

**A Species Action Plan for the
Florida Sandhill Crane
*Grus canadensis pratensis***

**Final Draft
November 1, 2013**



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EXECUTIVE SUMMARY

A biological assessment of the Florida sandhill crane (*Grus canadensis pratensis*) determined that the species met criteria for listing as Threatened on the Florida Endangered and Threatened Species List. Florida Fish and Wildlife Conservation Commission staff, with stakeholder assistance, developed this plan with the goal of increasing the number of Florida sandhill cranes so that the species is secure within its range and will not again need to be listed.

The objectives of this plan are to maintain or increase the amount of suitable habitat and the Florida sandhill crane population within 10 years of plan implementation. Maintaining existing wetlands, restoring natural hydrology, and managing for open habitats are critical to achieving these objectives. Ensuring that crane habitat needs are incorporated into existing conservation and incentive programs, including those concerning water resources, is important. Research and monitoring by cooperating groups and agencies on both public and private lands is also essential. Other specific actions proposed in this plan include range-wide surveys, research to understand Florida sandhill crane productivity relative to habitat type, the creation of habitat management guidelines for public and private land, and using venues such as golf courses for outreach and education. Nuisance crane issues must also be addressed.

This plan details the actions necessary to improve the conservation status of the Florida sandhill crane. 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. 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

Artificial wetland: A wetland created by humans including borrow pits, impoundments, cattle-watering ponds, and wetlands produced by mitigation and reclamation projects.

Breeding Season: The period from nest initiation until chicks fledge.

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 a Florida Fish and Wildlife Conservation Commission (FWC) staff recommendation on whether or not the species status meets the listing criteria in Rule 68A-27.001, Florida Administrative Code. 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.

CCB: Cooperative Conservation Blueprint

CUP: Consumptive Use Permit for groundwater resources.

DEP: Florida Department of Environmental Protection

DOACS: Florida Department of Agriculture and Consumer Sciences

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.

FCREPA: Florida Committee on Rare and Endangered Plants and Animals

Fledgling: Young that is capable of flight.

Foraging: Searching for, acquiring and ingesting food.

F.S.: Florida Statutes

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

GIS: Geographic Information System

Habitat: The area used for any part of the life cycle of a species (including foraging, breeding, and sheltering).

Habitat Parameter: Specific, quantifiable elements or components of habitat such as tree basal area, herbaceous ground cover, shrub height, and proportion of open water. Parameters can be rated as optimal, suboptimal, marginal, or poor.

Hydroperiod: The period of time that a wetland is covered by water or that soil remains saturated.

ISMP: Imperiled Species Management Plan

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

LAP: Landowner Assistance Program, a federal cost-share program administered by the FWC.

MFL: Minimum Flows and Levels: the minimum water flows and/or levels adopted by a Florida Water Management District Governing Board as necessary to prevent significant harm to the water resources or ecology of an area resulting from permitted water withdrawals. MFLs define how often and for how long high, average, and low water levels and/or flows should occur to prevent significant harm. When use of water resources alters the water levels below the defined MFLs, significant ecological harm can occur.

Nest: A structure created or used by Florida sandhill cranes for reproduction, whether or not reproduction was successful.

NGO: Non-Governmental Organization

NRCS: Natural Resource Conservation Service, a branch of the United States Department of Agriculture.

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

PVA: Population Viability Analysis

Reproductive Success: The number of fledglings produced annually by 1 breeding pair.

WMD: Water Management District

INTRODUCTION

Biological Background

Description and Taxonomy

Sandhill cranes are omnivorous, heavy-bodied gray birds with long necks and legs ([Figure 1](#)). They inhabit open grasslands and marshes (Tacha et al. 1992). Their distinctive, rattling calls can be heard from far away. The sexes appear identical except the male is slightly larger. The Florida sandhill crane (*Grus canadensis pratensis*) is non-migratory and 1 of 2 subspecies of sandhill crane occurring in Florida. The migratory greater sandhill crane (*G. c. tabida*) winters in Florida, arriving in October and November and leaving for breeding grounds in northern U.S. and Canada in late February and early March. Although the 2 sandhill crane subspecies occurring in Florida cannot be distinguished, those observed in the peninsula from April to September can be assumed to be the resident Florida subspecies. The 2 subspecies are not known to interbreed.

Range and Habitat

Florida sandhill cranes occur from southern Georgia, primarily in the Okefenokee Swamp, to the Everglades (Stys 1997). However, most of the population is in peninsular Florida from Alachua County in the north to the northern edge of the Everglades in the south ([Figure 2](#)).

Sandhill cranes rely on shallow marshes for roosting and nesting and open upland and wetland habitats for foraging (Wood and Nesbitt 2001). Preferred crane habitat occurs where most vegetation is less than 50 cm (20 in) high (Stys 1997). Cranes in north Florida spent 86% of their time in 4 habitat types: pasture, freshwater marsh, pasture– marsh transition, and pasture–forest transition (Nesbitt and Williams 1990). A pair’s average home range is about 450 ha (1,100 ac). Home ranges overlap but core nesting areas are defended from other cranes and vary from 120 to 250 ha (300 to 635 ac).

Life History

Florida sandhill cranes are perennially monogamous and long-lived, with a low annual reproductive potential (Wood and Nesbitt 2001). They begin breeding at 3 years of age but are rarely successful until age 5 (Nesbitt 1992). Although Florida sandhill cranes can begin breeding as early as December and extend nesting through August, they nest primarily from February through April. Nests are built of plant stems in shallow marshes. Water depth at nests averages 13 to 33 cm (5 to 13 in). Although each pair’s eggs are laid in only 1 nest, accessory nests or platforms are also built. Nesting success is dependent on relatively predictable water levels and absence of predators. Pairs can renest after a nest failure.



Figure 1. Adult Florida sandhill cranes stand about 1.2 m (almost 4 ft) tall. Photograph by the Florida Fish and Wildlife Conservation Commission.

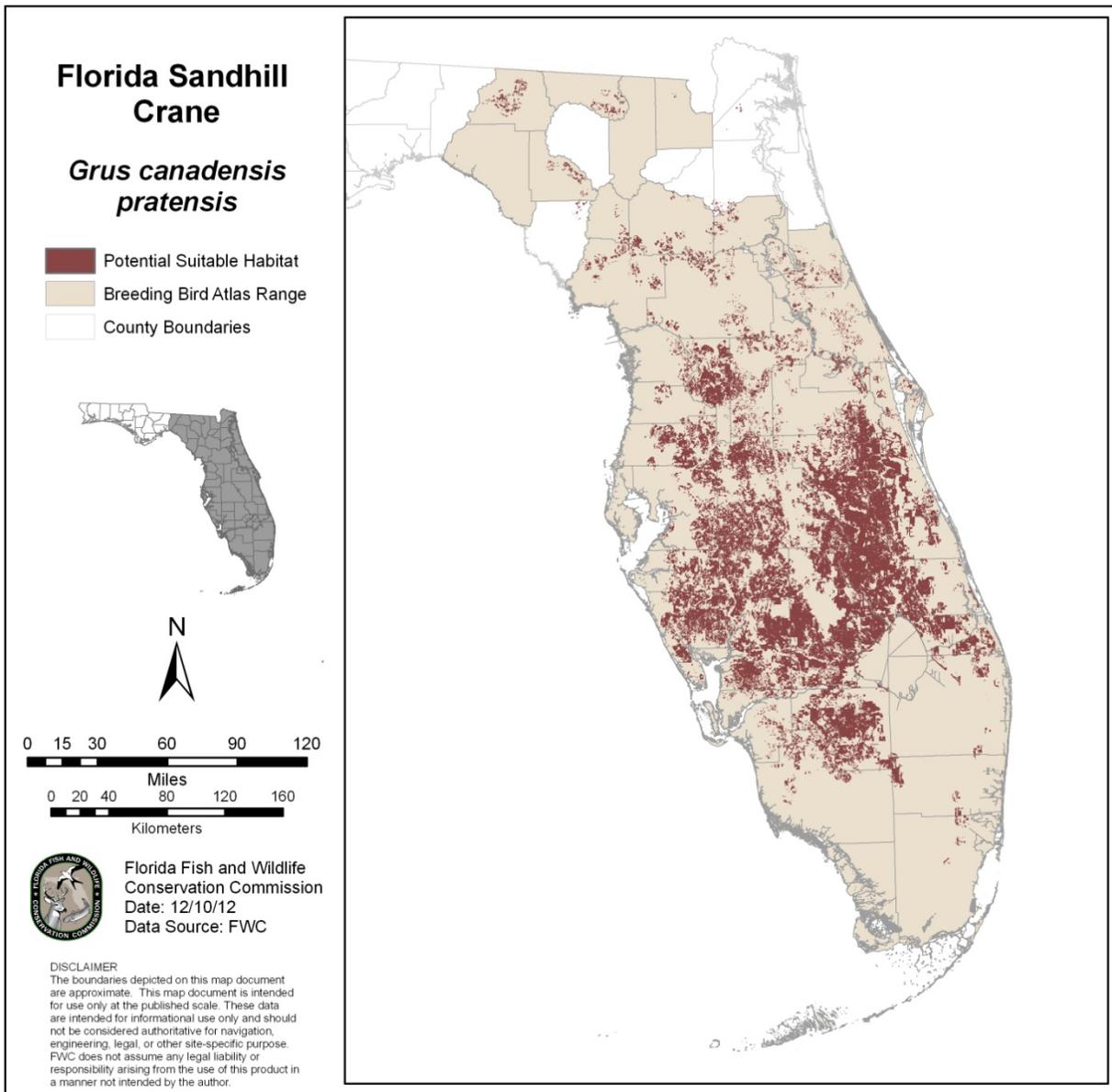


Figure 2. Range and potential habitat of the Florida sandhill crane.

