

# Wood Stork Conservation and Management for Landowners



## General Information

**Common Name:** Wood Stork

**Scientific Name:** *Mycteria americana*

**Relationships to other birds:** Wood Storks are members of the Family Ciconiidae (storks) and are related to ibises, herons, vultures, and pelicans.

**Nicknames:** wood ibis, flinthead, ironhead, gourdhead, and gannet.



(Harris Neck NWR)

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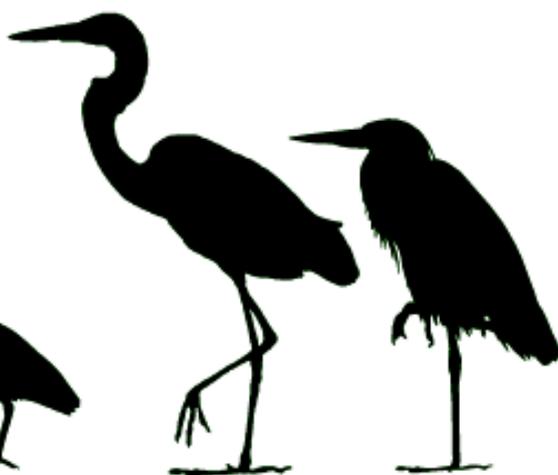
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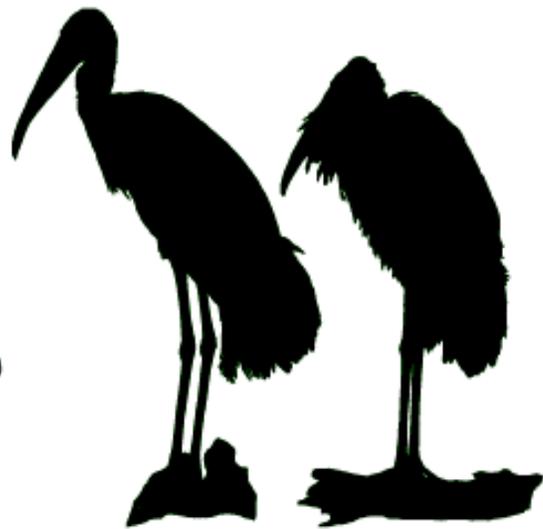
## Wading bird comparisons



*White Ibis*



*Great Egret*



*Wood Stork*

## Introduction

Wood Storks are large wading birds that usually feed in shallow fresh- and saltwater wetlands and breed in trees or shrubs over water or on islands. The appearance and behavior of Wood Storks make them a distinctive sighting in wetlands in southeastern states. The population of storks in the United States is at risk and is protected as a federally Endangered Species. The purpose of this brochure is to inform landowners and other interested groups about the habits of this unique species and present ways to possibly aid in their recovery.

### Size and Description

Wood Storks stand 33 to 45 inches tall, weigh 5 to 8 pounds, and have a wingspan of 58 to 65 inches. Adult Wood Storks are generally white, except for their tails and the ends and trailing edges of their wings, which are black. The head and neck of adults are unfeathered and the skin appears dark and scaly. Wood Storks also appear to have a bald “cap” just over their eyes. The bill of the stork is dark, thick, and curves slightly downward near the tip. Their legs and feet are dark, although their toes are lighter in color and often appear pink during the breeding season.

Three “age-classes” of Wood Storks can be distinguished, including the adults described

above. Young storks in their first year after leaving the nest have yellow bills and gray feathers on their head and neck. Sub-adult storks, between 1 and 4 years of age, have



*Juvenile Wood Storks (Harris Neck NWR).*

darker bills than the younger birds and their bald “cap” is apparent, but they still have some feathering on their necks.

Because of their unique appearance, it is difficult to confuse storks with other wading birds. White Ibis, which are all white with black wing tips, are much smaller than storks and have red bills.

