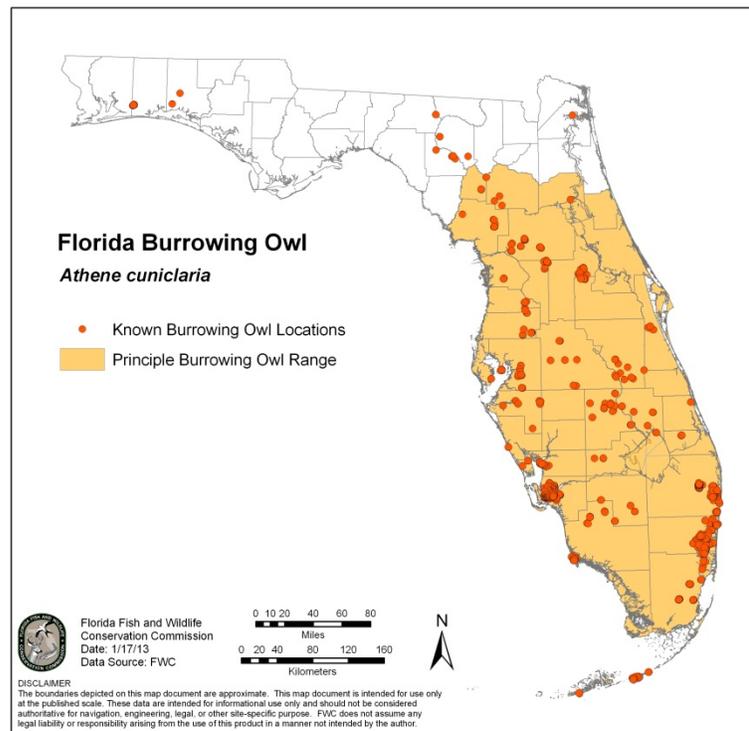


Figure 1. Range of the Florida burrowing owl.

Burrowing owls mainly eat insects, especially grasshoppers and beetles. They can be of special benefit in urban settings because they also consume roaches and crickets. Small lizards, frogs, snakes, birds, and rodents are also important prey.

Florida burrowing owls typically dig their own burrows but will use gopher tortoise (*Gopherus polyphemus*) or armadillo (*Dasypus novemcinctus*) burrows and other structures such as manholes, sewer drains, and concrete pipes. Owl family units will often use a breeding burrow and one or more satellite burrows. Juvenile owls rely on both primary and satellite burrows 30 to 60 days after they are flight capable (Mealy 1997). Burrows are typically 2 to 3 m (6 to 9 ft) in length, up to 1 m (3 ft) deep, and are lined with materials such as grass clippings, feathers, paper, and manure. Use of burrows may vary between owls that reside in urban areas and those that reside in rural environments (e.g., pastures). Burrowing owls in urban areas are known to use burrows year-round, for roosting during the winter and for raising young during the breeding season (Millsap 1996). However, year-round use of burrows by owls in rural environments has not been as well documented. In fact, some research suggests that burrowing owls may have limited use of burrows outside of the breeding season. Mrykalo (2007) reported decreased burrow use in pastures that are frequently flooded during the summer rainy season. Whether or not these owls use alternate burrows during this time is unknown. Burrowing owls may also roost in structures (Zambrano 1998) or trees.



Figure 2. An adult burrowing owl feeding young. Photograph by Ron Bielefeld, FWC.

The typical nesting season is from February (courtship begins) to July (brood-rearing), with eggs primarily laid in March, but nesting can also occur from October through May. The female lays 6 to 8 eggs over a 1-week period. She will incubate the eggs for 21 to 28 days. At hatching, white, downy feathers cover the young owls and their eyes are closed. They emerge from the burrow when they are 2 weeks old. At 4 weeks, they are learning to fly but cannot fly well until they are 6 weeks old. They remain with their parents until they are 12 weeks old.

Population Status

The current population status of the Florida burrowing owl is unknown. There are a number of indications of fluctuation and possible decline, including local establishment and subsequent extirpation of small colonies of burrowing owls. Since the 1800s, the number of burrowing owls using native habitats appears to have decreased in response to loss of this habitat (Courser 1979). In contrast, numbers of burrowing owls in south Florida coastal habitats have apparently increased, due mainly to habitat modification during the development of coastal urban centers such as Cape Coral and Marco Island (dredge and fill projects). Other development activities that

have attracted burrowing owls to inhabit urban areas include clearing of forests and draining of wetlands. This has facilitated the recruitment of owls from interior portions of Florida's peninsula. These urban birds have adapted to human activity and now occupy these areas, sometimes in high densities. These easily accessible areas have facilitated research efforts resulting in the subsequent development of nest-protection guidelines for urban areas. While this information has been extremely important for owl conservation in urban environments, the long-term viability of these populations is uncertain because of the persistent threats (e.g., automobile collisions) of living in close proximity to people. Conversely, obtaining population information on burrowing owls in rural areas remains a challenge because owl populations are dispersed over vast, undeveloped areas and there is very limited access to private lands.



Figure 3. A young burrowing owl exercising its wings. Photograph by Ron Bielefeld, FWC.

Conservation History

Following the extirpation of burrowing owls in several communities in Florida, the species was listed as a Species of Special Concern by the Florida Game and Fresh Water Fish Commission in 1979 (Florida Department of State 1979; also see Millsap 1996). The owls and their nests are protected under Rule 68A-27.005, Florida Administrative Code (F.A.C.), and under the Migratory Bird Treaty Act (16 U.S.C. 703-712). A permit is required to remove a burrowing owl burrow as outlined in [FWC Burrowing Owl Protection Guidelines](#) for urban areas.



Figure 4. Young burrowing owls. Photograph by Ron Bielefeld, FWC.

Much of what is known about the Florida burrowing owl is based on research conducted in urban areas, namely Cape Coral. FWC conducted two 5-year studies (1987 to 1991 and 2002 to 2007) in Cape Coral to investigate the effects of development on burrowing owl density and reproductive success over time. Results from the previous studies, when available, will be helpful in determining whether existing protections are sufficient for conserving the species in urban areas. The city of Cape Coral also has an active education program intended to reduce harassment of owls by school-aged children.

Bowen (2001) conducted a statewide survey that included both rural and urban habitats in 62 counties. Bowen recorded 1,757 adult owls, although it was difficult to survey owls in rural areas due to low densities and limited property access. More recently, there have been several local monitoring efforts in urban and rural areas (U.S. Fish and Wildlife Service 2003). A current statewide survey is needed to obtain estimates on population size and trends for the Florida burrowing owl.