A clutch consists of 1 to 3 eggs, but is usually 2 (mean 1.72) (Nesbitt 1988). Both members of the pair share in incubating the eggs and raising the young; the average incubation period is 30 days. Brood size averages 1.32. The downy young are cinnamon brown (Figure 3) and achieve flight at 65 to 70 days of age. Young sandhill cranes stay with their parents about 10 months before becoming independent and gaining their featherless red crowns.

Dispersal

Observed dispersal distances for this species average 11.58 km (7.2 mi), with a maximum observed of 48 km (29.8 mi). Females disperse farther (mean = 11.6 km) than males (mean = 3.9 km) from their natal territory (Nesbitt et al. 2002).

Conservation History

The Florida Game and Fresh Water Fish Commission (predecessor to the Florida Fish and Wildlife Conservation Commission [FWC]) included the Florida sandhill crane on its initial 1972 Endangered Species List, but reclassified the subspecies as Threatened in 1974. Florida sandhill cranes were listed as Threatened by the 1978 Florida Committee on Rare and Endangered Plants and Animals (FCREPA) (Nesbitt 1996). The FCREPA re-evaluated all species in 1994 and the subspecies was again listed as Threatened. Florida sandhill cranes are also protected under the federal Migratory Bird Treaty Act. Their population was estimated to be 4,000 to 6,000 individuals in 1992

(Tacha et al. 1992), with about 25% being non-breeding subadults. In 2008, their population was estimated using habitat data at just under 4,600 individuals (Nesbitt and Hatchitt 2008).



Figure 3. Precocial sandhill crane chicks are able to leave the nest within a day of hatching but remain flightless for another 65 days. Photograph by Marty Folk, FWC.

Few government or private organizations have deliberately managed lands for Florida sandhill cranes. However, prescribed burning, a standard habitat management tool in Florida, benefits this species. Private, and sometimes public, rangelands are managed intensively through the use of grazing, prescribed burning, mowing, and roller-chopping to discourage woody species and encourage grassy and herbaceous vegetation, often making them a preferred habitat for cranes. Cranes also benefit from wetland protection policies, such as wetland mitigation banks and incentive programs like the [Northern Everglades and Estuaries Protection Program](#). However, no such protective measures prevent the development of upland habitats that are an essential part of every crane's home range. In addition to protecting prey species, maintaining water quality is important to help prevent succession of herbaceous marshes into cattail and willow (*Typha* spp. and *Salix* spp.) communities, which are less suitable for the species.

Wetland protection laws have benefitted Florida sandhill cranes. However, rules that mitigate the destruction or disturbance of a nesting marsh in 1 location by preserving an existing marsh elsewhere can still result in a net loss of wetland habitat. Other conservation efforts include “wildlife crossing” signs along roadways to minimize vehicle-caused injury or mortality. The 1997 Florida Game and Fresh Water Fish Commission *Nongame Technical Report No. 15, Ecology of Florida Sandhill Cranes* recommends reducing human activity within 125 m (400 ft) of an active nest (Stys 1997). Recommendations were also made for the construction of “crane-friendly” fencing (Stys 1997) but it is not known how often the recommendations are heeded ([Action 21](#)).

Threats and Recommended Listing Status

Threats

The primary threats to Florida sandhill cranes are habitat loss and degradation. These threats result from development and lack of appropriate land management, and are increasingly likely to be exacerbated by climate change, which is expected to affect habitat through altered hydroperiods and changing fire regimes. Like many declining species in Florida, Florida sandhill cranes depend on open habitats such as prairies, improved pastures, and freshwater marshes. Because much of their habitat is privately owned, it is vulnerable to development and overgrowth of unsuitable wetland and upland vegetation (Figure 4). Cranes avoid overgrown habitats and dense forest canopies that result from ecological succession unchecked by disturbances, such as fire. Loss of natural fire regimes in both upland and wetland plant communities across the Florida landscape hamper crane success. As habitat conditions degrade, cranes will leave their home range and travel up to 15 km (9.3 mi) to find resources, making them more vulnerable to mortality from collisions and predators. Thus, proximity of wetlands for roosting and nesting to upland foraging areas is important.

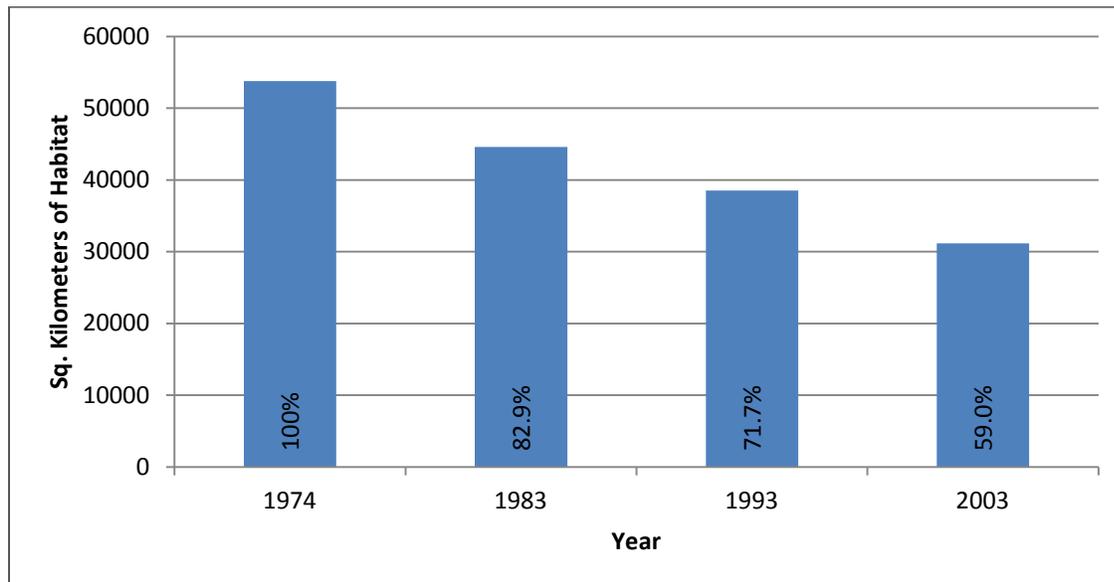


Figure 4. Potential crane habitat in Florida declined by an average 16.6% per decade between 1974 and 2003; total available habitat was estimated to have declined 42% in these 3 decades (Nesbitt and Hatchitt 2008).

Dense vegetation contributes to increased crane mortality through predation. As crane habitat has become less abundant, cranes have become more common in overgrown areas where predators like bobcats (*Lynx rufus*) are more successful at killing cranes. Crane predation is also exacerbated by an abundance of native predators, like raccoons (*Procyon lotor*), that thrive near humans. Non-native predators such as coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), domestic dogs (*Canis lupus familiaris*), feral hogs (*Sus scrofa*), and fire ants (*Solenopsis invicta*) are also a threat.

Due to their reliance on wetlands for roosting and nesting, cranes are particularly vulnerable to factors affecting water levels including flooding, drought, storms, and ground water withdrawals

by humans. Droughts threaten crane nesting success and extended droughts can lead to low annual-reproduction. Cranes usually forgo nesting when wetlands are dry. Low water levels leave nests and young vulnerable to predation. Increased duration and intensity of drought due to climate change threaten historic hydrological levels, leading to loss of nesting habitat. Longer dry periods can also cause changes in fire regime that would affect vegetation structure of upland crane habitat. Other human impacts, such as ditching and diverting water to drain wetlands, are far-reaching and detrimental.

Conversely, rapid rises in water levels can also cause crane nests to fail. Wetlands near impermeable surfaces such as roads and parking lots are subject to more rapid flooding. Climate change predictions for Florida also include increased heavy rainfall events, which will likely lead to localized flooding, another source of nest failure. Additionally, the timing of precipitation events may shift, contracting the breeding season and resulting in lower nesting success.

