
Flowing Water Swamps

FNAI Global Rank:	G3/G4
Federally Listed Plants:	S2/S4
Federally Listed Species in S. FL:	5
State Listed Species in S. FL:	79

Flowing water swamp. *Original photograph by Deborah Jansen.*



Flowing water swamps are seasonally inundated forested wetlands located along or within drainage channels. They include the floodplain wetlands along clearly defined rivers, as well as the strands and sloughs that characterize shallower and more diffuse flowways. Because these systems are typically deep swamps subject to long-term flooding, few have been successfully converted to other land uses. However, most have been degraded to some extent by logging, drainage, impoundment, melaleuca invasion, and/or pollution from agricultural or urban runoff. Appropriate timber management, hydrological restoration, and exotic species control are the greatest management concerns. In comparison to most South Florida ecological communities, a substantial percentage of flowing water swamp has already been placed under conservation management. Preservation and restoration of headwater systems, flatwoods and prairie buffers are more critical to the long-term preservation of flowing water swamps than acquisition of additional floodplain and strand swamps.

Synonymy

Flowing water swamps include: FNAI's floodplain swamp, freshwater tidal swamp, slough, and strand swamp, NRCS's cypress swamp, and cypress hardwoods, and the Society of American Foresters' (SAF) bald cypress, bald cypress-tupelo, water-tupelo, swamp-tupelo, southern red cedar, cabbage palmetto, sweetbay-swamp, and tupelo-redbay. Synonymies for each of these communities are provided in the synonymy tables at the end of the account. Note that some of these definitions include northern types that do not occur in South Florida.

Distribution

In the northern part of South Florida, flows are funneled into rivers lined with floodplain swamps. Further south,