Threats and Recommended Listing Status

The major threats to the Florida burrowing owl are reliance on human-altered habitats and loss of native habitat (Owre 1978, Millsap 1996). Habitat is created by clearing of vegetation and draining of wetlands in preparation for development, but this habitat is temporary as it is lost when construction begins. In urban and suburban areas, preferred nesting habitat and burrows are destroyed by construction activities, domestic animals (e.g., dogs), and humans. Collisions with automobiles also are a frequent cause of owl mortality in these areas (Millsap and Bear 2000), while burrow abandonment can be caused by harassment by people. It also is likely that domestic (e.g. cats, dogs) and exotic wildlife (tegu [*Tupinambis merianae*], monitor lizards [*Varanus niloticus*], etc.) contribute to owl mortality but the full impact on owl populations needs further investigation. No known data exist on the effects of contaminants (e.g., pesticides and herbicides) on survival and reproduction of owls using urban or rural habitats, but given the propensity for the use of such chemicals in both the urban and rural landscape, research assessing this potential threat is warranted.

For burrowing owls in rural areas, lack of protected habitat is a concern. Most human-altered habitats, including those in rural areas (e.g., improved pasture), have not previously been made a priority for conservation (Mueller et al. 2007), but often are preferred by burrowing owls. Mrykalo et al. (2007) noted the lack of management strategies for burrowing owls in rural areas. Additional monitoring of burrowing owls in rural settings is necessary to determine how important these areas are to the conservation of the species. Also, it is unknown how many burrowing owls are being impacted by land-use changes in rural areas. Management strategies are needed to address conservation needs of both urban and rural burrowing owls.

In 2010, the FWC directed staff to evaluate the status of all species listed as Threatened or Species of Special Concern that had not undergone a status review in the past decade. To address this charge, staff conducted a literature review and solicited information from the public on the status of the Florida burrowing owl. The FWC convened a Biological Review Group (BRG) of experts on the Florida burrowing owl to assess the biological status of the species using criteria specified in Rule 68A-27.001, F.A.C. This rule includes a requirement for BRGs to follow the Guidelines for Application of the International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1). The BRG developed a draft Biological Status Report (BSR) that included their findings and a preliminary listing recommendation from staff. FWC distributed the draft for peer review, and the reviewers' input was incorporated into the final report (the [Florida Burrowing Owl BSR](#)).

The BRG found the Florida burrowing owl met the following criteria for listing as Threatened:

- Criterion C, Population Size and Trend, which includes a population size estimate of fewer than 10,000 mature individuals, a continuing projected decline in numbers of mature individuals, and all mature individuals are in 1 subpopulation. There are clearly fewer than 10,000 individuals, with estimations as low as 1,700. Further compounding the low population size and projected decline is the lack of knowledge about genetic exchange between individuals in different areas of the state (i.e., is the burrowing owl in 1 population or many subpopulations?).

Based on the literature review, information received from the public, the BRG findings, and peer-review input, FWC staff recommended the Florida burrowing owl be listed as Threatened on the Florida Endangered and Threatened Species List.

CONSERVATION GOALS AND OBJECTIVES

Goal

Conservation status of the Florida burrowing owl is improved to a point that the species can be removed from the Florida Endangered and Threatened Species list and will not again need to be listed.

Objectives

I. Maintain a stable or increasing population trend for the Florida burrowing owl within 10 years.

Rationale

This objective addresses criterion C(1) and C(2), in the BSR. By meeting this objective within 10 years we will have reversed the projected decline in the burrowing owl population criterion C(2). The decline must be less than 10% to avoid triggering criterion C(1) of the listing process. Thus, immediate needs are to obtain estimates of population size and trajectory. Conducting surveys to obtain this information is necessary to measure progress in meeting this objective.

II. Determine if Florida burrowing owls exist as 1 or more populations and assess and monitor the status of the existing population(s).

Rationale

Determination of the number of populations of the Florida burrowing owl will allow for more accurate evaluation of conservation status, and therefore, listing status. This addresses criterion C(2), in the [BSR](#). The BSR states that the Florida burrowing owl met criterion C(2[ii]), that the species is a single subpopulation, by making an assumption that the dispersed distribution of the burrowing owl in Florida and known mobility of individuals may indicate sufficient genetic exchange of individuals throughout the state. However, there is no direct genetic or demographic data to support whether the burrowing owl exists as 1 or many populations. Thus, research is needed to determine the population structure of the Florida burrowing owl.

III. Protect and manage burrowing owl habitat to ensure long-term population viability.

Rationale

Human-altered habitats are now the primary habitats utilized by burrowing owls. With effective management, urban areas such as Cape Coral could continue to provide suitable places for burrowing owls to maintain long-term populations. Altered rural habitats, especially cattle ranches, have great potential for compatible land-use practices that benefit landowners and burrowing owls alike. However, partnerships between FWC and private landowners will need to be expanded to ensure effective land-use practices are established and maintained. Moreover, opportunities exist to expand public land holdings and conservation easements to increase protected habitat for burrowing owls.

CONSERVATION GOALS AND OBJECTIVES

IV. Minimize impacts of development and other land-use conversion on burrowing owls.

Rationale

Conversion from native habitats and other owl-compatible land uses to intensive development and other owl-incompatible uses remains a threat to burrowing owls. Conservation guidelines can improve protection for burrowing owls in areas where they may be impacted and provide mitigation options for incidental take of owls and their burrows.

V. Expand awareness and shared responsibility among stakeholders and partners to manage and protect burrowing owls and their habitat.

Rationale

Partnerships with local, state, and federal agencies; private landowners; and non-governmental organizations are essential to conserving this species. Given the propensity of owls to live either in urban areas in close proximity to people or on rural, mostly private lands, the future of burrowing owl conservation in Florida is largely dependent on how much people value this species.

CONSERVATION ACTIONS

The following sections describe the conservation actions that will make the greatest contribution toward achieving the conservation objectives. Actions are grouped by category (e.g., Habitat Conservation and Management, Population Management). The Conservation Action Table ([Table 1](#)) provides information on action priority, urgency, potential funding sources, likely effectiveness, identified partners, and leads for implementation.