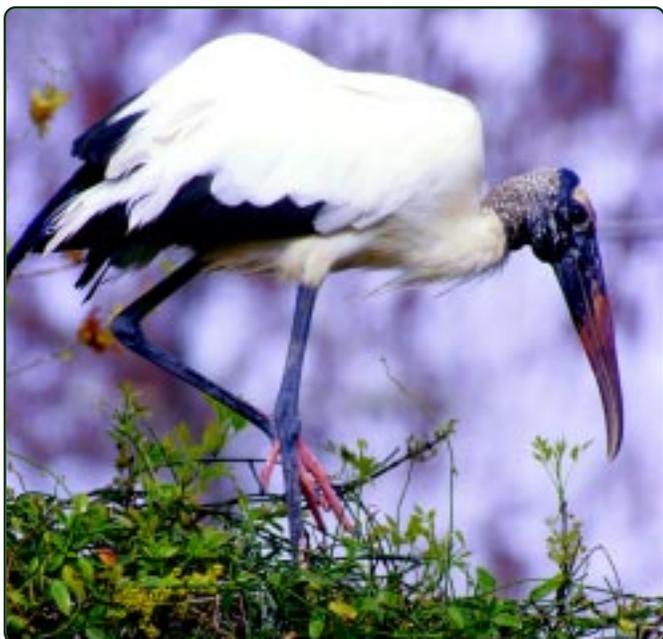
### Range

In the United States, Wood Storks currently nest in only three southeastern states: Florida, Georgia, and South Carolina. In the late summer and early autumn months, after the breeding season, storks disperse from their colonies and are also seen in North Carolina and the Gulf Coast states (Alabama through Texas). Storks marked with leg bands as nestlings in Georgia have been observed as far west as Mississippi. However, most, if not all, of the storks seen in Louisiana and Texas may be dispersing north from populations in Mexico. Wood Storks also are found in Central and South America. The population status of Wood Storks outside the United States ranges from healthy to threatened to unknown.

## Population Status

### *History in the United States*

Historically, Wood Storks may have nested in all of the southeastern coastal states from South Carolina through Texas. In the last century, prior to the 1970s, all Wood Stork nesting occurred in Florida, primarily southern Florida. As human population and agriculture grew in the late 1900s, demands on that region’s water supply increased and the natural hydrology of southern Florida changed. Numbers of nesting storks, which feed primarily on fish and therefore are closely linked to regional hydrology (see more below), dropped considerably in the 1900s. At the same time, Wood Storks began



