

National Audubon Society's Corkscrew Swamp Sanctuary: A Wetland of Distinction

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In February 2019, the Society of Wetland Scientists recognized National Audubon Society's Corkscrew Swamp Sanctuary (Naples, Florida, USA) as its newest Wetland of Distinction. The honor comes to a site that is an increasingly-rare remnant of Old Florida, one whose rich biodiversity and dynamic sub-tropical wetland ecology are preserved as a result of a conservation effort that has spanned over a century. Today, Corkscrew's old-growth bald cypress (Figure 1), hardwood hammock (Figure 2), marsh (Figure 3), wet prairie (Figure 4), and pine flatwoods (Figure 5), are increasingly at risk from factors outside the sanctuary's boundary, such as a lowered water table, regional wildfire suppression practices, and invasive species. Despite these challenges, Corkscrew remains an ideal site for experiencing and studying the ecology of a mature cypress swamp.

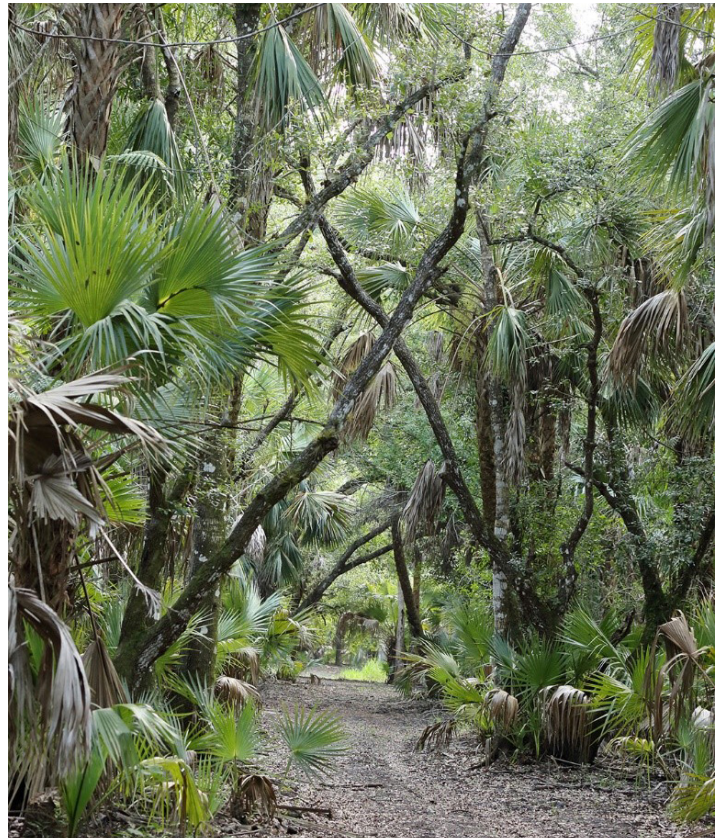
The large wading bird rookery within the Corkscrew Swamp was among those targeted by the plume hunters devastating Everglades' wading bird colonies in the early 1900s. National Audubon Society warden Rhett Green lived within what is now Corkscrew Swamp Sanctuary, deputized and armed to protect the >5,000 pairs of wood storks and other wading birds nesting during the spring and summer months (Phelps 1914). In the 1940s and 50s, decades after the collapse of the plume trade, Corkscrew again faced an uncertain future as logging of bald cypress (*Taxodium distichum*) swept across the Big Cypress Swamp. In 1954, National Audubon Society assumed ownership and management of nearly 970 ha of contiguous old-growth cypress forest acquired by a variety of conservation organizations, the Lee Tidewater Cypress Company, and Collier Enterprises (Wilder and McCollom 2018). Corkscrew Swamp Sanctuary now stands at 5,260 ha and is home to the largest remaining stand of old-growth bald cypress in the United States (Figure 6).