Habitat Conservation and Management

One of the challenges to recovering Florida's burrowing owl population will be to develop strategies that effectively address the unique management needs of burrowing owls on public and private lands in both urban and rural areas. Most of what is known about burrowing owls in Florida is the result of research efforts conducted in urban areas. However, additional research is needed to better understand the specific habitat needs of this species on public and private land in rural areas. To address some of these rural landscape concerns, Mueller et al. (2011) identified 5 land-cover classes preferred by burrowing owls: 1) improved pasture, 2) row and/or field crop (to include hay and/or grass), 3) bare soil and/or clear-cut, 4) grassland, and 5) dry prairie. Mueller et al. (2011) also found that although these preferred land-use classes made up 26% of the land areas in their 38-county study area, only 8.3% of these land-use classes were found on managed public lands. Due to the lack of preferred habitat on public lands, burrowing owl population data in these areas also are scarce. This underscores the important role that private lands will play in the conservation of burrowing owls in Florida and further emphasizes the need for state and local governments to work with private landowners to garner support for burrowing owl conservation efforts (see [Education and Outreach](#) and [Incentives and Influencing](#)). Research conducted on burrowing owls in Florida by Bowen (2000) and Mueller et al. (2007) have further identified access to private lands as a major obstacle in obtaining critical population and habitat information.

The research above, as well as that offered by Mrykalo et al. (2007), have been some of the first attempts to address owl habitat use in rural, Florida landscapes. There is still much more to learn about other habitat parameters preferred by burrowing owls in Florida. Optimal vegetation height for nesting and foraging, nest-site selection, tolerance for various grazing intensities, and habitat use during and outside of breeding season are just some of the measurable habitat characteristics that require further investigation. Such information is critical in defining specific habitat needs and developing conservation strategies (see the [Monitoring and Research](#) section for further discussion).

The actions outlined in this section are designed to improve the quality and quantity of habitat for burrowing owls on public and private lands.

Action 1 Develop and implement conservation guidelines for public and private landowners and land managers that will promote burrowing owl population growth.

One approach to promote the long-term viability of burrowing owl populations is to create conservation guidelines that will encourage public and private landowners and managers to create, enhance, restore, and maintain suitable burrowing owl habitat. Conservation guidelines will be voluntary, non-regulatory guidelines and will provide the greatest degree of protection for

burrowing owls and their burrows and promote the implementation of beneficial land management practices. Private landowners and managers can employ conservation guidelines independently or they can receive technical assistance on how to implement conservation guidelines by contacting the FWC. FWC's Landowner Assistance Program (LAP) biologists regularly interact with private landowners and managers to provide habitat management advice. The LAP biologists also provide landowners with information on financial incentives for managing wildlife.

The following are examples of conservation guidelines that are likely to improve the conservation status of burrowing owls in urban and rural settings.

In urban areas:

- Avoid the use of pesticides, insecticides, and/or herbicides near burrowing owl burrows, especially during the nesting season.
- Post signs to provide protection from harassment, but only when necessary.
- Provide starter burrows. Burrowing owls can be attracted to excavate a burrow in a given area where a starter burrow exists. Create a starter burrow by removing a circular plug of soil or sod (0.3 m [1 ft] in diameter) and piling loose soil near the hole (Millsap 1996). Simply disturbing a patch of suitable habitat by mechanically clearing vegetation may attract burrowing owls if they are in the vicinity.
- Provide perches near burrows. Perches provide hunting and observation sites for burrowing owls. Wooden fence posts or other perches placed in immediate vicinity of burrows will provide a suitable perch.
- To reduce the risk of nest abandonment, minimize activity near burrowing owl burrows during the nesting season. Activities that can induce abandonment include disturbance by humans, pets, machinery, etc. The exception would be to allow short-duration disturbance when mowing near owl burrows to maintain suitable vegetation height. Avoid mowing over burrow entrances and use a weed trimmer to maintain vegetation immediately around burrow entrance.

In rural areas:

- Avoid the use of pesticides, insecticides, and/or herbicides near burrowing owl burrows, especially during the nesting season.
- Maintain vegetation height that is beneficial for burrowing owls through mowing, prescribed grazing, and/or prescribed burning.
- Take care to avoid digging or using heavy equipment near burrow entrances during the breeding season so as not to collapse burrows and potentially trap owls or destroy eggs.
- If cattle are present, employ a selective cattle-grazing regime (i.e. prescribed grazing). Cattle grazing can effectively be used to reduce vegetation height to a level that is beneficial for burrowing owls. However, at high stocking rates, cattle may degrade or destroy habitat and burrows by trampling or wallowing in them. Consider other vegetation treatment options such as prescribed burning or mowing to maintain vegetation cattle do not graze.
- Avoid the conversion of pasture and dry prairie to more intensive land uses, such as row crops, silviculture, development, etc.

Conservation guidelines can also be incorporated into public land management. The FWC's Wildlife and Habitat Management section's Wildlife Conservation, Prioritization and Recovery program provides plans for species monitoring and management on lands in the Wildlife Management Area system. This approach uses information from statewide models, in conjunction with input from species experts and people knowledgeable about the area, to create site-specific wildlife assessments for a number of focal species, including the burrowing owl. Staff combines these assessments with management considerations to develop a wildlife management strategy for the area. As conservation guidelines are developed, they should be incorporated into the program to provide current information on the management needs of burrowing owls.

Action 2 Develop and implement conservation guidelines for land slated for development.

Create voluntary conservation guidelines (along with permitting guidelines) to benefit burrowing owls on land where development is planned. Use of these guidelines will encourage the preservation and enhancement of burrowing owl habitat in addition to avoiding take of burrowing owls as required by permitting guidelines. Implementation of conservation guidelines could lead to creation of new urban areas that include enough habitat to support burrowing owl populations in the long term.

The conservation of burrowing owls could be enhanced by outlining preferred timing of clearing and construction, methods of clearing and re-vegetating, preferred locations and design of stormwater management features, preservation of onsite ecosystem features, preferred location and size of open space, green space or conservation areas, and inclusion of development or density buffers. Incentives for incorporating these guidelines into development proposals could include reduced mitigation associated with permitting, local or state recognition, tax incentives, or density bonuses. Close coordination with developers early in the planning phase could facilitate the successful completion of this action.

Action 3 Anticipate human-induced, landscape-scale changes that threaten burrowing owls and adapt management efforts accordingly (e.g., threats from development, land-use changes, and climate change).