*Adult Wood Stork (J. N. “Ding” Darling NWR).*



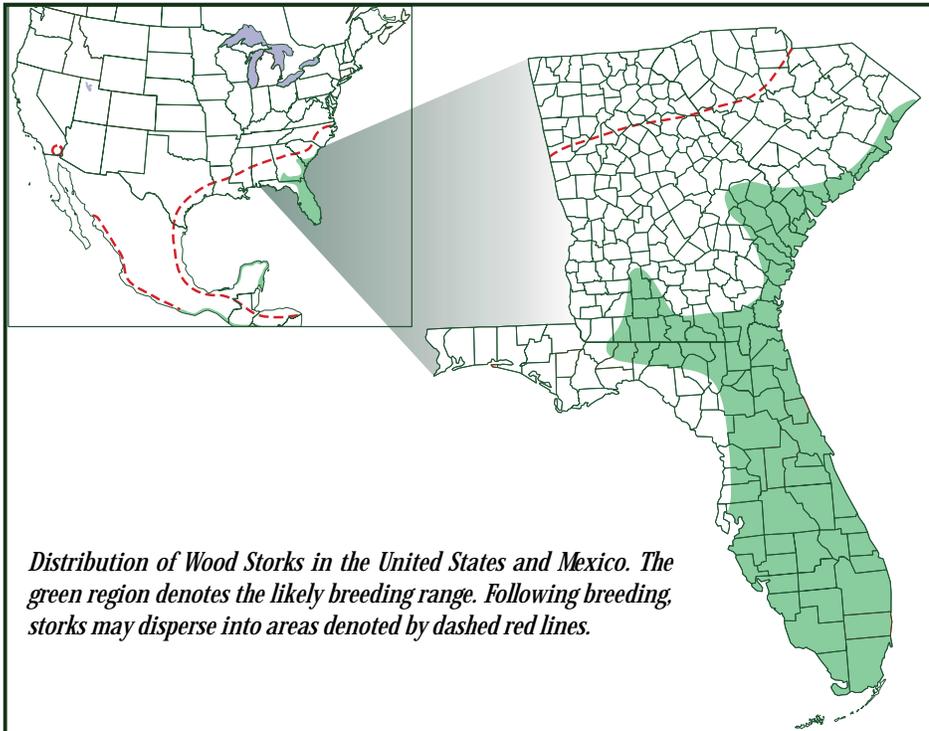
*Sub-adult Wood Stork (Everglades NP).*

## Natural History

### Breeding

**Habitat**—Wood Storks typically nest in groups termed colonies or rookeries. Other wading bird species such as egrets, herons, and ibis often nest at the same sites. Storks nest in trees or shrubs surrounded by water, as well as on islands. From 2-20 nests can be found in a single tree. Water around the nest trees provides an effective protective barrier against most terrestrial predators. In drought years when nest sites are dry, or in other situations when water is drained from under nest trees, the primary nest predator of storks—the raccoon—can literally wipe out most of the nestling birds produced in a colony. Raccoons usually do not invade colonies when wetlands have plenty of water because alligators inhabit most of the southeastern wetlands where storks nest. The presence of alligators, which are large enough to eat raccoons, usually keeps raccoons from swimming to nest trees. The alligators in colony sites get the benefit of consuming any food or unfortunate nestlings that fall from wading bird nests.

**Breeding Cycle**—Wood Storks need approximately 100-120 days for adults to proceed from courtship and nest building to the departure of their young from breeding sites. The timing of stork nesting and the production of young are generally



*Distribution of Wood Storks in the United States and Mexico. The green region denotes the likely breeding range. Following breeding, storks may disperse into areas denoted by dashed red lines.*

breeding farther north. Regular nesting by storks in Georgia was first reported in the mid-1970s and in South Carolina in 1981. By the 1990s, 40-50% of Wood Stork nesting in the United States occurred in Georgia and South Carolina. An extensive, multi-agency effort is currently underway to restore the natural (historic) hydrology of the Everglades ecosystem in south Florida and re-establish consistent stork nesting there.

### *When and why was this species listed as Endangered?*

The Wood Stork was listed as a federally “endangered species” in 1984 due to the severe drop in stork population size throughout the 1900s. The “endangered” classification means that there is a concern that this species could become extinct if the negative impacts continue. The population decline was thought to result from loss and alteration of the wetland feeding habitats storks need to survive. As an endangered species, the breeding population of Wood Storks is now protected under the Endangered Species Act of 1973, which states that it is unlawful to harass, harm, pursue, capture, or collect any such listed species anywhere within the United States. All Wood Storks breeding in Florida, Georgia, and

South Carolina and their young are protected throughout the year by this act of Congress. Habitats that these birds require for nesting, feeding, and roosting are also protected throughout the year. State laws within Alabama, Florida, Georgia, and South Carolina also protect Wood Storks. If you have any questions concerning what you should or should not do with storks and/or stork habitat on your land, please contact the appropriate agency (within your state) listed at the end of this brochure.



*Wood Storks feeding with other wading birds, including White Ibis (with red bills) and Snowy Egrets (Merritt Island NWR).*



*Wading bird rookery (Birdsville—GA DNR).*

dependent upon feeding conditions in a region. Storks nesting from central Florida to South Carolina usually start in late winter (February-March) and finish in July-August. This period includes the time of spring-summer wetland “drawdown” in this region. Fall and winter rains typically fill southeastern wetlands and result in the movement of fish into new areas. As the region warms in the spring-summer period, increased evapotranspiration (water loss from land and plant surfaces) results in dropping water levels in these wetlands, creating good foraging conditions for storks (see more below). The breeding season of Wood Storks is generally timed so that these good foraging conditions will occur when storks need to feed their rapidly growing young. Wood Storks nesting in southern portions of the range historically nest earlier than northern storks, with nesting completed before the onset of summer rains.