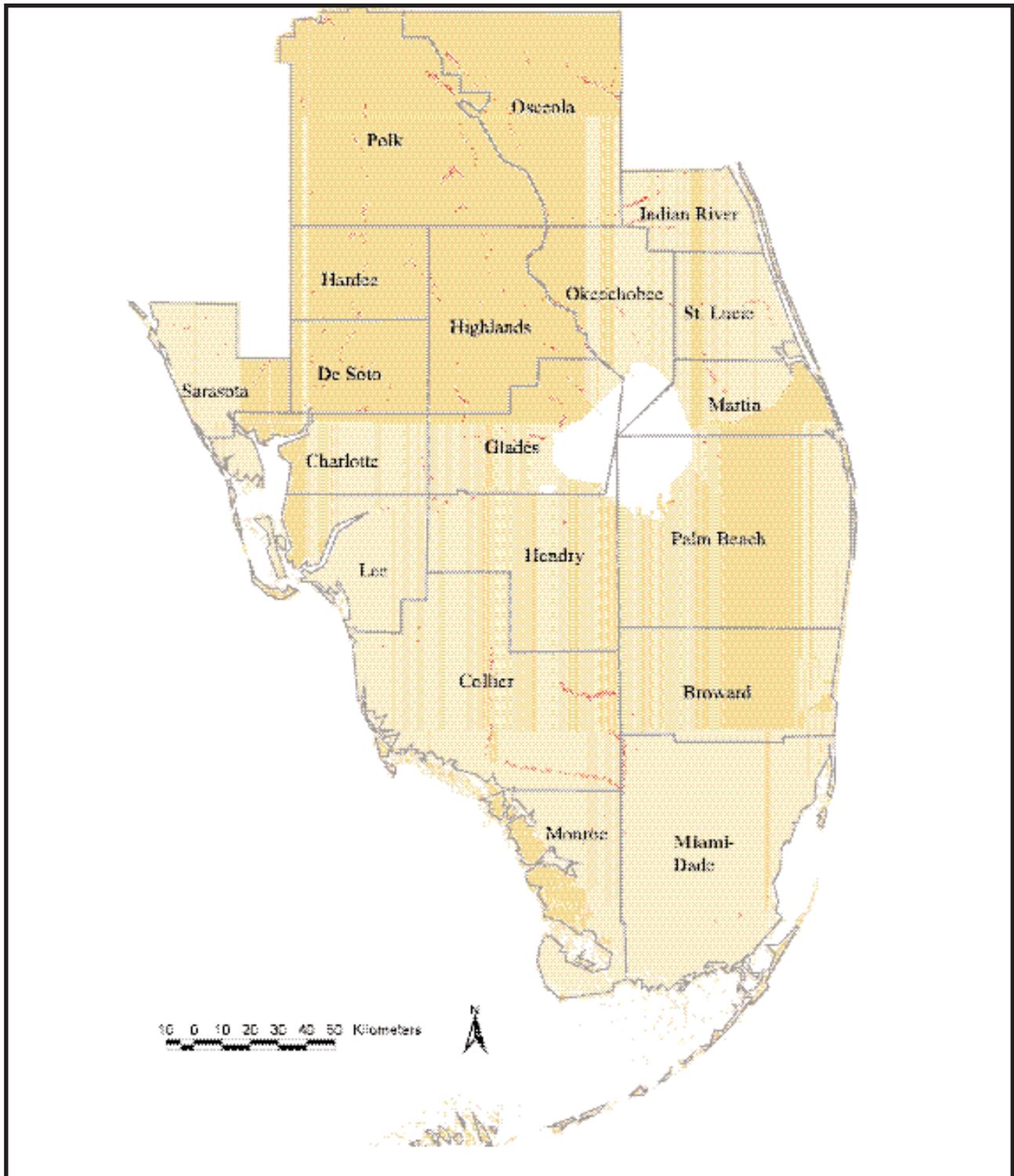


Figure 1. The occurrence of forested flowing water wetlands in South Florida (adapted from USGS-BRD 1996)

where the landscape has less relief, water moves across the landscape slowly through diffuse shallow channels. Strand swamps grow within these flowways (Figure 1).

Description

Topography and Geology

Floodplain swamps and associated riverine systems occur along streams that have eroded channels through the landscape. Strand swamps are generally situated in troughs in a flat limestone plain.

Soils

Strand swamps have sandy soils along their shallower fringes and increasingly deep peat soils towards their deeper central channels. The best developed forests are on deep peat that acts as a wick to draw moisture from groundwater up into the root zone during droughts.

Vegetative Structure

Strand swamps have small young “pond cypress” trees towards their outer edges, grading into larger and older “bald cypress” towards the interior, giving a strand a distinctly rounded cross-sectional profile. (Because pond cypress *Taxodium ascendens* and bald cypress *Taxodium distichum* can be recognized as clearly different in these field situations, the two names are used here. Although some authorities persist in considering these different species, most ecologists now regard them as morphological variations reflective of different growing conditions.) In the central part of the strand, there may be open ponds or deeper sloughs dominated by pop ash (*Fraxinus caroliniana*) and pond apple (*Annona glabra*).

Floodplain swamps have less distinctive gradation in tree sizes, but exhibit considerable variation in response to differences in substrate features.

Vegetative Composition

Typical strand swamp vegetation includes cypress, red maple (*Acer rubrum*), cabbage palm (*Sabal palmetto*), strangler fig (*Ficus aurea*), swamp bay (*Persea palustris*), sweetbay (*Magnolia virginiana*), royal palm (*Roystonea regia*), coastal plain willow (*Salix caroliniana*), wax myrtle (*Myrica cerifera*), myrsine (*Rapanea punctata*), buttonbush (*Cephalanthus occidentalis*), poison ivy (*Toxicodendron usneoides*), swamp lily (*Crinum* spp.), leather fern (*Acrostichum* spp.), and royal fern (*Osmunda regalis*). The canopy plants are mainly temperate, while the understory and epiphytic plants are generally tropical. The deeper sloughs are characterized by a subcanopy of pop ash and/or pond apple abundantly festooned with tropical epiphytes.

Wildlife Diversity

Typical strand swamp animals include white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), little blue heron (*Florida caerulea*), great egret (*Casmerodius albus*), blue-grey gnatcatcher (*Poliophtila caerulea*), ribbon snake (*Thamnophis sauritus sackerii*), cottonmouth (*Agkistrodon piscivorus*), opossum (*Didelphis virginianus*), wood rat (*Neotoma floridana*), bobcat (*Felis lynx*), mink (*Mustela vison evergladensis*), marsh rabbit (*Sylvilagus palustris*), red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quiscula*), boat-tailed grackle (*Quiscalus major*), limpkin (*Aramus guarauna*), red-shouldered hawk (*Buteo lineatus*), barred owl (*Strix varia*), American alligator (*Alligator mississippiensis*), Florida banded water snake (*Nerodia fasciata pictiventris*), soft shelled turtle (*Apalone ferox*), southern leopard frog (*Rana sphenoccephala*), green treefrog (*Hyla cinerea*), barking treefrog (*Hyla gratiosa*), squirrel tree frog (*Hyla squirella*), southern dusky salamander (*Desmognathus auriculatus*), lesser siren (*Siren intermedia*), two-toed amphiuma (*Amphiuma m. means*), mosquito fish (*Gambusia spp.*), yellow bullhead (*Ameiurus natalis*), swamp darter (*Etheostoma barratti*), sailfin molly (*Mollienesia latipinna*), flagfish (*Jordanella floridae*), least killifish (*Heterandria formosa*), bowfin (*Amia calva*), warmouth (*Chaenobryttus coronarius*), Florida gar (*Lepisosteus spp.*), and bluespotted sunfish (*Enneacanthus gloriosus*).