Continued developmental pressure from Florida's population growth is a known threat to burrowing owls. There is a projected decline ($\geq 10\%$) based on the numerous threats to the burrowing owl and any decline is likely to continue given projected increases in development ([Figure 5](#)). Another potential threat is the rehydration of previously drained rural lands that have enrolled in hydrological restoration programs, such as the U.S. Department of Agriculture Natural Resources Conservation Service's Wetland Reserve Program. Many of south-central Florida's working ranches have been drained to facilitate various agricultural activities. This may have artificially lowered the water tables and created soil conditions that were conducive to burrow excavation by owls. Many burrowing owls currently occupy central Florida rangelands and if hydrology is restored, subsequent soil moisture increase could render much of this land unsuitable to burrowing owls by flooding existing burrows, reducing acreage of suitable burrow sites, and ultimately reducing reproductive success. This is a management conflict with other species that would benefit from rehydration. Where areas are critical to burrowing owl

conservation (e.g., large numbers of owls or key areas for connectivity), then alternatives to rehydration should be considered.

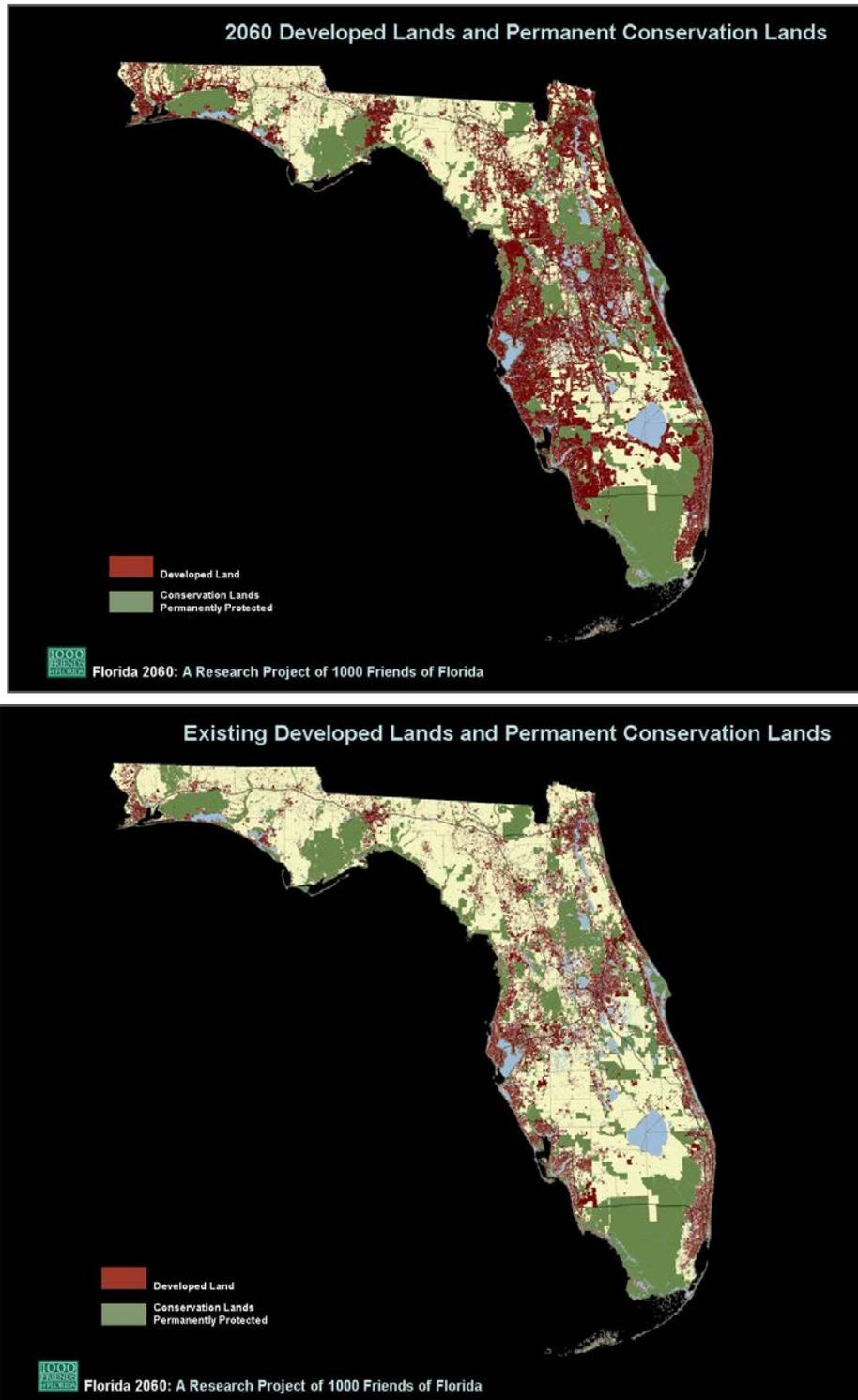


Figure 5. Maps depicting the change in developed and conservation lands based on the Florida 2060 report by [1000 Friends of Florida](#).

Climate change is also expected to contribute to a cascade of landscape-level impacts that may affect the burrowing owl, with the most direct impact being habitat loss due to sea level rise. Monitoring these impacts into the future will be necessary to adapt management efforts accordingly. In addition, FWC is working to develop a common set of tools and approaches for climate change adaptation planning that can be used across the agency's management programs. As needed, climate change adaptation strategies will be incorporated into future revisions of this plan.

Population Management

No specific population management actions have been identified at this time, largely because the parameters that limit burrowing owl populations (e.g., adult and juvenile survival and reproductive rates) are currently unknown. The [Monitoring and Research](#) section outlines actions that, upon implementation, will enhance our understanding of factors affecting the burrowing owl and allow managers to recommend effective population management actions. However, using existing information on habitat preferences and conservation needs of burrowing owls will be essential to conserving the species while new research is conducted. Recommended conservation guidelines land managers can initiate now are summarized in [Action 1](#).

Monitoring and Research

A better understanding of owl movement patterns is critical to establish whether Florida supports a single population of burrowing owls that is mixing or subpopulations that have little or no exchange of individuals among them. This information could influence the listing status of the species. In addition, a better understanding of the habitats (macro- and micro-) used in areas of the state where burrowing owls exist in relatively large numbers is needed in order to effectively target habitat conservation and management efforts. Lastly, precise estimates of survival rates for adults and young, as well as reproductive rates are needed to facilitate the development of sound population management actions during future revisions of this plan.

Recommendation to list the Florida burrowing owl as Threatened was based also on a perceived decreasing population trend. Again, there was a paucity of data on which this listing criterion was met. Thus, it is critical to determine the current status of the population(s) and be able to track status over time. To do so, a survey methodology needs to be developed and implemented that will provide a precise estimate of owl density for each known concentration of burrowing owls. Density estimates could be used as an index to population status and to determine trends.