Crane mortality in Florida is often human-related (Folk et al. 2001). Cranes are frequently killed by vehicle collisions, especially with their increasing reliance on road right-of-ways for foraging. Collisions with utility lines and fences also occur (Figure 5). Entanglement in foreign objects such as monofilament line and other plastic debris is another source of mortality. Less visible, and more difficult to assess, is the effect of exposure to pesticides and other toxins in human-altered landscapes.



Figure 5. Cranes are prone to collisions with utility lines. Photograph by Marty Folk.

Lastly, with an estimated population of fewer than 5,000, a genetic bottleneck may impact population viability of the species in the future. However, introducing genetic stock to the current population is a last resort action and beyond the scope of this plan.

Recommended listing status

In 2010, 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 sandhill crane. The FWC convened a biological review group (BRG) of experts on the Florida sandhill crane to assess the biological status of the species using criteria specified in Chapter 68A-27.001, Florida Administrative Code (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). FWC staff developed an initial draft Biological Status Review report (BSR), which included the BRG's findings and a preliminary listing recommendation from staff. The draft was sent out for peer review, and the reviewers' input was incorporated into a [final report](#).

Florida sandhill cranes underwent an inferred population reduction of 36% between 1974 and 2003, based on habitat loss and degradation (Nesbitt and Hatchitt 2008).

Thus, the BRG concluded in their [Biological Status Review report](#) (BSR) that the species met the following criterion for listing as a Threatened species:

- Criterion A(a)2 *Population Size Reduction*. An inferred population size reduction of at least 30% over the last 3 generations (12.5 yrs x 3 = 37.5 yrs), where the reduction or its causes are not expected to cease.

Based on the literature review, information received from the public, the BRG findings, and input from peer-reviewers, FWC staff recommended the Florida sandhill crane be retained as Threatened on the Florida Endangered and Threatened Species List. The objectives outlined in this plan are designed to ensure the long-term conservation of this species.

CONSERVATION GOALS AND OBJECTIVES

Goal

Improve the conservation status of the Florida sandhill crane so the species is secure within its historical range.

Rationale

Due to the continuing conversion of natural and agricultural land for development, the decline in suitable Florida sandhill crane habitat is predicted to continue. With only an estimated 263 breeding pairs of these cranes living on public land, more than 85% of the current population is presumed to inhabit private land, which is vulnerable to development (Nesbitt and Hatchitt 2008). Human population growth in Florida since the 1940s continues to cause the conversion of rural lands to housing and commercial use. Without active land management (i.e., prescribed fire), habitat loss through degradation is also expected to continue. Furthermore, new threats from climate change affecting wetland and upland habitats are anticipated to affect the extent and suitability of available habitat.

Objectives

I. Maintain or increase the statewide area of habitat suitable for cranes at or above 31,200 km² (19,400 mi²) over the next 10 years.

Rationale

Conservation of suitable habitat will be necessary to stabilize or increase the population of Florida sandhill cranes. Suitable crane habitat in 2003 was estimated at 31,200 km² (19,400 mi²) by Nesbitt and Hatchitt (2008). Through management, more habitat can be made suitable. With most of the crane population using private land, conservation through easements should be a top priority.

II. Increase by 10% the statewide estimated population of 4,600 Florida sandhill cranes over the next 10 years to enhance its long-term viability.

Rationale

The population could be increased above its current level if habitats are improved. Some of the actions outlined in this plan specifically aim to reduce crane mortality. These include efforts to reduce collisions with vehicles and power lines and to rescue cranes entangled in foreign objects.

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

Florida sandhill cranes are habitat generalists and will occupy several plant communities that have an open aspect, as long as a suitable wetland exists nearby for roosting and nesting. The measurable objective to maintain or increase statewide suitable habitat at 31,200 km² (12,046 mi²) will require a combination of permanent land protection and close partnerships among regional, state and federal agencies, local governments, non-governmental organizations (NGOs), and especially private land owners. Although public lands can provide a high level of security for wildlife because of statutory provisions for long-term management funding and for guiding habitat management on those lands (ss. 259.105 and 259.032, Florida Statutes [F.S.]), it is believed that public land hosts fewer than 300 breeding pairs of the species (Nesbitt and Hatchitt, 2008). While this plan relies in part on the ability of public lands to continue to support Florida sandhill cranes, private landowner cooperation will be essential.

Ongoing land management practices that benefit other species of wildlife also benefit cranes by increasing open plant communities, maintaining healthy wetlands, and providing suitable roosting, nesting, and foraging habitat. These management practices include prescribed fire, cattle grazing, invasive-species control, restoring overgrown forests to a more open condition, and thinning overstocked pine stands.

Habitat Conservation

Action 1 Conserve and manage suitable land, through fee-simple and less-than-fee-simple acquisition, in areas that support existing Florida sandhill crane populations.

Protecting habitat through conservation easements figures prominently in achieving habitat conservation. Cattle ranches are a stronghold of Florida sandhill cranes, and thus should be maintained and protected. It will also be important to increase the number and representation of wetland types in land conservation programs in order to capture a variety of wetlands and minimize the net loss of nesting habitat. Wetland communities projected to persist under future climate conditions should be prioritized for land protection (i.e., acquisition, easements) and restoration. Though ranch management practices can be compatible with crane conservation, guidelines should be developed to ensure that practices employed are appropriate, applied with continuity, and standardized ([Action 6](#)). Minimum standards should be determined for those landowners seeking conservation easements for cranes; these should include the existence of suitable crane habitat ([Action 10](#)), minimum area, and land use and management assurances.

Action 2 Create new, and support ongoing, water conservation programs in regions critical to Florida sandhill cranes, especially when extreme drought is predicted during the breeding season.

Groundwater removal for urban and agricultural purposes reduces the amount of shallow-water wetlands available to the species for roosting and nesting. The impact of groundwater withdrawal is greatly increased during extended droughts and may be further exacerbated by climate change. Wetland preservation is imperative for crane conservation, and maintenance of adequate surface water should be considered when issuing consumptive use permits (CUPs) for surface and groundwater withdrawals. Typically, CUPs require the applicant to establish groundwater and surface water monitoring sites. Minimum ground and surface water levels should be established in areas with high Florida sandhill crane densities to ensure that groundwater removal does not lead to loss of the shallow water wetlands on which they rely. Water Management Districts (WMDs) review CUPS for groundwater withdrawals without FWC involvement; however, FWC can provide technical assistance to WMDs.

The U.S. Environmental Protection Agency, Florida Department of Environmental Protection (DEP), and the 5 WMDs monitor and regulate water quality and quantity (e.g., minimum flows and levels or MFLs) to maintain healthy conditions for aquatic plants, fish, and other wildlife. Tiered water billing, which financially rewards those users that consume less water by charging less per unit, should be supported and encouraged. Partnerships with utility companies, municipalities, counties, WMDs, and large-scale water consumers such as farms and cement plants would be required. Reduction of water consumption should be encouraged through outreach and incentives to implement water conservation measures ([Incentives and Influencing, Coordinating with Other Entities, Action 24](#)).

Prairie regions of the following counties support substantial numbers of Florida sandhill cranes: Alachua, Charlotte, DeSoto, Lake, Osceola, and Putnam. These areas should be considered critical to conservation of the species.

Action 3 Ensure the incorporation of Florida sandhill crane habitat needs into existing programs that influence habitat acquisition and management.

Pastures, prairies, and freshwater marshes are all important to maintaining healthy prey populations and foraging habitat for Florida sandhill cranes. Federal, state, and local governments monitor and manage some of these habitats and funding to restore and enhance them is provided by programs like the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and Landowner Assistance Programs (LAPs) ([Action 16](#)). The FWC Invasive Plant Management and Aquatic Habitat Enhancement and Restoration sections work to monitor, restore, and control aquatic plants through permit reviews, chemical, mechanical, or biological control of invasive species, and enhancement projects to improve habitats for fish and other wildlife. These habitat management efforts should be coordinated in order to maximize suitable foraging and nesting habitats for cranes in Florida.

The Everglades Headwaters National Wildlife Refuge and Conservation Area, established in 2012, is expected to protect approximately 61,000 ha (150,000 ac) in Polk, Osceola, Highlands, and Okeechobee counties, including prime crane habitat. Of this area, 40,000 ha (100,000 ac)

will be protected by conservation easements or other less-than-fee-title means in cooperation with willing landowners, and 20,000 ha (50,000 ac) will be owned and protected as a National Wildlife Refuge.