**Courtship**—All storks have courtship behaviors or rituals that they use to get a mate for the breeding season (they do not mate for life, as some other birds do). Male Wood Storks generally arrive at the colony sites first and establish territories (or sites)

where they hope to nest; these territories are defended from other males. Individual female storks then begin to approach males. Males typically chase the females from their nest site over a period that can last from hours to days, until the male finally accepts the female as his mate or the female decides to try elsewhere.

**Parental behavior**—Both parents build and maintain the nest, which ranges from 20-35 inches in diameter, and share in incubation duties. Storks can lay up to five eggs, but a three-egg clutch is normal. Eggs are incubated for 25-27 days prior to hatching. Hatching storks weigh about two ounces (60 grams), and are attended by at least one parent until they are approximately four weeks old. Until they reach that age, they are protected against avian predators such as vultures, crows, and grackles and are shaded from the hot sun. During very warm periods,



*Mating (Chew Mill Pond—private land).*

parent storks also collect water in their gullet and bring it to the nest to drool on and into the nestlings. At four weeks of age, the chicks’ down and feathers have developed to the stage where they can thermoregulate (adjust to external temperature changes) better and they are large enough (chicken-sized: 3.3 pounds/1,600 grams) that avian predators are no longer a major threat.

When nestlings are small, one parent protects the young while the other collects food for



*Courtship (Chew Mill Pond—private land).*

them. Nestlings grow at an incredible rate. At age 14 days, they weigh 10 times more than they did at hatching and they are 25 times heavier at 28 days of age. When the chicks are four weeks old, both parents leave the nest at the same time to forage for their young and continue to do so until the nestlings “fledge” (leave the nest) at age 60-70 days. The young may continue to return to the colony for another 10-15 days to roost or to try to get food from their parents. A colony is considered successful if its parents average at least 1.5 fledged young per nest.



*Female Wood Stork on the nest (Chew Mill Pond—private land).*



Adult Wood Storks with young in the nest (Birdsville-GA DNR).

### Foraging

**Prey**—Wood Storks primarily eat small to medium-sized fish (1-5 inches), but will also take crayfish, amphibians (usually tadpoles) and, rarely, small reptiles (snakes) and large aquatic insects. They tend to consume various species of sunfish the most, but these are the types of fish most typically found in freshwater wetlands where storks forage. In coastal settings, they primarily consume common marsh fish such as Mummichogs and Killifish, and will take some shrimp in addition to fish available in local freshwater wetlands.

**Behavior**—Wood Storks, unlike most other wading birds, feed by tactilocation (“touch”). Storks put their partially open bills in the



Unlike most other wading birds, Wood Storks feed by tactilocation (Merritt Island NWR).

water and literally push it through the wetland. When the bill bumps into a prey item, the stork snaps it up with a lightening-quick reflex. Wood Storks feed most efficiently in wetland habitats that have dense or crowded prey items, such as might occur in a drying wetland during the late summer months. Storks use two behaviors to enhance their chances of capturing prey. They pump their feet under the water (foot-stirring), since that might startle a fish into moving and make it more “catchable.” Storks also “flash” or suddenly extend a wing out away from their body to either startle a fish into movement or provide a shaded area that a fish may want to move into. Wood Storks frequently feed in large groups, because the presence of a few storks may attract others to a potentially good feeding site or because more birds moving through the water will cause the fish to be more active and more



Wood Storks typically feed on small prey.

easily captured. By using tactilocation, Wood Storks can feed in muddy waters and at night as easily as they can during the day.

Visual feeders such as herons and egrets must be able to see the prey before they spear it or grab it with their sharp bills. Although most herons and egrets are restricted to feeding during the day, these birds are able to forage on the edges of deep wetlands, a habitat that storks cannot use effectively.



Flashing behavior during feeding (J.N. “Ding” Darling NWR).

**Habitat**—Wood Storks generally forage in open, shallow wetlands, including ditches, temporary “wet weather” ponds or swamps, and tidal creeks, as well as forested wetlands. Wetlands that are ideal for storks must have areas that are shallow (less than 18-20 inches in depth) since storks must wade through them to capture prey. With their tactile method of feeding, storks prefer to feed in wetlands relatively free of aquatic plants since their presence could inhibit the storks’ ability to “touch” and capture their prey. Typical stocked fish ponds, with steep edges and water at least 1.5 feet deep, are not good feeding habitats for storks unless the ponds are being drained.