Wildlife Species of Concern

Federally listed species that depend upon or utilize the flowing water swamp community in South Florida include: Florida panther (*Puma (=Felis) concolor coryi*), bald eagle (*Haliaeetus leucocephalus*), wood stork (*Mycteria americana*), Kirtland's warbler (*Dendroica kirtlandii*), and eastern indigo snake (*Drymarchon corais couperi*). Tanner (1942) reported that the ivory-billed woodpecker (*Campephilus principalis*) occurred adjacent to swamps dominated by bald cypress and hardwoods. Biological accounts and recovery tasks for these species are included in "The Species" section of this recovery plan.

Florida panthers utilize the strand swamp systems of southwest Florida. Any efforts to control impacts of feral hogs on such swamps should be balanced with concern for the role these exotic animals have in maintaining the panther food base in these marginal habitats.

The **American swallow-tail kite** (*Elanoides forficatus*) prefers tall pines and cypress trees for nesting and requires a diverse mosaic of swamp and floodplain forest, vegetated margins of rivers and lakes, hardwood hammocks, bayheads, prairies, sloughs, and mangroves for foraging (Meyer and Collopy 1990).

Large flat-topped cypress in the interior of Corkscrew Swamp and other major strand swamps are critical nesting habitat for the **wood stork** (*Mycteria americana*). These birds breed successfully only when water levels are dropping during drought periods, but they will abandon their rookeries if the ground

Osprey. Original photograph by Barry Mansell.



beneath the nests goes dry. Therefore maintenance of long hydroperiods in the deep sloughs within old-growth cypress swamps is essential to this species.

The **osprey** is one of four subspecies distributed throughout the world, with *Pandion haliaetus carolinensis* being the North American variant. In Florida, the osprey is afforded the status of a state species of special concern for Monroe County only. The osprey occurs throughout Florida wherever there are sufficient bodies of open water for fishing. Nests are constructed on the tops of cypress, mangrove, pine trees, utility poles, radio towers, channel markers (Schreiber and Schreiber 1977) and even in shrubs or on the ground as in the Florida Bay area (Ogden 1977). In eastern North America, the osprey is considered stable except for the declining Florida Bay population in Everglades NP (Kushlan and Bass 1983, Poole 1989). Ospreys are considered somewhat tolerant to human activity which makes them particularly vulnerable to entanglement in fishing monofilament, striking power lines, shooting, waterfront development, and human-induced changes in food availability. This species is highly susceptible to environmental contaminants, although there is no known threat from heavy metals, PCBs, and pesticide contamination.

Bald eagles frequently nest in old flat-topped cypress, so maintaining old-growth trees in strands near open water is important to this species. In addition to being federally listed, the bald eagle is State threatened.

Plant Species of Concern

Many **tropical epiphytes** are dependent upon the warm moist microclimate of strand interiors for survival of winter freezes. They typically grow on the rough bark of pond apple and pop ash trees in the central sloughs, where they are also sheltered from the wind and securely anchored to resist destruction during hurricanes. Most of these are State listed tropical orchids and bromeliads that reach the northern limits of their ranges in these situations. A few are globally

rare species. Tropical epiphytes listed by FNAI for strand swamps include: birds nest spleenwort (*Asplenium serratum*), tailed strap fern, (*Campyloneuron costatum*), many flowered catopsis (*Catopsis floribunda*), nodding catopsis (*Catopsis nutans*), cowhorn orchid (*Cyrtopodium punctatum*), clamshell orchid (*Encyclia pygmaea*), Acuna's epidendrum (*Epidendrum blancheanum*), night-scented orchid (*Epidendrum nocturnum*), pendant epidendrum (*Epidendrum strobiliferum*), Fuch's bromeliad (*Guzmania monostachia*), hanging clubmoss (*Huperzia dichotoma*), delicate ionopsis (*Ionopsis utricularioides*), blunt leaved peperomia (*Peperomia obtusifolia*), frost-flower orchid (*Pleurothallus gelida*), ghost orchid (*Polyrrhiza lindenii*), fuzzywuzzy air plant (*Tillandsia pruiosa*), entire winged bristle fern (*Trichomanes holopterum*), and brown-flowered vanilla (*Vanilla phaeantha*). All of these species are listed as endangered by the State, and all are found in Fakahatchee Strand in Collier County.