The FWC and partners have been creating a Cooperative Conservation Blueprint (CCB) that will build a common vision for important conservation lands in Florida. This vision should include incentives and policies that make it acceptable to all partners. The effort has been coordinated with the U.S. Fish and Wildlife Service's Everglades Headwaters National Wildlife Refuge project through multiple meetings and use of common data sources such as the Critical Lands and Waters Identification Project. The CCB is providing more regional data and partner context to the new refuge, and the new refuge is providing 1 source of incentive funding and opportunity to the CCB. Florida sandhill cranes will benefit from the CCB, the new refuge, and similar efforts.

Habitat Management

Action 4 Encourage the restoration of natural hydrological conditions.

Measures to restore natural hydrology to the landscape, especially those that help to retain water in wetlands or reduce rapid changes in water levels, will benefit cranes. Simply filling or plugging drainage ditches and installing culverts under roads are methods of restoring natural hydrology. FWC currently coordinates with the Natural Resources Conservation Service (NRCS) to implement restoration of critical wetlands through the Wetlands Reserve Program. On lands where the hydrology has been altered to facilitate pine plantations or other agricultural operations, the natural hydrology should be restored. Reliable and lengthy hydroperiods are conducive to crane reproductive success.

Dispersed Water Management Programs to store excess surface water should be encouraged. The [Northern Everglades Payment for Environmental Services Program](#), administered collaboratively by South Florida WMD and a coalition of other groups, offers payment to willing landowners to provide water retention and nutrient load reduction services beyond regulatory requirements. [Florida Ranchlands Environmental Services Project](#) is among the programs that provide incentive against selling ranch land for more intensive agriculture and urban development. This innovative initiative, known as "water farming," will benefit Florida sandhill cranes.

Action 5 Promote the application of prescribed fire and mechanical treatment on public and private land to reduce woody encroachment in uplands and wetlands.

Historically, the recurrence of lightning-ignited fire and human-induced ignitions was pivotal in setting back vegetative succession and shaping species composition and structure of Florida's upland and wetland plant communities. In lieu of naturally-ignited fire, the regular application of prescribed fire is critical for the maintenance and enhancement of habitat conditions preferred by Florida sandhill cranes. Prescribed burning reduces shrub and hardwood encroachment in uplands and wetlands and stimulates growth of low-growing plants such as grasses, forbs, and legumes. Burning during the early growing season (April through June) causes more pronounced vegetative responses compared to burns conducted during the dormant season (October through February). The application of land management tools such as fire should take precedence over protecting individual crane nests from disturbance, although nests and flightless young can often

be protected during prescribed burns. LAPs have the ability to provide funding for habitat management, including the application of prescribed fire, on private lands.

Mechanical treatments, such as roller-chopping, mowing, shredding or mulching, and tree-cutting, also benefit the Florida sandhill crane. These techniques are sometimes used in conjunction with or instead of fire when habitats have become severely overgrown or when burning cannot be used. Cattle ranchers use these treatments to maintain pastures, which act as surrogate habitat for cranes where native plant communities, such as wet and dry prairie, have been lost. Some hammocks and dome swamps that are the result of past fire suppression can be restored to flatwoods and marshes through mechanical treatments and fire. Chemical treatments are sometimes necessary, particularly in wetlands with long hydroperiods, where fire or use of heavy equipment is impractical to reduce woody vegetation.

Promoting prescribed fire and mechanical treatments requires education, outreach, and incentives for public and private land managers ([Actions 6, 16](#) and [19](#)). As mentioned previously, climate change may lead to altered natural fire regimes and prescribed fire may become more difficult to apply in some areas. Alternative management actions should be considered in areas where prescribed fire is no longer an option. As prescribed fire becomes more challenging due to climate change and smoke management concerns, mechanical treatment will likely become increasingly important. Forestry contracts to remove trees from Florida sandhill crane habitats may be necessary.

The FWC, through programs including Florida's Wildlife Legacy Initiative, promotes the application of prescribed fire on public and private lands. For example, the Legacy Initiative has used State Wildlife Grants to support the development and maintenance of Fire Strike Teams modeled after the successful Central Florida Ecosystem Support Team. These teams provide additional equipment and trained personnel to assist public and private land managers in the safe implementation of controlled burns. Other agencies employ similar models to maximize resources for application of prescribed fire.

Action 6 Make habitat management recommendations for public and private lands based on results of [Action 10](#).

Most private land used by cranes is managed for cattle ranching, sod farming, and other agriculture. These and other agricultural land uses that maintain open areas used by Florida sandhill cranes should be encouraged. LAP staff provides technical assistance and help to administer NRCS incentive programs that encourage habitat management for wildlife on private lands. All public lands should be assessed for potential and current crane habitat and, for those lands with adequate habitat supporting the species, recommendations to maintain and increase the population should be included in their overall management plans. On all lands, the impact of roads on wetlands should be minimized, for example, through the use of culverts.

Action 7 Maintain cattle grazing as a management tool to reduce woody encroachment on public and private lands already in pasture.

Conservation easements should be used to help maintain working cattle ranches ([Action 1](#)). Private land use by grazing operations supports cranes far better than do alternatives such as

housing, food crops, silviculture, and even sod farming, which can attract large numbers of cranes and increase their exposure to pesticides. When ranches are purchased by local, state or federal governments for conservation or recreation purposes, cattle grazing should be maintained as an alternative to, or until, restoration begins on specific sites.

Population Management

The highest priority for achieving and maintaining the desired population of Florida sandhill cranes will be through conservation and management of appropriate habitats, as outlined in the previous section. However, since cranes are long-lived, require 2 to 5 years to reach reproductive maturity, and have low reproductive rates, preventing mortality of breeding adults will contribute significantly to overall crane productivity and population stability.

Action 8 Reduce crane mortality from vehicles.

Florida sandhill cranes use roadside habitat, making them vulnerable to collisions with vehicles (Figure 6). Their use of roadsides is increasing, perhaps due to an increase in the number of roads or a reduction in other foraging habitats. Also, adult cranes will typically walk across roads with flightless young. FWC can work with the Florida Department of Transportation and homeowners associations to develop actions that make roadsides less attractive and less lethal to cranes. Traffic-calming measures such as caution signs and speed bumps in residential areas, as well as managing roadsides to be less suitable for foraging (vegetation height greater than 1 m [40 in]), could reduce collisions and should be focused in areas frequented by crane families. Adequate signage in appropriate locations can minimize collisions between wildlife and vehicles; caution signs for wildlife crossings could be used as well as crane-specific signs. Reduction of open, grassy areas adjacent to roads or placement of hedgerows along roadways are less feasible. Maintaining roadsides completely devoid of vegetation is another option.



Figure 6. Collisions with cars are a common mortality source for cranes. Photograph by Marty Folk, FWC.

Action 9 Mark power lines to reduce crane mortality caused by collisions.

Where possible, power lines should be routed or buried to avoid areas frequented by cranes. Marking existing power lines should be prioritized in those areas most commonly traversed by cranes or where injuries and mortalities have been reported. Reflective kinetic markers are designed specifically to divert birds in flight (Figure 7). Coordination with utility companies is essential to implement this action as they install power and transmission lines. Power companies should consult with FWC when planning new lines in areas of known crane use.