Many southeastern freshwater wetlands undergo a long-term or seasonal draw-down that drops water levels and concentrates fish in smaller and smaller volumes of water. These wetlands usually are still water or very slow-flowing systems. However, in the coastal region, Wood Storks will often feed in tidal creeks within marshes. Fish, having sought food and shelter within the grassy marshes, typically must exit via these tidal creeks when



Larger prey items, like this gar, are occasionally taken (Everglades NP).

the tide drops and drains the marsh. Storks usually feed in these creeks during the 1-2 hours surrounding low tides, when water levels are lowest and the density of fish is the highest.

### *Roosting*

Wood Storks, like many species of birds, will roost or rest together in flocks (usually in trees) when they are not involved in an activity such as feeding or nesting. Potential reasons for this behavior include ease of locating feeding sites, increased vigilance and defense against predators, and thermoregulation. Storks may roost in flocks so that less successful foragers can follow more successful foragers to feeding sites, rather than try to find a site on their own. This would obviously benefit younger, less experienced storks. Free-ranging storks (those having the ability to fly) have few predators and typically reside in warm climates that should not require group thermoregulation.

Storks often roost in habitats similar to those where they nest, such as in trees surrounded by water or on islands. However, it is also common to find flocks of storks “resting” on mud flats and on the ground near feeding sites. These sites are probably “day roosts” where the storks are waiting for changing water levels (for example low tide) or increased activity of prey (many species of fish are more active and therefore more “catchable” at different times of the day) before they start to feed.



*Adult and juvenile Wood Storks roosting in a tree (Chew Mill Pond–private land).*



*A Wood Stork “day roost” on the edge of a feeding pond (Silver Bluff Sanctuary–Audubon Society).*

### *Flight*

Wood Storks typically fly more like soaring hawks and vultures than like other wading birds that flap their wings constantly. Although storks can and do use standard flapping flight for short trips, they prefer to soar in convective currents or thermals, circling in these rising pockets of warm air to reach altitudes of one to three thousand feet before gliding to their destination or the next thermal. By soaring, storks expend little energy while traveling as far as 30-40 miles to reach a feeding site.

### *Seasonal Movements*

Movement patterns of storks are linked to abundance and availability of food. As mentioned previously, storks breed during a time of year when foraging conditions are most likely to provide adequate food for their rapidly growing young. After the breeding season is over, both adults and juveniles continue the search for good feeding areas. If the local area around the colony contains feeding habitat, Wood Storks will probably stay in the area. Typically, nearby feeding habitats have been fished out by the end of the season or are no longer suitable (too low or dry) for the birds, so they must disperse from their colony sites in

search of better habitats. Storks from Florida often travel north and feed in freshwater wetlands and coastal salt marshes of Georgia and South Carolina. Storks from northern inland colonies in Georgia and South Carolina also tend to move to coastal sites, before slowly moving to the south (Florida) for the coldest periods of the winter. Low numbers of storks successfully stay the “winter” on the Georgia and South Carolina coast, but some, typically juveniles, get caught during colder periods and die of exposure.



## **Conservation**

### *Stork–Human Interactions*

Wood Storks are influenced by human activities at many levels. On a regional scale, the spread of the stork population from southern Florida into Georgia and South Carolina is likely due to human impacts on



*As wetlands draw down, they become attractive feeding sites for Wood Storks (Merritt Island NWR).*

the Everglades ecosystem. The endangered status of this species results primarily from human impacts on the south Florida ecosystem as well as the effects of wetland loss and alteration on the regional landscape where storks try to live. On the local level, landowners and managers can impact stork nesting, feeding, and roosting sites in both positive and negative ways.