Ecology

Hydrology

The normal strand swamp hydroperiod is 200 to 300 days with a maximum water depth of 46 to 76 cm (18 to 30 inches). Water is deepest and remains longest near the center where the trees are biggest.

Longer hydroperiods slow growth rates, since cypress do not grow when inundated. Extended hydroperiods may also prevent cypress reproduction by inhibiting seed germination or drowning seedlings. The latter is especially true when inundation occurs during the growing season (Brandt and Ewel 1989). Submergence during the dormant period of flood tolerant species may be less detrimental. Likewise, brief periods of inundation under clear, cool water is less detrimental than under warm, turbid water (Putnam *et al.* 1960 cited in Brandt and Ewel 1989).

During periods of prolonged drought, cypress may be outcompeted by shrubs and hardwoods. In southwest Florida, where the water table is receding, hardwoods are replacing cypress (Craighead 1971 cited in Brandt and Ewel 1989).

Cypress grows much better in flowing water than in standing water, probably due to increased aeration and nutrient availability. In a flowing water swamp, cypress may grow to twice the height and produce two to five times the biomass (dry weight) as in a similar pond swamp (Dickson and Broyer 1972 cited in Wharton *et al.* 1976).

Sea-level rise can be expected to have noticeable effects on the freshwater tidal swamps near the mouths of rivers before evidence is obvious in most other systems. Existing tidal swamps will change into mangrove forests and tidal effects will influence floodplain swamps previously beyond their reach.

Fire

Fire occurs in strand swamps on a cycle of perhaps 30 to 200 years, with the largest trees on the deepest peat towards the center of the strand burning least frequently. Fire is essential for maintenance of this community; without fire, hardwood invasion and peat accumulation would convert a strand to a hydric hammock in a few hundred years. Periodic fire is further necessary to reduce

understory vegetation and allow for cypress regeneration. Frequent fire, however, can destroy seed sources and young trees and retard the growth of mature trees. While cypress is very tolerant of light surface fires, intense fire may kill the above-ground portion of the tree. Cypress is capable of resprouting from the stump, but muck fires burning deep into the peat can kill the trees entirely, lower the ground surface, and ultimately transform a strand into a slough. In many strands, past fires have eaten away areas of the peat deposits and created deeper pond apple and pop ash sloughs.

Soil Disturbance and Succession

Increased soil bulk density resulting from compaction impedes root penetration, reduces aeration, and restricts the movement of air and water (Hanna 1981 cited in Brandt and Ewel 1989). Cypress seeds may not germinate as well in compacted soils where drainage has been compromised (Brandt and Ewel 1989).

Status and Trends

Although a number of researchers have estimated wetland loss rates in Florida, little of this data is refined enough to permit meaningful estimation of the extent to which flowing water swamps have been lost. Between 1940 and 1980, Florida's total forested area declined by 27 percent (Knight and McClure 1982 cited in Noss *et al.* 1995). Since 1970, forested wetland communities throughout Florida have been reduced by 17 percent (Noss *et al.* 1995).

Land cover changes in Florida since European colonization have been estimated based upon mapping of historic vegetation types (Davis 1967, Cox *et al.* 1997). Of Florida's original swamps, 67 percent of the cypress and 63 percent of the hardwoods still exist (Cox *et al.* 1997). Of these remaining forested wetlands statewide, 33 percent of the cypress and 25 percent of the hardwoods have been protected through public ownership to be managed as natural areas (Cox *et al.* 1997).

Using 1985 to 1989 Landsat satellite imagery for Florida, another mapping analysis estimated that managed areas protect 58 percent of the remaining shrub swamps, 34 percent of the cypress swamps, and 25 percent of the hardwood swamps (Kautz *et al.* 1993 cited in Cox *et al.* 1997).