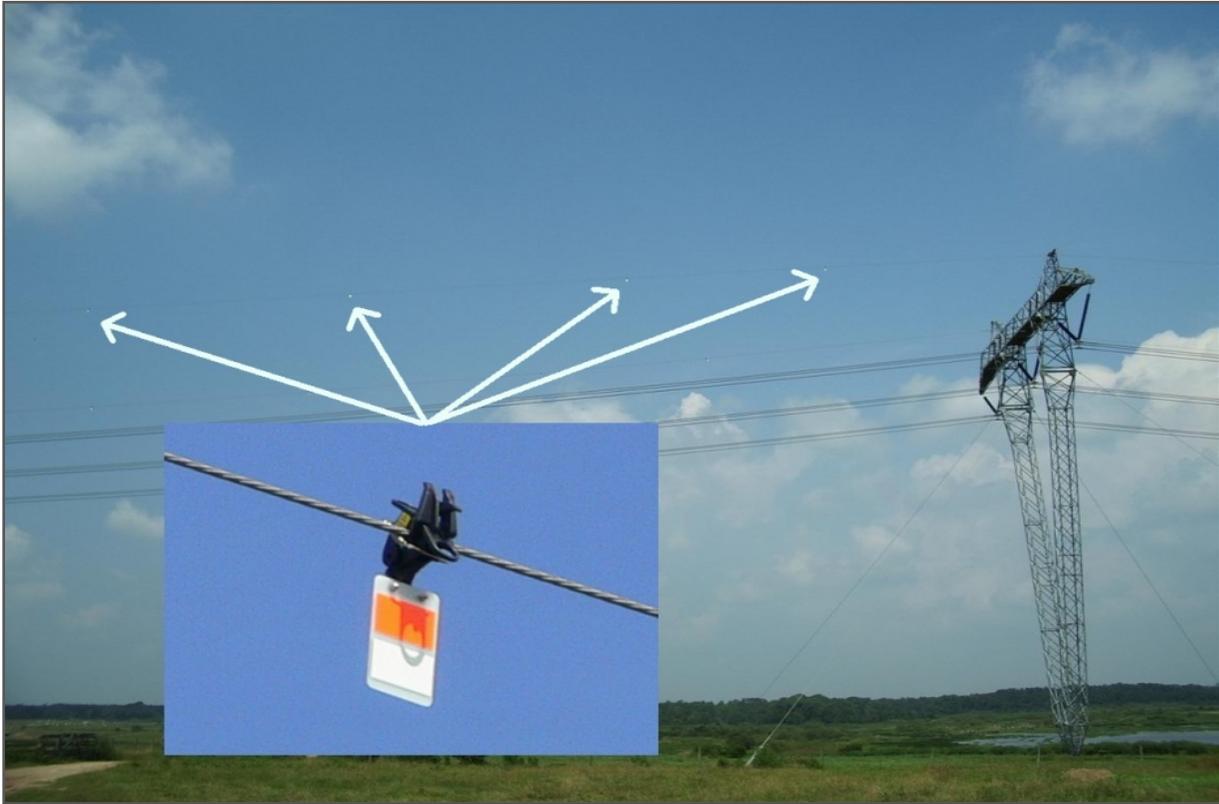


Figure 7. Power line markers can reduce the hazard to cranes and other birds. Arrows indicate 4 installed markers on a barely visible line. Photograph by Marty Folk, FWC.

Monitoring and Research

Research is necessary to provide a refined estimate of the current population size, available habitat, and carrying capacity for Florida sandhill cranes. While the general habitat needs of the species are known (Stys 1997, Wood and Nesbitt 2001), specific habitat parameters have not been identified via empirical data collected for this purpose. Once these parameters are determined ([Action 10](#)), management recommendations should be made for lands where improvements will benefit this crane ([Action 6](#)). Other research that will facilitate conservation of the Florida sandhill crane includes data collection on survivorship, productivity, and habitat use on conservation lands and suburban areas ([Action 12](#)); most previous studies were conducted on private rangeland. A monitoring protocol should be developed ([Action 13](#)) that will allow detection of trends in its population. Citizen scientists and wildlife groups (e.g., National Audubon Society chapters) should be encouraged to assist with population monitoring. Research is also necessary to develop more effective methods to deter nuisance cranes ([Action 20](#)).

Action 10 Quantify the habitat parameters and determine the vegetation associations preferred or avoided by Florida sandhill cranes.

Although the wetland needs of Florida sandhill cranes are fairly well known, additional information is needed on upland requirements. Data on specific habitat parameters can be applied to land management. For example, uplands should be relatively open with most of the vegetative cover ≤ 50 cm (20 in) in height (Nesbitt 1996, Stys 1997). Habitat parameters, such as

soil type, elevation, and percent of open ground, must be further quantified to develop a habitat suitability model and desired future conditions for crane conservation. Once the upland habitat and vegetative needs of the species have been identified, crane habitats, especially on conservation lands, should be assessed through ground-truthing and standard vegetative surveys to determine their relative value to cranes.

The FWC’s Fish and Wildlife Research Institute’s avian research group currently has a project underway to address this action. Goals of this research include comparing productivity of cranes on dry prairie and improved pasture, and determining if habitat manipulation can be used to enhance productivity.

Action 11 Determine the distribution and quality of existing habitat using Geographic Information System (GIS) analysis to detect changes in habitat since 2003.

The GIS habitat study conducted by Nesbitt and Hatchitt (2008) to assess the amount of crane habitat lost to development should be repeated using current information to provide an update of potential habitat within its range. These data will assist in measuring progress on achieving [Objective I](#) of this plan.

Action 12 Determine survivorship and productivity related to habitat use of Florida sandhill cranes on conservation lands and suburban areas in Florida.



Figure 8. Cranes live among humans, but their population viability in suburban areas is unknown. Photograph by Marty Folk, FWC.

Little is known about factors influencing adult survival. To determine annual crane recruitment, mortality, and their ties to habitat quality, an intensive radio-telemetry study of a suitable sample of birds in representative areas of the state is required. In order to understand causes of reproductive failure, new research is needed using methods such as remotely triggered cameras at nests.

Previous research has focused on private ranch lands. The increasing use of suburban habitats by cranes remains unstudied, especially its effect on productivity ([Figure 8](#)). Habitat management recommendations can be made for areas identified as sub-optimal based on the results of research outlined in [Actions 10](#) and [11](#).

Action 13 Develop and implement a population monitoring protocol.

Application of a statewide monitoring program would result in better understanding of the species’ population, allow detection of population trends, and assess progress toward [Objective II](#) of this plan. Cranes are a focal species in FWC’s Wildlife Conservation Prioritization and

Recovery program, which develops and implements survey protocols on all FWC-managed land. This monitoring protocol consists of opportunistic observations of nests and fledgling recruitment and could be expanded, using a website, to all public lands and encouraged on private land with adequate crane habitat.

In addition, survey routes for annual population recruitment might be systematically spaced across the range of the Florida sandhill crane to include private land and attain an adequate sample size. Once developed, these routes can be surveyed by citizen scientists and local conservation land managers working in cooperation with private landowners. Developing a volunteer nest-watch program would aid in collecting productivity data on private lands and in suburban areas. Information from Audubon's Christmas Bird Count and Breeding Bird Atlas surveys should be compiled. Aerial surveys are effective during the breeding season because nests are conspicuous and easy to spot from above. To maximize transportation resources, surveys could be combined with those of other species (e.g., bald eagles, mottled ducks, white-tailed deer, and alligators) monitored through aerial surveys, but separate observers would be needed. This multi-pronged survey approach will require coordination between FWC, Audubon Florida, the Florida Ornithological Society, and land management entities that conduct surveys such as WMDs, DEP, and the Florida Natural Areas Inventory.

The FWRI avian research group has initiated a research project with the following objectives that address [Actions 11-13](#):

- Assess the current level of crane monitoring and management by land managers on public lands with crane habitat.
- Measure the regional productivity of sandhill cranes to identify areas where habitat management may be employed to enhance productivity.
- Develop a protocol for periodic monitoring of a sample of the population to measure trends that will facilitate responsible long-term conservation of the species and its habitats.
- Estimate available crane habitat using newly-updated GIS data.

Action 14 Develop a population model using the existing population viability analysis (PVA).

Productivity is low among cranes due to delayed sexual maturity, low clutch size, and long chick-rearing period. A PVA (Endries et al. 2009) determined that adult survival and adult fecundity were the most influential parameters on population growth and suggested that the Florida sandhill crane population is relatively stable. However, most of the smaller populations are not likely to persist over time without occasional dispersal, and habitat reductions were not accounted for in the PVA. These models assume that there are no catastrophes and no changes in habitat, which further emphasizes the importance of the larger populations and dispersal among the populations. The PVA determined that management and research for the species should target adult survival, the little-studied parameter most influential on long-term trends.

Rule and Permitting Intent

The BRG concluded that the Florida sandhill crane met criteria to remain designated as Threatened per Rule 68A-27.001(3)(a)2, F.A.C.

Protections afforded to the species under Rule 8A-27, F.A.C., are such that no person shall take, possess, or sell any Threatened species or their nests or eggs except as authorized by FWC rule or by permit from FWC.

Intentional take permits authorizing the take of state-designated Threatened species are issued for scientific or conservation purposes

that will benefit the survival potential of the species, or as described in Rule 68A-27.003, F.A.C.

Incidental take permits, on

the other hand, are issued if the permitted activity clearly enhances the survival potential of the species or when there is a scientific or conservation benefit and only after showing that the permitted activity will not negatively impact the species.



Figure 9. Cranes build their nests from wetland vegetation in about 30 cm (1 ft) of water. Photograph by Marty Folk, FWC.

The following guidelines have been developed to minimize disturbance to nesting cranes during development or infrastructure planning.

Permitting Guidelines

For new development activities that involve occupied or potential Florida sandhill crane habitat, but do not involve removal of nests, the following guidelines will minimize potential impacts:

- Avoid activity within 125 m (400 ft) of all types (incubation and accessory) of nest sites during the breeding season (January through August).
- Avoid placement of impermeable surfaces, such as roads, adjacent to wetlands used by nesting cranes. This reduces the chance of nest failure due to flooding ([Figure 9](#)).
- Incorporate culverts into new road designs that will allow for maintenance and/or restoration of natural hydrology.
- Include a shallow end or shelf, vegetated with native herbaceous wetland species such as maidencane (*Panicum hemitomon*), pickerelweed (*Pontederia cordata*), and smartweeds (*Polygonum* sp.) when constructing new ponds.
- Use fencing that is more permeable (i.e., barbed wire versus woven wire or chain link) and less dangerous to cranes when constructing fences in or around nesting wetlands and associated uplands ([Action 22](#)).