*Nesting sites* are particularly vulnerable to change, especially when the storks are actively nesting. Leaving the birds, and the wetlands they inhabit, alone is usually the best policy. As mentioned, maintenance of water levels under the nest trees is vital to keeping predators such as raccoons away from nests. Removal of water and trees from the nest site should be avoided. Nesting sites are protected under the Endangered Species Act, ***even during the times of year when storks are not nesting there.*** There are specific zones in which certain activities are limited (see the USFWS Habitat Management Guidelines for Wood Storks). If you are considering land management in or around a nesting site, please contact the state or federal agency you have dealt with previously to find out what you can and cannot do, and to examine alternatives. If you are interested in managing to enhance Wood Stork populations, see the section on “Management” below.



*Wood Storks living in urban areas have grown accustomed to the presence of humans.*

Wood Storks are susceptible to disturbances throughout the breeding cycle. Therefore, disturbances (loud noises, people in boats, etc.) in the nesting colony, especially at night, should be avoided whenever possible. Disturbing nesting birds can be catastrophic because parent storks will likely be flushed from eggs or young they might be attending, and eggs and young can be knocked out of the nest. Unattended eggs and young become easy prey for other birds such as grackles, crows, and vultures. The most vulnerable stages for storks are during courtship, egg incubation, and when the young are learning to fly.



*Human activity can disturb wading birds on feeding grounds (Merritt Island NWR).*

*Wetland foraging sites* are also important habitats that need to be conserved. Ditching or draining a foraging site has an obvious negative impact by eliminating the aquatic life used as food by storks. Flooding of habitats can also be detrimental by making the site too deep for stork foraging. Disturbing or harassing storks while they feed should be limited. Although storks may acclimate over time to the presence of humans, particularly those in vehicles, and may not flush from a site as motorists drive past, it is best to refrain from attempting to observe them too closely as they forage. It is also best not to try to “tame” wild birds such as storks by leaving fish or fish parts near wetlands.

### ***Contaminants***

Wildlife can be negatively affected by various chemicals used in industrial production and agricultural processes. These substances make their way into wetlands and can “magnify” in concentration as they move up the food chain (for example, contaminated algae may be eaten by an aquatic insect that is then eaten by a crayfish that is then eaten by a fish, resulting in fish with high levels of contaminants that may be fed on by storks). The best policy is to try to limit any chemical spraying or releases near wetlands. Mercury is an example of a pollutant that is entering wetlands through a form of air pollution. Mercury is now found at varying levels in most wetlands in the southeastern United States and studies indicate that Wood Storks throughout their range have it in their tissues. It is not known at this time whether the observed levels of mercury, which has no biological function in stork physiology, are affecting their ability to survive.

### ***Research***

Several avenues of research have greatly enhanced our knowledge about Wood Storks. Long-term studies of breeding biology, foraging ecology, and seasonal movements have been conducted on several stork populations. Attaching color-coded leg bands to nestling storks identifies known-aged birds from known locations.

## Managing for Storks

Landowners and managers interested in managing wetlands to benefit Wood Storks can receive technical, and occasionally financial, assistance (see programs below) through various federal and state natural resource agencies. If you are interested, you are strongly advised to seek this technical assistance before attempting any techniques to manage for storks.

### Nesting Habitat

One of the most important management strategies for nesting habitat is making sure that water is maintained under the nesting trees throughout the breeding season to limit predation by raccoons and other mammalian predators. The ability to maintain water levels will obviously depend on the nature of the site (natural or man-made) and the presence of some type of water control device (for example, "riser boards"). The type of wetland, its natural water cycle, and the tree species present will influence site management decisions. Many types of trees cannot tolerate being flooded year-round and will die if the wetland is kept flooded year after year. Periodic drawdown of nesting sites for short periods when the birds are not nesting can benefit the nesting trees and shrubs.

Reduction of thick under- and mid-story plants can eliminate over-water pathways for mammalian predators. However, this should not be done if other wading birds are using these trees and shrubs as nesting habitat. The removal of thick mats of aquatic vegetation can also limit the ability of predators to reach nest trees. Removal of herbaceous plants, shrubs, and trees can be accomplished by various mechanical and chemical (herbicide) methods. At sites where herbaceous aquatic plants are a problem, stocking sterile grass carp may be an effective biological method of reducing the density of herbaceous plants. There are several "Partners for Fish and Wildlife" projects (see below) directed at removal of woody and herbaceous vegetation in colony sites.