A key aspect in the development of the aforementioned research is the inclusion of both urban and rural components. Florida burrowing owls exist in both urban and rural areas. Research on other non-migratory species (e.g., mottled ducks [*Anas fulvigula*]), has shown that the basic ecology of a species can differ greatly between individuals using urban versus rural habitats even if humans have extensively altered both areas (Varner et al. 2013). Thus, any research that is proposed must represent owls from both types of areas if the results are to be applied to the Florida burrowing population as a whole.

Action 4 Determine gross movement patterns of Florida burrowing owls that use urban and rural areas to assess if birds from different areas are intermixing and if any differences in movement patterns exist between rural and urban groups.

Action 5 Assess the genetic make-up of Florida burrowing owls in different areas of the state.

Another way to gain information on the demographics of burrowing owls in Florida is through genetic testing to determine the level of genetic homology of individuals in different areas of the state. Use of restriction-site associated deoxyribonucleic acid (DNA) markers can determine if there are any genetic differences among burrowing owls from different areas.

Data obtained from such a study would provide additional information regarding whether there are 1 or more subpopulations of burrowing owls within the state. Moreover, it will provide information on any genetic differentiation that may be taking place among existing populations. This information will help create management strategies: should the burrowing owl be managed as 1 population or several subpopulations?

Action 6 Determine macro-habitat characteristics used by Florida burrowing owls during the breeding season.

Through the use of historic and current burrowing owl locations in conjunction with available Geographic Information System (GIS) landscape coverage data, we can identify macro-habitat characteristics (Mueller et al. 2011) being used by burrowing owls and assess the distribution of these habitats in Florida. Knowing which habitat types burrowing owls use and the distribution is essential to conserving existing preferred habitats, as well as improving marginal habitats through targeted habitat-enhancement efforts.

Action 7 Determine mean annual survival rates of adult and young Florida burrowing owls in both urban and rural areas and determine if they differ.

Passive Integrated Transponder (PIT) tag technology has evolved to the point where it can be employed on a much wider basis for animal study at a relatively low cost. PIT tags would be implanted in a representative sample of adult and young owls and PIT tag readers installed over burrow entrances to capture data. Use of this technology should improve the efficiency and accuracy of data collection when compared to other means of marking and monitoring individuals (e.g., leg banding). Conducting a capture–recapture type study using PIT tags to estimate survival rates of adult and juvenile owls would provide data on a key vital rate needed to formulate sound population management decisions.

Action 8 Assess prevalence and levels of contaminant loads carried by burrowing owls and investigate if levels detected could be detrimental to survival and reproduction of owls using urban and rural areas.

Feather samples collected from birds in both rural and urban areas should be analyzed for the presence and levels of various chemicals associated with commonly used herbicides and pesticides to determine if mean levels carried by individuals could be negatively affecting survival and reproductive rates.

Action 9 Determine mean annual reproductive success of Florida burrowing owls using urban and rural areas and determine if they differ.

Use burrow observations to estimate reproductive success. An estimate of reproductive rate is a critical component of constructing a population model for this species. In turn, a population model is needed to help determine which population vital rates (e.g., survival) may be limiting this population's growth.

Action 10 Conduct a statewide survey until sound data are available to establish a population trajectory. The survey should continue for additional years as deemed necessary to monitor population status.

This survey effort will provide the data necessary to determine the current trajectory of the burrowing owl population, and provide data for future biological assessments. This information may influence future conservation actions and listing status. The survey should continue until enough precise population estimates are available to calculate a trend and continue as long as population monitoring is deemed necessary.

The first step in developing an operational population survey for burrowing owls is delineating a preliminary survey area. This area will be established based on known and probable owl locations gleaned from data acquired from [Action 6](#).

The second step in developing an operational population survey for burrowing owls is to conduct an exploratory survey that will assess the logistics (e.g., where best to use transect versus points and number of survey crews needed to complete the survey in a designated time) of the survey design and allow refinement of the survey area based on observations. The survey area should be adjusted as needed as new data on burrowing owl distribution are obtained.

Once the survey area and logistics are refined from preliminary survey efforts, the final design for the operational statewide survey will be completed using a combination of line-transect and point-transect methods and distance sampling techniques.

Use of line- and point-transect methods will allow both rural and urban areas to be surveyed efficiently as line transects can be hard to employ in urban areas. Use of distance sampling techniques will allow for modeling of detection probabilities, a crucial element to obtaining unbiased density estimates. Electronic calls can be used by observers to maximize burrowing owl detections, as meeting a minimum number of detections (e.g., 50) is crucial to being able to calculate a precise density estimate. Active burrows will be the sampling unit with 1 burrow representing 2 adult burrowing owls (satellite burrows will be excluded from this estimate). Burrowing owl distribution maps of surveyed areas should be produced based on survey results.

Action 11 Develop a website to collect incidental observations of Florida burrowing owls from the public.

Website information will be used to increase knowledge of the distribution of burrowing owls in Florida. This type of information will be helpful in further refining the area surveyed during annual population monitoring, as well as bolstering our understanding of habitat use patterns for this species. It may also identify partners willing to work with FWC to conserve burrowing owls.

This effort differs from that proposed in [Action 12](#) in that it will provide the public with the ability to provide burrowing owl sightings along with pertinent ancillary data directly to state wildlife managers. Moreover, this effort has the potential to provide a long-term dataset, whereas [Action 12](#) will provide only 2 to 3 years of distribution data.

Action 12 Continue coordination with the Breeding Bird Atlas II (BBA2) to collect observations of Florida burrowing owls.

The BBA2 project, coordinated by the Florida Ornithological Society, will generate distribution information at the statewide level beginning in 2012. In addition to occurrence data collected and recorded at the scale of the United States Geological Survey 7.5-minute quad maps (x mile²), the BBA2 Technical Committee also will collect detailed distribution records for specific focal species. An interactive website for entering locations of breeding Florida burrowing owls will be developed cooperatively by the BBA2 and FWC.

Action 13 Develop a population-monitoring protocol to measure the success of local management efforts aimed at conserving the Florida burrowing owl.

This is a separate effort from the statewide population monitoring survey. The goal of this effort is to gain understanding of the effectiveness of local-scale management efforts on local burrowing owl numbers.

This effort will focus on working with private landowners who implement habitat and/or population management actions aimed at conservation of a local group of burrowing owls. The objective is to monitor recruitment and survival of local groups over time. Monitoring these population parameters will allow assessment of the effectiveness of specific habitat and population management techniques on burrowing owls. Ultimately, this will provide understanding, on a local scale, of the types of management that have the most positive effect on burrowing owls.