For existing and ongoing activities, the following guidelines will minimize impacts:

- Minimize fertilizer, herbicide, and pesticide runoff into wetlands.
- Cranes are not likely to be disturbed by routine use of existing roads, homes and infrastructure; however, where vehicle-caused mortality is common, post signs in areas frequented by cranes to alert motorists.
- Avoid operating motorized watercraft within 125 m (400 ft) of nests or cranes engaging in nest-building activities.

Disturbances in and around wetlands where active nests exist can greatly decrease nesting success. Humans approaching a nest location within 75 m (250 ft) of a nest site can cause a crane to flush (Dwyer and Tanner 1992). The recommended buffer zone of 125 m (400 ft) would provide an expanse wide enough to include the reported flushing distances and an additional awareness zone (Stys 1997).

Loud, motorized watercraft can flush birds from their nests as well as interrupt nest building activities. The wake from motorized watercraft can also flood nests. Most crane nests are located in areas inaccessible to motorized watercraft, with the exception of airboats, due to the shallow waters in which Florida sandhill crane nests typically occur.

Law Enforcement

Action 15 Continue enforcement of illegal take rules, the prohibition against feeding Florida sandhill cranes, and wetland protection laws.

Current enforcement of rules and laws pertaining to crane protection, feeding prohibition (Rule 68A-4.001[5], F.A.C) and wetland protection should be maintained. FWC law enforcement officers actively pursue and recommend prosecution for those who intentionally violate wildlife laws. The FWC law enforcement officers also educate the public on how to identify and report violations. The FWC Division of Law Enforcement administers the Wildlife Alert program, which receives information via a toll-free number (1-888-404-3922) that is answered 24 hours a day, 7 days a week. Cash rewards are offered to callers who provide information about any illegal activity that results in an arrest. Callers may remain anonymous and are not required to testify in court.

Incentives and Influencing

Wildlife Conservation Measures

FWC should draft recommendations for conservation measures that can be used by developers for low-impact developments as well as measures that can be used for lands slated for more intensive development. Use of these measures could preserve or enhance additional habitat or avoid take of the species by identifying such things as the preferred timing of clearing and construction; methods of clearing and re-vegetating; preferred locations and methods of stormwater management features; preservation of onsite ecosystem features; preferred location of open space, green space, and conservation areas; inclusion of development or density buffers; or inclusion of conservation easements over conservation areas. Incentives for incorporating these conservation measures into development proposals could include reduced or expedited

permitting, reduced permitting fees, local or state recognition, tax incentives, or density bonuses. Other state and federal programs exist to provide incentives for wildlife habitat conservation.

Action 16 Create incentives for maintaining or creating marshes embedded in suitable uplands through Landowner Assistance Programs (LAPs).

FWC’s LAP advances species conservation objectives through public– private conservation partnerships. These programs are voluntary and some offer financial assistance to landowners implementing conservation plans. Participation in these incentive programs may provide opportunities to gather information about the impacts to cranes from agricultural practices or development. FWC assistance in evaluating the effects of development practices on the species’ population would help provide the necessary information to develop better avoidance, minimization, and mitigation options for agriculture and development on private property.

Suitable habitat juxtaposition is critical to crane survival and productivity (Nesbitt and Williams 1990). For LAPs to work effectively, viable economic landowner incentives will need to be realized. Examples of incentive programs include Conservation Reserve Program, Environmental Quality Incentives Program, Forest Stewardship Program, Partners for Fish and Wildlife, Wetland Reserve Program, Wildlife Habitat Incentives Program, Safe Harbor Agreement, Habitat Conservation Plan, Conservation Banks, and Candidate Conservation Agreement with Assurances. Florida also provides tax incentives including property tax exemptions for landowners who put a perpetual conservation easement on their land. Additional incentives may include exemption from permits for activities that enhance wildlife such as mowing, roller-chopping, and tree stand thinning, as long as they are not a precursor to development. These programs should be focused in areas critical to the conservation of the Florida sandhill crane, such as the Kissimmee Prairie.

Action 17 Work with partners to raise the value of emergent marsh relative to forested wetlands in mitigation programs.

Opportunities exist for landowners to create wetlands mitigation banks with a developer or third party or to protect, restore or enhance existing wetlands. Compensatory mitigation, in accordance with Section 404 of the [Clean Water Act](#), uses methods such as resource restoration, establishment, and enhancement to compensate for impacted aquatic resources so there is “no net loss” of wetlands. Preference should be given to natural and restored wetlands over created wetlands, and herbaceous marshes over forested wetlands. Florida Statutes state: “Mitigation banks and offsite regional mitigation should emphasize the restoration and enhancement of degraded ecosystems and the preservation of uplands and wetlands as intact ecosystems rather than alteration of landscapes to create wetlands. This is best accomplished through restoration of ecological communities that were historically present” (s. 373.4135, F.S.). Wetlands restored for mitigation require long-term monitoring and management to ensure they are meeting the required and desired functions. Mitigation banks are authorized by a state permit, issued by either a WMD or DEP; the U. S. Army Corps of Engineers authorizes the federal permit.

Florida sandhill cranes can use artificial wetlands for nesting (Toland 1999). Thus, some wetland mitigation projects can result in no net loss of crane habitat. However, these artificial wetlands are often retention ponds or borrow pits, so they are more susceptible to rapid changes in water level, leaving crane nests vulnerable. Toland (1999) found that Florida sandhill cranes were less productive in developed areas than in natural areas and cautioned that mitigation wetlands in developed areas may be biological sinks for the population. Artificial wetlands, including livestock ponds, can be constructed to provide crane habitat by creating a shallow end or shelf that allows the establishment of emergent herbaceous wetland plants.



Figure 10. Sandhill cranes are easily identified and apparent in the landscape. Photograph by Marty Folk, FWC.

Education and Outreach

Education is critical to public awareness of the Florida sandhill crane's listing status and habitat needs. Well-informed citizens can take actions to support crane conservation efforts ([Figure 10](#)). Both formal and informal settings can serve as opportunities to educate Floridians about imperiled species. A unified and comprehensive approach to education and outreach will serve to inform the public, at their own pace, regarding the need and means to protect the species.

Action 18 Create public service announcements about Florida sandhill cranes.

Federal public service announcements were used to educate the public on whooping cranes and their Endangered status. A similar campaign is recommended for Florida sandhill cranes. The campaign should address the following 3 key messages:

- Florida sandhill cranes are Threatened and thus protected by law from intentional and unintentional harm and harassment, including habitat modifications that can lead to death or injury.
- Feeding cranes is illegal. Feeding cranes can cause them to become nuisance wildlife and also endangers them.
- Cranes require both wetlands and open, grassy landscapes for survival.

Action 19 Provide information about living with cranes to audiences such as land managers, golfers and golf course managers, homeowners, hunters, zoo visitors, and students.

Targeting specific audiences and venues will increase the efficacy of any education campaign. Cattlemen's associations and other landowner groups should be a target audience, especially so property managers can be encouraged to use the appropriate practices described above. Florida sandhill cranes often use golf courses because they provide the open habitat they need for

foraging. Score cards at golf courses could be a medium to disseminate information about cranes, their protected status, and why feeding them is prohibited. Photographs of injured cranes from wildlife rehabilitators can educate the public about the dangers of entanglement from improperly discarded waste. The imperiled species section of FWC’s hunter education course should be further developed and updated. The FWC should develop signs with the 3 key messages ([Action 18](#)) for facilities that house native species and are open to the public. PowerPoint presentations and videos can be developed and posted on agency websites or YouTube. In addition to the key messages, they should address how to live with cranes and how to manage their habitat. Schools, especially those near crane habitat, should be targeted for crane conservation education. If Florida sandhill cranes are nesting on or adjacent to school grounds, the schools could “adopt” a pair, providing monitoring information to FWC.

Efforts to reduce cases of nuisance cranes will advance crane conservation and public education. Florida sandhill cranes that habituate to bird feeders and suburban yards can seem tame but can become territorial and aggressive. Cranes sometimes destroy property to reach food on porches and damage lawns and golf courses while foraging. Scare tactics and relocation are ineffective. Only through long-term food deprivation can cranes be dissociated from human food sources. Windows and reflective surfaces that cranes can easily approach can elicit aggressive behavior; planting a visual buffer in front of the reflective surface or fencing the area off may reduce this problem. Homeowner associations should be addressed in areas with many crane-human encounters.

Action 20 Test new methods of deterring nuisance cranes.