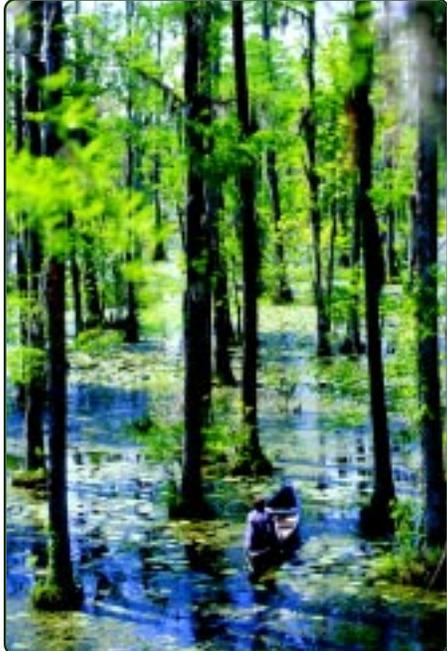


Wood Storks can be affected by contaminants that "biomagnify" through food chains.

Subsequent sightings of these "tagged" birds over the years provide information on stork movements and longevity. During the banding process, researchers also collect blood samples, which will be analyzed for contaminants, parasites, and genetic attributes. Genetic studies conducted to date suggest that Wood Storks in the Southeast are part of a single large population, despite being dispersed geographically into smaller breeding colonies. In other words, storks in south Florida are closely related to storks in Georgia and South Carolina.



An SREL researcher banding a Wood Stork nestling (Harris Neck NWR).



Successful Wood Stork breeding sites are isolated from potential mammalian predators.

In cases where the trees and shrubs used by storks for nesting sites are dying or are otherwise no longer available, or if you want to provide nesting habitat where it is currently lacking, artificial nest structures can be constructed. Biologists with the U.S. Fish and Wildlife Service designed structures made of wood, re-bar, and fencing that storks have been using for nesting since 1992 at the Harris Neck National Wildlife Refuge. Plans for the construction of artificial nest platforms are available from the Fish and Wildlife Service, Savannah Coastal Refuges office (see back cover).



Banded stork nestling being returned to the nest (Harris Neck NWR).



*Artificial nest platforms have been constructed to encourage Wood Stork nesting in suitable wetland areas on the Georgia coast (Harris Neck NWR).*

### ***Foraging Habitat***

Managing wetlands, ponds, or impoundments as Wood Stork foraging habitat can be as simple as letting water levels be controlled by southeastern climatic conditions. The Southeast typically experiences a summer “draw-down” due to increased heat, evaporation, and plant growth. If a wetland or pond has a water control structure of some type, the adage “if you drain it, they will come” often works for



*Wood Storks on artificial nest platforms (Harris Neck NWR).*

storks, provided it is the time of the year when Wood Storks are in the area and the wetland has appropriate food for storks. Lowering the water level in a pond mimics a natural draw-down that concentrates prey into smaller volumes of water. Owners of several waterfowl impoundments in coastal South Carolina work with the South Carolina Department of Natural Resources to partially drain their impoundments to provide foraging habitat for wading birds.

Creation of new stork foraging habitat is obviously a more involved process, but it can be highly successful. The U.S. Department of Energy cooperated with the National Audubon Society Silver Bluff Sanctuary to create the Kathwood foraging ponds near Jackson, SC. These stocked ponds, which total 25 acres, have been used by Wood Storks every year since 1986, with as many as 300 storks being seen on a single day. Kathwood receives its water from a creek and features a gravity flow system that requires no pumping. The Harris Neck National Wildlife Refuge on the Georgia coast also has stocked foraging impoundments that are used regularly by Wood Storks. Water must be pumped into the Harris Neck ponds to maintain levels prior to draining. Both impoundment systems use “riser boards” to control water levels.



*Lowering the water level...*

*“Riser boards” are used to control the water level in a Wood Stork foraging pond (left and above; Harris Neck NWR). A Wood Stork foraging pond created near Jacksonboro, SC (below).*



Near Jacksonboro, SC, a 10-acre supplemental foraging pond was established in 1995 one-half mile from a stork colony through the U.S. Fish and Wildlife Service “Partners for Fish and Wildlife” Program. This site, which receives water through rainfall and occasional pumping, has been used regularly by storks since its creation.