When the sediments in the Central Marsh were cored in the 1970s, Corkscrew was found to have a continuous 10,600-year sedimentary record, which was the longest known record from a typical South Florida wetland. As sea levels rose at the end of the Pleistocene, gradually rais-

FIGURE 1. Corkscrew's old-growth bald cypress trees, as seen from the sanctuary's boardwalk. (Photo D. Korte)



FIGURE 2. A backcountry trail through Corkscrew's hardwood hammock. (Photo D. Korte)



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FIGURE 3. Corkscrew's marsh in the mid-1970s, prior to significant hydrologic change and invasion by Carolina willow. (Photo M. Duever)



FIGURE 4. Wood storks, roseate spoonbills, and immature white ibis in flight over Corkscrew's wet prairie. (Photo D. Korte)



FIGURE 5. Pine flatwoods with a saw palmetto understory. (Photo D. Korte)



FIGURE 6. Corkscrew's oldest bald cypress trees are ~500 years old, hypothesized to be limited by a massive wildfire that helped shape the swamp we know today. (Photo D. Korte)



FIGURE 7. Schematic profile of Corkscrew Swamp Sanctuary habitats along an elevational gradient (not to scale). Horizontal and vertical scales indicate approximate hydroperiod (days inundated per year) and average annual maximum water depth (inches), respectively. Reproduced from Wharton et al. (1977).

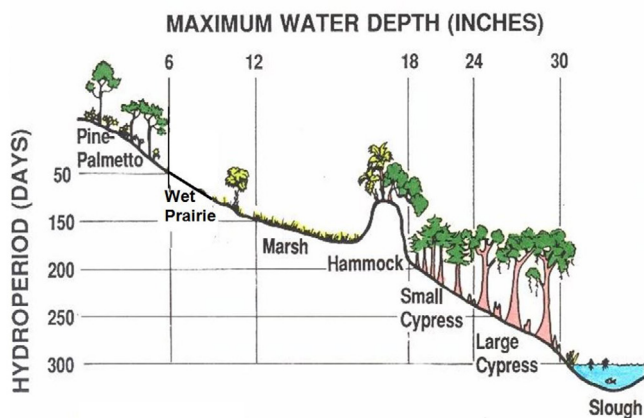


FIGURE 8. A trail camera used for mammal monitoring captures a female Florida panther on a backcountry trail with a small, freshly-caught white-tailed deer.



ing inland water tables, marl sediments began to form in a newly created wet prairie environment in the center of a large depression that was going to become Corkscrew Swamp. As sea levels continued to rise for the next 5,000 years, marl sediments slowly accumulated, until wetter conditions initiated the accumulation of organic substrates, which have since continued to accumulate by increasing in depth and spreading up the sloping edges of the large depression. The old-growth cypress forest developed on this organic substrate, with the larger and older trees growing on the deeper organic substrates towards the center of the depression. On the sandy more upland areas around the swamp, pine flatwoods dominate the drier uplands and herbaceous wet prairies are found as a transition between the pinelands and cypress forests (Figure 7).

Today, Corkscrew Swamp Sanctuary's matrix of fire-dependent upland and wetland habitats stands as a reminder of the expansive Big Cypress Swamp that covered southwestern Florida a century ago. As agriculture, industry, and residential development swept across Florida's peninsula, Corkscrew's ecology remained largely unchanged until recent decades. While Florida panther (*Puma concolor coryi*) and Florida black bear (*Ursus americanus floridanus*) are still commonly seen roaming the sanctuary's pine flatwoods and hardwood hammocks (Figure 8), and wood storks (*Mycteria americana*) still forage in the marsh (Figure 9) and nest (albeit in smaller numbers) atop the sanctuary's 500-year-old bald cypress trees, effects of regional land use changes are becoming more apparent inside the sanctuary's boundaries. A marked change in the sanctuary's hydrology (Clem and Duever 2019) is likely a primary driver for recent changes in plant and animal communities. Regional fire suppression and encroaching

FIGURE 9. Wood storks, roseate spoonbills, great egrets and white ibis foraging in a depression in a drying marsh. (Photo D. Korte)



residential development have increased the challenge for land managers using prescribed fire as a primary tool for maintaining native plant communities. In addition to other successional changes, this has allowed native Carolina willow (*Salix caroliniana*) to rapidly expand across parts of Corkscrew's marsh, prompting a multi-million dollar mechanical removal effort that is currently underway (Figure 10, 11). Like their peers across South Florida, Corkscrew's land managers are also engaged in a relentless effort to remove non-native invasive plants (e.g., *Schinus terebinthifolius*, *Scleria lacustris*, *Panicum repens*) and are on high alert for signs of non-native invasive reptiles, such as Burmese pythons (*Python bivittatus*) and Argentine black and white tegus (*Salvator merianae*), which could seriously threaten meso-mammals and other native wildlife but have yet to be found in the sanctuary (Figure 12).