Research is needed on new, low-cost ways of deterring these cranes from residences and businesses where they are causing damage or creating a nuisance. Recorded crane distress calls may repel cranes but are untested. The efficacy of chemical repellents added to bait should be tested; chemical repellents tested and used by the International Crane Foundation are not yet legal in Florida. Methods for keeping the species away from vehicles and windows should be sought. Other methods of negative or aversive conditioning of cranes can be developed through research. The need to obtain a permit to harass Florida sandhill cranes should be waived so that aversive conditioning can be used as soon as problems start.

Action 21 Through a variety of media, engage wildlife rehabilitators and the public on appropriate responses to injured cranes.

Adult survival is thought to have the greatest impact on long-term population trends, so saving individual cranes may benefit the population. Capturing birds (as opposed to cutting the line) to remove monofilament and other human-related hazards should be encouraged, but only by licensed and experienced wildlife rehabilitators ([Figure 11](#)). The FWC should design and



Figure 11. Entanglements result in many calls from the public to wildlife officials and rehabilitators. Photograph by Marty Folk, FWC.

provide adequate informational materials and training to wildlife rehabilitators on how to safely capture, handle and transport injured or sick Florida sandhill cranes and ensure that rules regarding handling, transport and care of these birds are followed (Rule 68A-9.006, F.A.C.)

Action 22 Provide information on fencing materials which are less likely to entangle cranes.

Barbed wire fencing with 3 strands is better than 4-strand or 5-strand fencing, especially if the bottom strand is 46 cm (18 in) above the ground (Nesbitt 1996). Woven or welded wire fence, also called hog or animal wire, is more of an impediment to the subspecies. A framed “walk-through” (45 cm high x 60 cm wide [24 x 18 in]) placed periodically (every 0.48 km [0.3 mi]) in a woven wire fence would allow cranes to walk through the fence while still restraining livestock (Nesbitt 1996). Land managers and ranchers are the target audience for this information.

Coordination with Other Entities

Coordination between the FWC and other governmental and non-governmental entities is essential for the successful conservation and management of the Florida sandhill crane. While coordination was addressed within the actions above, the following actions warrant specific attention to coordination.

Action 23 Coordinate with local or county governments to ensure consideration of the Florida sandhill crane during development or infrastructure planning.

Highlighting the importance of Florida sandhill cranes to local governments is crucial because permitting and planning officials may be unaware of the habitat needs of this Threatened species. County growth management plans and land-development regulations provide the avenue by which FWC can inform and influence land and water uses relevant to the conservation of the species. The [BSR](#) and this plan identify the threats that warrant listing the Florida sandhill crane, as well as permitting recommendations that specify means to avoid, minimize, or mitigate activities associated with threats to the subspecies. To that end, FWC offers conservation planning services to local governments when plan amendments to the growth management plans and associated development proposals are being considered. When private lands are planned for development and significant impacts to sensitive wildlife are anticipated, staff from FWC’s Office of Conservation Planning Services reviews the development proposals and provides recommendations to minimize negative impacts to Florida sandhill cranes. Early coordination with FWC can streamline FWC’s review process.

Local governments can assist FWC in obtaining new occurrence information by adding questions to their development applications asking for information on what listed species surveys have been conducted on the property or by inspecting parcels for the presence and absence of Florida sandhill cranes. Requiring notification of FWC staff that the species or its habitat has been identified onsite prior to issuing clearing or building permits should expedite FWC’s review and approval.

Action 24 Work with DEP and WMDs on wetland regulations and to set minimum flows and levels (MFLs) and groundwater levels in areas with high Florida sandhill crane densities to ensure groundwater removal does not lead to loss of shallow water wetlands (see [Action 2](#)).

The WMDs have several programs related to ensuring that water supply needs of both people and natural systems are met. MFLs are established for lakes, streams, rivers, wetlands, springs, and aquifers in order to prevent significant harm to the water resources or ecology of an area resulting from permitted water withdrawals. WMDs identify a range of water flows and levels above which water might be permitted for consumptive use. State law requires the establishment of MFLs, as well as the annual lists of specific waterbodies for which MFL rules will be established during the next 5 years.

Within the FWC, each administrative region currently has or is developing a MFL Team that is responsible for providing comments on MFL plans within their region. MFL teams should include biologists with a diversity of expertise representing all aquatic wildlife, including Florida sandhill cranes. In some cases, these teams may have the opportunity to participate earlier during MFL development or modification, rather than by commenting on a near-final product. FWC recommendations are more likely to be included in the final plan if provided early in the development process. Regional MFL Teams will, at a minimum, provide technical assistance to WMDs through agency commenting on the development or modification of MFLs.

Action 25 Provide timely crane-related information to land use planners by regularly updating the Florida Wildlife Conservation Guide.

The [Florida Wildlife Conservation Guide](#) is an online resource that facilitates effective land use planning, project design, and the management of natural communities, with a focus on wildlife conservation. Developed by the FWC in partnership with the U.S. Fish and Wildlife Service and the Florida Natural Areas Inventory, its purpose is to provide an easily accessible repository of information on wildlife life history, habitat management, and conservation options. The FWC aims to provide a common platform of ecologically based wildlife information based on best available scientific information. As a dynamic resource, it is maintained with current guidelines and recommendations for wildlife management and protection, and includes numerous links to relevant external sources of information. The guide will have the specific information related to Florida sandhill cranes and necessary conservation measures that are developed.

Private landowners

It will be critical to work with private landowners for the long-term success of Florida sandhill cranes. It has been estimated that over 85% of occupied habitat is on private lands (Nesbitt and Hatchitt 2008). This highlights the need to work with private landowners to develop and implement conservation measures that simultaneously maintain agricultural and ranch lands and benefit cranes. Options should be explored to further incentives for private landowners who manage habitat for the benefit of cranes. These could include expansion of programs like the Landowner Incentive Program and Safe Harbor, pursuing and encouraging large Conservation Banks, and promoting responsible ecotourism opportunities on private land. ([Actions 5, 6, 7, 16, 17](#) and [22](#))

Other entities

The FWC should engage with NGOs and other entities, such as the Florida Wildlife Society and the Florida Audubon Society, that have a vested interest in Florida sandhill cranes. These partners could help with messaging, education, and citizen science opportunities. Existing,

ongoing Audubon programs, such as the Christmas Bird Count and the Breeding Bird Atlas, can contribute to monitoring efforts ([Action 13](#)).