*Wood Storks foraging near the South Carolina coast.*

## Programs to Assist Landowners

Several programs have been established to assist landowners and land managers who have endangered species such as Wood Storks nesting, roosting, or feeding on their property, or who are willing to manage, create, and/or restore wetlands for use by endangered species. These programs include land swaps to trade acreages of land, tax incentives or relief, annual “rental” of properties, cost-sharing (varying percentages) to maintain and/or enhance natural or degraded habitats, and cost-sharing to create or improve conditions for endangered species such as the Wood Stork. These programs tend to be site-specific, so you should contact the appropriate agency to get detailed information about whether your lands qualify for the particular programs (see contact information on back cover).

### *U.S. Department of Agriculture* Farm Service Agency or Natural Resources Conservation Service

- Conservation Reserve Program—for restoring wetlands previously farmed.
- Environmental Quality Incentive Program—wetland restoration or improving wetland quality.
- Wetland Reserve Program—restores and preserves wetlands that have been degraded by agricultural practices.
- Wildlife Habitat Incentives Program—creates, enhances, and restores habitats for upland and wetland wildlife species.

### *U.S. Department of the Interior* Fish and Wildlife Service

- Partners for Fish and Wildlife—provides financial and technical assistance to restore and enhance wildlife habitat, especially for threatened and endangered species.

### *Other Groups*

State agencies and/or private conservation groups such as  
The Nature Conservancy

- Conservation Easements—protect property and consist of restrictions, similar to deed restrictions, that landowners voluntarily place on their property to legally bind the actions of present and future property owners.
- Easements with a Wetland Mitigation Bank—protect or restore wetlands, but may limit development.
- General Property Exchanges—some groups/agencies will exchange land that can be farmed or be logged, etc. for your land that contains stork habitats.



(Chew Mill Pond—private land)

## Acknowledgments

We thank the administrators of the following National Parks and Wildlife Refuges for assisting us with photography on their facilities:

- Everglades National Park
- Harris Neck National Wildlife Refuge (special thanks to John Robinette)
- Merritt Island National Wildlife Refuge
- J. N. “Ding” Darling National Wildlife Refuge (special thanks to Jeffries D. Bolden)

This brochure was produced by The University of Georgia Savannah River Ecology Laboratory, in cooperation with the U.S. Fish and Wildlife Service. Funding was provided by the U.S. Fish and Wildlife Service (Cooperative Agreement No. 1448-40181-00-G-090 to The University of Georgia) and the SREL Environmental Outreach Program.

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**Layout and design:** Laura L. Janecek

**Printing:** Southeastern Color Lithographers, Inc.

Printed on recycled paper

August 2001



The University of Georgia

Savannah River Ecology Laboratory

#### FEDERAL

- U.S. Department of Agriculture–Natural Resource Conservation Service  
Athens, GA 706-546-2039  
Columbia, SC 803-253-3948  
Gainesville, FL 352-338-9543
- U.S. Fish and Wildlife Service  
Charleston, SC 843-727-4707  
Savannah Coastal Refuges, Savannah, GA 912-652-4415  
Brunswick, GA 912-265-9336  
Jacksonville, FL 904-731-3332  
Panama City, FL 850-769-0552

#### STATE

- Florida Fish and Wildlife Conservation Commission–Gainesville 352-955-2230
- Georgia Department of Natural Resources–Brunswick 912-262-3143
- South Carolina Department of Natural Resources–Green Pond 843-844-2473
- South Florida Water Management District 561-686-8800
- Savannah River Ecology Laboratory, Aiken, SC 803-952-7451

#### PRIVATE

- Audubon's Silver Bluff Center & Sanctuary (Kathwood) 803-827-0781
- The Nature Conservancy  
Florida Chapter 407-682-3664  
Georgia Chapter 404-873-6946  
South Carolina Chapter 803-254-9049



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*This brochure was a joint production of the U.S. Fish and Wildlife Service and  
The University of Georgia Savannah River Ecology Laboratory.*