As development increases across southwest Florida and the population center pushes farther inland, the vital role Corkscrew plays for wet season water storage, aquifer recharge, and surface water filtration can hardly be overstated. Central to the ~24,000 ha Corkscrew Regional Ecosystem Watershed, the sanctuary and its surrounding watershed buffer wet season flooding by allowing surface water to inundate its wetlands, often temporarily inundating uplands as well. Storing this water in the swamp allows the aquifer to recharge and reduces rapid discharge of surface water to nearby estuaries for the purpose of flood control. This short-term storage also allows a slow overland flow of freshwater to Estero Bay, allowing wetland plants to remove nutrients and helping regulate coastal salinity. Maintaining healthy wetlands in this pyrogenic landscape also serves as a buffer, reducing the occurrence of large, uncontrollable wildfires.

FIGURE 10. A limpkin searches for apple snails in a restored marsh. Corkscrew's limpkin population appears to be benefitting from the spread of non-native island apple snails. (Photo D. Korte)



Corkscrew Swamp Sanctuary provides an excellent opportunity to learn about the ecology of old-growth swamps, develop best practices for management of South Florida wetlands, and examine wetland restoration. An extensive catalog of ecological research conducted at the site in the 1970s and 1980s (e.g. Duever et al. 1978, 1976, 1975, 1974), at a time when Corkscrew Swamp was one of the least disturbed natural areas in South Florida. In addition, a 60-year continuous hydrologic record (daily surface water level and rainfall) provides ample baseline data and a firm foundation for evaluating changes associated with natural process and human influences. Nearby

FIGURE 11. Great egrets and snowy egrets flush from a restored section of Corkscrew's marsh. Native invasive Carolina willow is being mechanically removed to facilitate prescribed fire and improve wildlife habitat. (Photo D. Korte)



FIGURE 12. Meso-mammals like this raccoon remain abundant at Corkscrew in the absence of Burmese pythons, which have been found in the region but have yet to be seen in the sanctuary. (Photo D. Korte)



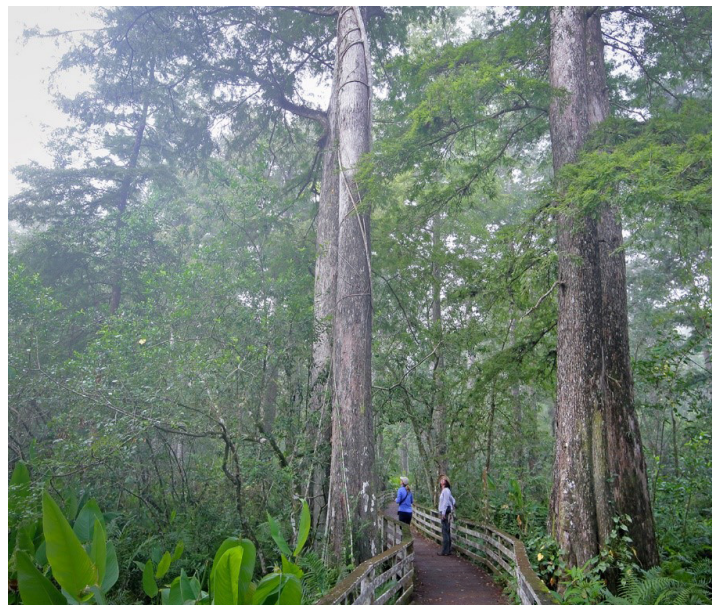
protected areas, including Big Cypress National Preserve, Fakahatchee Strand Preserve State Forest, and Florida Panther National Wildlife Refuge, provide great opportunity for comparative studies. The sanctuary's Western Everglades Research Center welcomes applications for visiting scientists interested in conducting research that enhances ecological knowledge and facilitates conservation.

Audubon's Corkscrew Swamp Sanctuary is located approximately 30 minutes east of Naples, Florida and open 365 days/year. A wheelchair-accessible 3.6-km raised boardwalk (Figure 13) and seasonally-offered swamp walks (Figure 14) make this ecological gem available for the public to explore a rich biodiversity of plants and animals. From ghost orchids (*Dendrophylax lindenii*) and painted buntings (*Passerina ciris*), to Eastern diamondback rattlesnakes (*Crotalus adamanteus*), North American river otters (*Lontra canadensis*) and over 36 species of warblers, Corkscrew truly is above and beyond. ■

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FIGURE 13. Corkscrew's raised 3.6-km boardwalk makes the old-growth cypress forest easily-accessible for the public to learn about and appreciate this ecosystem. (Photo D. Korte)



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FIGURE 14. The sanctuary seasonally offers guided swamp walks to allow visitors to experience the old-growth cypress from ground level. (Photo D. Korte)