Table 1. Florida Sandhill Crane (*Grus canadensis pratensis*) 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?
1	1	1	Conserve and manage suitable land, through fee-simple and less-than-fee acquisition, in areas that support existing Florida sandhill crane populations.	Habitat Conservation & Mgmt, Incentives & Influencing	EXPANDED	NO	YES	\$100k+	Legislature, Existing Budget	WHM, SCP, CPS	USFWS, USDA, DEP, FFS, NGOs, private landowners	High	Moderate- effective but difficult to implement.	Yes, suitable habitat is key.
1	2	2	Create new, and support ongoing, water conservation programs in regions critical to Florida sandhill cranes, especially when extreme drought is predicted during the breeding season.	Habitat Conservation & Mgmt, Incentives & Influencing	EXPANDED	NO	YES	TBD	Legislature, Grant, Existing Budget	CPS	USFWS, USDA, DEP, FFS, WMDs, NGOs, private landowners, industry, municipalities, counties, utility companies	High	Moderate- effective but difficult to implement.	Yes, natural hydrology is key.
1	3	3	Ensure the incorporation of Florida sandhill crane habitat needs into existing programs that influence habitat acquisition and management.	Habitat Conservation & Mgmt, Incentives & Influencing	EXPANDED	NO	YES	TBD	Legislature, Grant, Existing Budget	CPS	USFWS, USDA, DEP, FFS, WMDs, NGOs etc.	Unknown	Moderate- effectiveness unknown.	Yes, natural hydrology is key.
1	2	4	Encourage the restoration of natural hydrological conditions.	Habitat Conservation & Mgmt, Incentives & Influencing	EXPANDED	NO	YES	TBD	Existing budget, Grant	CPS, WHM	USFWS, USDA, DEP, FFS, WMDs, NGOs	High	Moderate- effective but little money available for easements and acquisition.	Yes, natural hydrology is key.
1	1	5	Promote the application of prescribed fire and mechanical treatment on public and private land to reduce woody encroachment in uplands and wetlands.	Habitat Conservation & Mgmt, Incentives & Influencing	EXPANDED	YES	YES	TBD	Existing budget, unknown	CPS, WHM, OCR	USFWS, USDA, DEP, FFS, WMDs, NGOs, private landowners	Moderate, management may not result in improved crane population stability.	Moderate- treatments are effective but results for crane conservation is unknown.	Yes, suitable habitat is key.
1	2	6	Make habitat recommendations for public and private lands based on results of Action 10.	Habitat Conservation & Mgmt, Incentives & Influencing	NEW	YES	YES	TBD	Existing budget	CPS, WHM,	USFWS, USDA, DEP, FFS, WMDs, NGOs, private landowners	Moderate, management may not result in improved crane population stability.	Moderate/high- once preferred upland habitat is quantified.	Yes, suitable habitat is key.
1	1	7	Maintain cattle grazing as a management tool to reduce woody encroachment on public and private land already in pasture.	Habitat Conservation & Mgmt, Incentives & Influencing	EXPANDED	NO	YES	\$0-25k	Existing budget	CPS, WHM	USFWS, USDA, DEP, FFS, WMDs, NGOs, private landowners	High, management for grazing is known to produce suitable crane habitat.	High- rangeland management is practical and already exists.	Yes, ranch lands provide important habitat.
2	3	8	Reduce crane mortality from vehicles.	Population Mgmt	NEW	NO	YES	TBD	Existing budget, Grant	CPS	FDOT	Low, may save a few cranes.	Low/moderate - similar to other wildlife-vehicle issues.	No, mortality will continue but should be reduced.
2	3	9	Mark power lines to reduce crane mortality caused by collisions.	Population Mgmt	EXPANDED	NO	YES	TBD	Existing budget, Grant	CPS	Private industry, Utility companies	Low, may save a few cranes.	Low/moderate - similar to other bird-power line issues, implementation is costly.	No, mortality will continue but should be reduced.
1	2	10	Quantify the habitat parameters and determine the vegetation associations preferred or avoided by Florida sandhill cranes.	Monitoring & Research	NEW	YES	YES	\$25-50k	Existing budget, Grant	FWRI	Universities	Moderate, habitat quantification may not result in crane conservation but is essential in identifying suitable habitat.	Moderate/high- requires research with sufficient sample size/time.	Yes, cannot conserve suitable habitat unless identified.
1 & 2	2	11	Determine the distribution and quality of existing habitat using Geographic Information System (GIS) analysis to detect changes in habitat since 2003.	Monitoring & Research	EXPANDED	YES	YES	\$25-50k	Existing budget, Grant	SCP or FWRI	Universities	Moderate, habitat inventory may not improve crane population stability but is essential in targeting land conservation.	High - can be done remotely.	Yes, cannot conserve primary habitat unless identified.
1 & 2	1	12	Determine survivorship and productivity related to habitat use of Florida sandhill cranes on conservation lands and suburban areas in Florida.	Monitoring & Research	NEW	YES	YES	\$25-50k	Existing budget, Grant	FWRI	Universities	Moderate.	Moderate/high- requires research with sufficient sample size/time.	Yes, unknown whether cranes are productive outside of ranch lands.
2	1	13	Develop and implement a population monitoring protocol.	Monitoring & Research	NEW	NO	YES	\$0-25k	Existing budget, Grant	FWRI	USFWS, DEP, FFS, WMDs, Universities, Audubon, other NGOs etc.	Moderate.	Moderate - requires coordination.	Yes, only way to know whether conservation objectives are met.
2	5	14	Develop a population model using the existing population viability analysis (PVA).	Monitoring & Research	EXPANDED	YES	YES	\$0-25k	Existing budget, Grant	FWRI	Universities	Low.	High - but may not be reliable.	No, not necessary for conservation.
1 & 2	1	15	Continue enforcement of illegal take rules, the prohibition against feeding Florida sandhill cranes, and wetland protection laws.	Law Enforcement	ONGOING	YES	YES	\$0-25k	Existing budget, Grant	LE	Local LE, home owners associations	Moderate to high.	Moderate - requires enforcement.	Yes, these are key to crane-human interactions & crane protection.

Table 1. Florida Sandhill Crane (*Grus canadensis pratensis*) 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?
1	3	16	Create incentives for maintaining or creating marshes embedded in suitable uplands through Landowner Assistance Programs (LAPs).	Incentives & Influencing	NEW	YES	YES	\$100k+	Existing budget, Grant	CPS	USFWS, USDA, IFAS Extension	Moderate, wetlands are a necessary component of crane habitat.	Moderate- may not result in crane conservation.	No, general water & wetland protections are more important than specific/small scale conservation strategies.
1	3	17	Work with partners to raise the value of emergent marsh over forested wetlands in mitigation programs.	Incentives & Influencing	NEW	NO	YES	\$0-25k	Existing budget, Grant	CPS	USFWS, USDA, IFAS Extension	Moderate.	Moderate-may not result in conservation.	No, impact of mitigation programs not known.
1 & 2	2	18	Create public service announcements about Florida sandhill cranes.	Education & Outreach	NEW	YES	YES	\$25-50k	Existing budget, Grant	OCR	Media, IFAS Extension	Low, may not contribute to large-scale crane conservation.	High - feasible.	No, not critical to immediate survival.
1&2	2	19	Provide information about living with cranes to audiences such as land managers, golfers and golf course managers, homeowners, hunters, zoo visitors, and students.	Education & Outreach, Coordination with Other Entities	NEW	YES	YES	\$50-100k	Existing budget, Grant	OCR, Imperiled Species	Zoos, golf courses, landowners, hunters, home owners, students	Moderate, targeting audiences will make outreach efficient.	Moderate/high - feasible but requires implementation and coordination.	No, not critical to immediate survival of species but will help individuals.
2	2	20	Test new methods of deterring nuisance cranes.	Education & Outreach, Monitoring & Research	NEW	YES	YES	\$0-25k	Existing budget, Grant	FWRI, SCP	Home owners, businesses	Moderate, may help save individual cranes and contribute to public support of conservation.	Low/moderate - nuisance animal issues continue to be challenging.	No, but nuisance cases are increasing and impact public perception of cranes.
2	2	21	Through a variety of media, engage wildlife rehabilitators and the public on appropriate responses to injured cranes.	Education & Outreach, Coordination with Other Entities	NEW	YES	YES	\$0-25k	Existing budget, Grant	OCR, Imperiled Species	Rehabilitators, media	Moderate, contributes to conservation and public knowledge.	High - can be done remotely but requires coordination.	No, not critical to immediate survival of species but will help individuals.
2	4	22	Provide information on fencing materials that are less likely to entangle cranes.	Education & Outreach, Coordination with Other Entities	NEW	YES	YES	\$0-25k	Existing budget, Grant	OCR, CPS	Media, IFAS Extension	Low, may help a few cranes.	Moderate- effectiveness unknown.	No, may help a few individuals.
1 & 2	2	23	Coordinate with local and county governments to ensure consideration of Florida sandhill crane during development and infrastructure planning.	Coordination with Other Entities	ONGOING	YES	YES	\$0-25k	Existing budget, Grant	CPS	Counties, municipalities	Low to moderate, development can be mitigated to meet crane conservation needs.	Moderate - requires coordination.	Yes, especially for projects that impact large areas.
1	2	24	Work with DEP and WMDs on wetland regulations and to set minimum flows and levels (MFLs) and groundwater levels in areas with high Florida sandhill crane densities to ensure groundwater removal does not lead to loss of shallow water wetlands (see Action 2).	Coordination with Other Entities	NEW	NO	YES	\$0-25k	Existing budget	CPS, FWRI	DEP, WMDs, USFWS, US Army Corps of Engineers	Effect of groundwater use on surface water not entirely known.	Low/moderate - requires coordination and compromise.	Yes, but climate impacts are also at play.
1 & 2	4	25	Provide timely crane-related information to land use planners by regularly updating the Florida Wildlife Conservation Guide.	Coordination with Other Entities	EXPANDED	YES	YES	\$0-25k	Existing budget	CPS, FWRI	Land use planners	Low to moderate, development can be mitigated to meet crane conservation needs.	Low/moderate - land use planning not always heeded.	No, nebulous impact.

Acronyms used in this table:

- CPS: Conservation Planning Services, a Section of the FWC's Division of Habitat and Species Conservation
- DEP: Florida Department of Environmental Protection
- FDOT: Florida Department of Transportation
- FFS: Florida Forest Service
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- GIS: Geographic information system
- IFAS: Institute of Food and Agricultural Sciences, a program administered by the University of Florida
- LAP: Landowner Assistance Program
- LE: Law enforcement
- NGO: Non-governmental organization(s)
- OCR: Office of Community Relations, administered by the Florida Fish and Wildlife Conservation Commission
- SCP: Species Conservation Planning, a Section of the FWC's Division of Habitat and Species Conservation
- TBD: To be determined
- USDA: United States Department of Agriculture
- USFWS: United States Fish and Wildlife Service
- WHM: Wildlife and Habitat Management, a Section of the FWC's Division of Habitat and Species Conservation
- WMD: Water Management District(s)

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