Rule and Permitting Intent

Protections

The actions in this section are intended to ensure burrowing owls, their eggs, young, and burrows are protected. These protections also are intended to provide some flexibility for wildlife managers, ranchers, farmers, and homeowners. This flexibility should allow for effective management of burrowing owls and their habitat on public and private lands.

Protections and permitting need to address the different challenges pertaining to burrowing owls in urban areas and rural areas. In urban areas such as Cape Coral, it is often clear where burrowing owls and their burrows are located (usually on single-family lots). Burrows and burrowing owls are visible from public roads. Local government staff and the public keep track of activities that may impact this species, and often report problems to the FWC. Usually only a small number of burrows and a small amount of burrowing owl “habitat” are impacted under any single permit issued through the [FWC Burrowing Owl Protection Guidelines](#) for urban areas.

Locations of burrowing owls in rural areas are not well known. Large developments taking place in rural areas may impact large numbers of burrowing owls, their burrows, and their habitat. Surveys will be needed to estimate numbers of burrowing owls and burrows present in areas being developed to determine how to best avoid, minimize and or compensate for impacts. Other rural areas consisting of farm or ranch lands contain habitat critical to the species' long-term survival. Under some circumstances, only avoidance and minimization of impacts to burrowing owls may be possible. In other cases, if species needs are considered, activities such as cattle ranching could provide long-term, quality habitat for burrowing owls without negative impacts to landowner operations.

Burrowing owls also are protected under the Migratory Bird Treaty Act, 16 U.S.C. § 701-12 (MBTA). Under this Act it is unlawful to pursue, hunt, take, capture, kill, or sell migratory birds, including their feathers, eggs, and nests.

Action 14 Assess current agency policy and rules pertaining to the conservation of the Florida burrowing owl (Chapter 68A-27, F.A.C.) and suggest changes to provide the protections necessary to achieve the goal of this plan.

Current rules state that Florida burrowing owl *nests* and *eggs* are protected. However, it is not sufficiently clear whether active burrows (young or eggs present) and inactive burrows (no young or eggs present) are all protected under this rule. Protections for burrows will need to be clarified either through guidelines, policy, or rule changes. Guidelines can also clarify what activities are exempt from some, or all, permitting requirements. These might include activities intended to improve habitat for burrowing owls or actions required to protect human safety or the environment.

Permitting Threshold

FWC rules, as discussed above, will address when an activity is prohibited and when a permit is required. Permitting teams and stakeholder groups formed subsequent to the approval of this plan should investigate the possibility of requiring permits and mitigation in cases where significant amounts of burrowing owl habitat are lost. Habitat loss can be as, or more, detrimental to the survival of a species as direct loss of individuals or their burrows (Owre 1978, Millsap 1996).

Permitting Guidelines

Action 15 Assess possible changes to permitting guidelines for burrowing owls.

Intentional take permits.—Permits issued for intentional take of burrowing owls, their eggs, or young include, but are not limited to, activities such as falconry, scientific collecting, research, and education. Permits to take burrowing owls for scientific or educational purposes should continue to be allowed. Permits will likely be reviewed on a case-by-case basis using criteria outlined in Rule 68A-27.007(2)(a), F.A.C.

Incidental take permits.—Permits issued for incidental take of burrowing owls, their eggs, young, or burrows are needed when planned, legal activities, such as development, occur in areas where listed species are present and will be impacted. Incidental take permits

currently are issued on a case-by-case basis. This plan proposes developing new permitting guidelines for incidental take that includes a standard process for addressing impacts.

Such permitting guidelines would include components necessary to ensure fair, effective, and efficient permitting statewide. The following sections are a recommendation and will be superseded by permitting guidelines approved by FWC subsequent to publication of this plan.

Recommended items to be addressed in permitting guidelines:

- How to determine when a permit is required: This section could provide information on burrowing owl burrow definitions and activity categories, rules (see [Protections](#)), and enforcement policies. Enforcement policies outline how FWC's Division of Law Enforcement interprets and enforces rules protecting burrowing owls. This section also could include information on how site preparation activities for development (including infrastructure such as roads and utilities) are handled in the permitting process. Without this information, it is often difficult for an applicant to determine when a permit is required.
- Burrowing owl survey protocol: This section could provide a standardized survey protocol for finding burrowing owls and their burrows that would be required prior to planned development activities.
- Permits and mitigation: This section could provide information on permitting options available and any measures necessary to offset take. Different permitting options could be considered, based on the number of burrowing owls directly or indirectly impacted by proposed projects. Avoidance and minimization should be considered in the permitting process. Mitigation banking, conservation easements, and creation of a mitigation fund for burrowing owls could be considered. Relocation of burrowing owls may also be considered as a potential component of the permit process, if such relocations are shown to be safe and effective. Construction of perches and starter burrows could also be considered as a low-cost component to offset take. Larger-scale permitting, similar to federal Habitat Conservation Planning permitting, could also be considered as a more efficient way to permit multiple properties simultaneously (if such permitting would achieve conservation objectives). Compensation for loss of burrowing owls and their habitat will be a crucial part of the permitting process and will provide conservation benefits for the species. Mitigation can be used to help achieve the objectives of this plan.
- Permit review and issuance process: This section could detail how permits are applied for, reviewed, denied, issued, and revoked. A clear review and issuance process is crucial to meet FWC deadlines for reviewing and issuing permits.
- Permitting guideline updates and modifications: This section could explain the process by which permitting guidelines are edited in the future to improve their efficiency and conservation value and respond to concerns expressed by FWC's stakeholders and the general public. A clear process for editing and approving new versions of the guidelines will help ensure problems are addressed and permitting guidelines are updated in a timely manner.

Once new permitting guidelines are developed, new database and website tools should be created to allow for an online permit application process. Database tools should also allow tracking of

the number of permits issued, the number of burrowing owls/burrows impacted, and information on mitigation actions or payments completed by the permittee.

Law Enforcement

The FWC's Division of Law Enforcement, in conjunction with federal, state, and local partners, is responsible for enforcing Florida's wildlife and fisheries laws. FWC's law enforcement officers are vital to the success of achieving the goals and objectives of this plan because they both ensure the enforcement of conservation laws and educate the public on how to identify and report violations.

Enforcement of rules protecting burrowing owls is essential for 2 main reasons. First, rules protect the species and its burrows directly from harm or destruction. Second, enforcement of rules is critical in ensuring an effective permitting and mitigation process for burrowing owls. Rules define the criteria under which developers and landowners are or are not required to enter the permitting process.

Action 16 Develop and implement a training program for FWC law enforcement officers on the identification of and rules and regulations pertaining to the Florida burrowing owl.

FWC will provide adequate training to FWC law enforcement officers to ensure that they are able to identify Florida burrowing owls accurately, are aware of all applicable rules and regulations pertaining to this species, and are able to explain to the public the ecological importance of burrowing owls.

Incentives and Influencing

Incentives

Action 17 Develop new, and expand existing, incentive opportunities to promote habitat protection and management on private rural and urban lands.

FWC currently utilizes several programs that promote conservation by providing technical and financial assistance and conservation easements to private landowners. FWC partners with other state and federal agencies to administer the Forest Stewardship Program, Wildlife Habitat Incentives Program, Wetlands Reserve Program, Environmental Quality Incentives Program, Partners for Fish and Wildlife Program, and the Cooperative Conservation Blueprint. These programs are voluntary and some may provide financial incentives, depending on annual funding appropriation for wildlife conservation and/or habitat management on private lands. Florida also provides tax incentives, including property tax exemptions, for landowners that put a perpetual conservation easement on their land. This would allow any landowner interested in maintaining their current conservation or agricultural practices to receive a break from property taxes for excluding additional development on their property. Additional incentives may include exemption from permits for activities that enhance wildlife activities such as mowing, roller-chopping, and timber-stand thinning, as long as they are not a precursor to development.

Action 18 Explore new and innovative ways to bring private rural and urban lands into protected conservation land status (e.g., creation of state programs based on federal models, such as Safe Harbor).

Safe Harbor Agreements are contracts that outline a baseline level of listed species to which potential impacts would require a permit/mitigation. If the landowner implements land management activities that enhance the habitat resulting in additional usage by listed species, the agreement protects the landowner from additional land-use restrictions and provides FWC the opportunity to move individuals over the baseline level. The landowner cannot impact the base level amount of wildlife without a permit. This agreement is tied to land use, so the conservation and preservation benefit is lost if the landowner decides to change land uses, such as from agriculture to development.

Influencing

Action 19 Develop a strategy to inform local and state governments about new burrowing owl rules and guidelines and develop memoranda of understandings (Memorandum of Understanding's, interlocal agreements, etc.) as part of the Burrowing Owl Outreach Plan (See [Education and Outreach](#)).

Action 20 Coordinate with local and state governments to establish conservation priority areas for the management of urban and rural burrowing owl populations.

Many public conservation lands are required to have a management plan approved by the Acquisition and Restoration Council (ARC) (for state lands), or the managing agency's governing board. Specifically, s. 253.034(5), Florida Statutes (F.S.) says in part that all land management plans shall include an analysis of the property to determine if significant natural resources, including listed species, occur on the property. If significant natural resources occur, the plan shall contain management strategies to protect the resources. The Florida Forever Act (s. 259.105, F.S.) adds that all state lands that have imperiled species habitat shall include, as a consideration in the management plan, restoration, enhancement, management, and repopulation of such habitats. For lands identified by the lead management agency as having burrowing owl populations or the potential to support burrowing owl populations, the FWC should be consulted (as statutorily required), and the lead management agency is encouraged to include FWC as part of the management plan advisory group.

Florida's growth management law places significant responsibility for land and water use decisions on local governments. Achievement of Florida's species conservation plans will necessitate that local government land and water use plans and regulations recognize important state fish and wildlife resources, including habitat, and provide adequate provision for their conservation. FWC will collaborate with and provide information to local governments regarding species management (including Species Action Plans), permitting guidelines and assistance programs that are available to landowners and the general public.

Chapter 163.3177, F.S. requires that county comprehensive growth management plans include a conservation element. The conservation element must include the identification of areas within the county that are locations of important fish, wildlife, or habitat resources; including state-

listed species. This element must contain principles, guidelines, and standards for conservation that restrict activities known to adversely affect the survival of these species. FWC is identified as a state agency authorized to review county growth management plans and plan amendments to ensure important state fish, wildlife, and habitat resources are adequately considered. Further, land development regulations require conditions on land or water use that specify how uses will be administered in a manner consistent with the conservation element of the county growth management plan. FWC can assist counties in developing their conservation elements and subsequent land development regulations to ensure that these regulations better reflect the needs of burrowing owls as identified in this plan.

Education and Outreach

Action 21 Create a Burrowing Owl Outreach Plan to increase awareness of burrowing owl conservation needs and participation in management actions.

The intent of the outreach plan is to expand awareness and shared responsibility among stakeholders, partners, and FWC to better manage and protect burrowing owls and their habitat in Florida. Creation of a Burrowing Owl Outreach Plan would comprehensively look at outreach and education needs to conserve the species including the creation of measurable objectives and sequential steps for implementation.

The following steps will be integral to the Outreach Plan:

- Identify the target audiences.
This would include land acquisition organizations, land managers, farmers, ranchers, homeowners, builders, developers, environmental consulting firms, law enforcement personnel, local governments, and school-aged children.
- Create key messages for each of these audiences. Messages would include:
 - Listing status of the Florida burrowing owl.
 - Proper conservation and management of burrowing owl habitat in urban and rural areas.
 - Minimizing threats to burrowing owls through specific messaging to selected audiences.
 - Overview of FWC permitting structure and burrowing owl protections.

The Outreach Plan should include the following actions:

- Support development of a website for public-generated burrowing owl sightings ([Action 11](#)).
- Create materials to communicate about management guidelines and habitat-monitoring protocols to land managers, farmers and ranchers, homeowners, builders and developers, and environmental consulting firms ([Actions 1 through 3](#)).
- Create materials to support farmers’ and ranchers’, homeowners’, builders’ and developers’, environmental consulting firms’, and local governments’ understanding of burrowing owl rules and permitting guidelines ([Action 15](#)).
- Create and distribute a brochure designed for broad audiences and which contains information about the status of the burrowing owl and management needed for its recovery.

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- Create and maintain a website designed for broad audiences (e.g., consider multiple generational and cultural interests) that contains information about the status of the burrowing owl and management needed for its recovery.
- Create materials to educate school-aged children in support of FWC's goal to create the next generation that cares.

Coordination with Other Entities

Many of the actions in this plan involve coordination with other agencies, non-governmental organizations, and local governments. Those actions are included in other sections where they are most relevant.

Table 1. Florida Burrowing Owl (*Athene cunicularia floridana*) Conservation Action Table

NOTE: An explanation of acronyms used is below the table.

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
4	1	1	Develop and implement conservation guidelines for public and private landowners and land managers that will promote burrowing owl population growth.	Habitat Conservation & Mgmt	NEW	YES	YES	\$0-25k	Existing	HSC	Agencies	HIGH	HIGH	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
4	1	2	Develop and implement conservation guidelines for land slated for development.	Habitat Conservation & Mgmt	NEW	YES	YES	\$0-25k	Existing	HSC	Agencies, Landowners, Local Government	HIGH	HIGH	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
3	4	3	Anticipate human-induced, landscape-scale changes that threaten burrowing owls and adapt management efforts accordingly (e.g., threats from development, land-use changes, and climate change).	Habitat Conservation & Mgmt	NEW	YES	YES	TBD	Existing	FWRI & HSC	None	MEDIUM	MEDIUM	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
2	1	4	Determine gross movement patterns of Florida burrowing owls that use urban and rural areas to assess if birds from different areas are intermixing and if any differences in movement patterns exist between rural and urban groups.	Monitoring & Research	NEW	YES	NO	TBD	Grant, Trust Fund	FWRI & HSC	University	HIGH	MEDIUM	YES - knowledge of the existing population is critical to the listing status.
2	1	5	Assess the genetic make-up of Florida burrowing owls in different areas of the state.	Monitoring & Research	NEW	YES	NO	TBD	Grant, Trust Fund	FWRI & HSC	University	HIGH	MEDIUM	YES - knowledge of the existing population is critical to the listing status.
3	1	6	Determine macro-habitat characteristics used by Florida burrowing owls during the breeding season.	Monitoring & Research	NEW	YES	YES	\$0-25k	Existing	FWRI & HSC	University	HIGH	MEDIUM	YES - knowledge of the existing population is critical to the listing status.
2	2	7	Determine mean annual survival rates of adult and young Florida burrowing owls in both urban and rural areas and determine if they differ.	Monitoring & Research	NEW	YES	NO	TBD	Grant	FWRI & HSC	University	HIGH	MEDIUM	YES - knowledge of the existing population is critical to the listing status.
3,4	3	8	Assess prevalence and levels of contaminant loads carried by burrowing owls and investigate if levels detected could be detrimental to survival and reproduction of owls using urban and rural areas.	Monitoring & Research	NEW	YES	NO	TBD	Grant	FWRI & HSC	University	MEDIUM	MEDIUM	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
2	2	9	Determine mean annual reproductive success of Florida burrowing owls using urban and rural areas and determine if they differ.	Monitoring & Research	NEW	YES	NO	TBD	Grant	FWRI & HSC	University	HIGH	MEDIUM	YES - knowledge of the existing population is critical to the listing status.
1	1	10	Conduct a statewide survey until sound data are available to establish a population trajectory. The survey should continue for additional years as deemed necessary to monitor population status.	Monitoring & Research	NEW	YES	NO	TBD	Grant	FWRI & HSC	All	HIGH	MEDIUM	YES - knowledge of the existing population is critical to the listing status.
1	4	11	Develop a website to collect incidental observations of Florida burrowing owls from the public.	Monitoring & Research	NEW	YES	YES	\$0-25k	Existing	FWRI & HSC	University	MEDIUM	MEDIUM	NO - the information this will provide will be limited.
1	4	12	Continue coordination with the Breeding Bird Atlas II to collect observations of Florida burrowing owls.	Monitoring & Research	ONGOING	NO	YES	\$0-25k	Existing	FWRI & HSC	All	MEDIUM	HIGH	NO - the information this will provide will be limited.
2	4	13	Develop a population monitoring protocol to measure the success of local management efforts aimed at conserving the Florida burrowing owl.	Monitoring & Research	NEW	YES	YES	\$0-25k	Existing	FWRI & HSC	Agencies, Landowners, Local Government	MEDIUM	MEDIUM	NO - this may not have a large impact on the conservation of the species.
4	1	14	Assess current agency policy and rules pertaining to the conservation of the Florida burrowing owl (Chapter 68A-27, F.A.C.) and suggest changes to provide and enhance protections necessary to achieve the goal of this plan.	Protections & Permitting	NEW	YES	YES	\$0-25k	Existing	HSC	None	MEDIUM	HIGH	YES - this will help prevent take.
4	2	15	Assess possible changes to permitting guidelines for burrowing owls.	Protections & Permitting	NEW	YES	YES	\$0-25k	Existing	HSC	None	MEDIUM	HIGH	YES - this will help prevent take.

Table 1. Florida Burrowing Owl (*Athene cunicularia floridana*) Conservation Action Table

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
4	2	16	Develop and implement a training program for FWC law enforcement officers on the identification of and rules and regulations pertaining to the Florida burrowing owl.	Law Enforcement	EXPANDED	YES	YES	\$0-25k	Existing	HSC & Law Enforcement	None	MEDIUM	HIGH	YES - this will help prevent take.
3	3	17	Develop new, and expand existing, incentive opportunities to promote habitat protection and management on private rural and urban lands.	Incentives & Influencing	EXPANDED	YES	YES	TBD	Existing, Unknown	HSC	Agencies, Landowners, Local Government	HIGH	MEDIUM	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
3	2	18	Explore new and innovative ways to bring private rural and urban lands into protected conservation land status (e.g., creation of state programs based on federal models, such as Safe Harbor).	Incentives & Influencing	NEW	YES	YES	TBD	Existing	HSC	Agencies, Landowners, Local Government	HIGH	MEDIUM	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
4	2	19	Develop a strategy to inform local and state governments about new burrowing owl rules and guidelines and develop memoranda of understandings (MOU's, interlocal agreements, etc.) as part of the Burrowing Owl Outreach Plan.	Incentives & Influencing	NEW	YES	YES	\$0-25k	Existing	HSC	None	MEDIUM	HIGH	YES - public interest in the species is key to survival because it often lives in proximity to people.
4	2	20	Coordinate with local and state governments to establish conservation priority areas for the management of urban and rural burrowing owl populations.	Incentives & Influencing	NEW	YES	YES	\$0-25k	Existing	HSC	Local Government	HIGH	HIGH	NO - this is needed in the long term but may not have immediate impacts to burrowing owl conservation.
4	1	21	Create a Burrowing Owl Outreach Plan to increase awareness of burrowing owl conservation needs and participation in management actions.	Education & Outreach	NEW	YES	YES	\$0-25k	Unknown	HSC	All	MEDIUM	MEDIUM	YES - public interest in the species is key to survival because it often lives in proximity to people.

Acronyms used in this table:

- F.A.C. Florida Administrative Code
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- HSC: Habitat and Species Conservation, a Division of the Florida Fish and Wildlife Conservation Commission
- MOU: Memorandum of Understanding
- TBD: To be determined

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