Comparative analysis of 1986 and 1991 Landsat imagery showed that St. Lucie County lost 3.4 percent of its floodplain forest and 1 percent of its floodplain swamp, strand swamp, and slough during this 5-year period (Duever *et al.* 1992).

Habitat fragmentation and associated hydrological impacts are the major causes of degradation of flowing water swamps. Changes in the landscape matrix have had and continue to have major impacts on flowing water swamps. Conversion of adjacent pinelands and prairies to pastures, farm fields, citrus groves, and residential developments has restricted the normal movement of fires, sheetflow, and wildlife essential to ecological processes within these communities.

Improperly designed roads have impounded upstream strand swamps and converted them to less productive basin swamps with vegetation stressed and degraded by excessively long hydroperiods. There is concern that the logging

trams in the Fakahatchee Strand have impeded water flows such that regeneration of the cutover cypress forest there is not proceeding as it should.

Borrow pits, surface mines, and wellfield drawdowns can lower water tables and impact hydrology in strands, sloughs, and headwater swamps.

Development of much of the surrounding landscape has increased the amount of runoff that must be absorbed by the remaining wetlands. Intentional drainage of irrigated agricultural lands into wetland systems is compounding the problem in many areas. In such places as Flatford Swamp, which drains from Manatee County into the Myakka River system in Sarasota County, cypress trees up to 60 to 70 years old have died from the stress of the artificially lengthened hydroperiod. Similar problems have been reported in the Sebastian area, primarily to the north in Brevard County, but within wetland systems that extend into Indian River County, and in St. Lucie County.

In the United States, agricultural practices account for greater than 87 percent of recent wetland losses (Nelson 1989 cited in Noss *et al.* 1995).

Agricultural runoff also poses a contamination threat. Not only does it commonly contain pesticides, but it is typically enriched with fertilizer residues. These fertilizers contain nutrients that promote eutrophication. Since fertilizer composition is unregulated and many fertilizer components originate as industrial byproducts, such runoff can also be a source of toxic waste contamination.

Cypress strands have been used to purify secondarily treated wastewater (Brandt and Ewel 1989). This introduces excess organic matter, nutrients, and minerals to the wetland system. "Major changes observed in swamps receiving treated effluent are the development and persistence of a continuous cover of duckweed (*Lemna* spp., *Spirodela* spp., and *Azolla carolinensis*) (Ewel and Odum 1984), development of anoxia in the water (Dierberg and Brezonik, 1984), and an increase in passerine bird populations together with elimination of amphibian reproduction (Harris and Vickers 1984)" (Brandt and Ewel 1989).

Exotic species invasion is an increasing problem in flowing water swamps. Exotic plants reported from this community include: melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), Japanese climbing fern (*Lygodium japonicum*), skunk vine (*Paederia foetida*), and aquatic soda apple (*Solanum tampicense*).

Exotic animals include: feral hog (*Sus scrofa*), house cat (*Felis silvestris*), Cuban tree frog (*Osteopilus septentrionalis*), and walking catfish (*Clarias batrachus*).

Historically, commercial interest in forested wetlands was limited to timber harvest, with little attention paid to long term management techniques (Brandt and Ewel 1989). The mature cypress, which were especially valuable for their resistance to decay, were almost all harvested during the logging boom that peaked in the 1920s (Brandt and Ewel 1989). The total volume of standing cypress timber reached its lowest point in 1933, but has steadily increased during the last 60 years (Brandt and Ewel 1989). The second-growth trees currently available do not produce the same quality of decay-resistant lumber as the old-growth trees did; they are primarily used for fenceposts, stakes, mulch, and pulp (Terwilliger and Ewel 1986 cited in Brandt and Ewel 1989). Clearcutting is widely practiced due, in part, to the fact that all sizes of trees can be made into chips for mulch (Brandt and Ewel 1989). The cypress mulch industry is more active in north Florida, but some South Florida cypress is harvested for this purpose.

Cypress knees are harvested and sold for lamp bases, floral arrangements, and various other kinds of curios and decorative items. Since the knees' function is poorly understood, the impact of their removal is unknown.

Numerous other materials are occasionally harvested from flowing water swamps. Deer, hogs, and other game animals are hunted here, which affects herbivore-vegetation and predator-prey relationships. Illegal collection of tropical orchids and bromeliads has had significant impacts on rare species. Collection of medicinal herbs is increasing in all habitats and may impact swamp vegetation in the future.

Cattle grazing to some degree impacts the outer edges of many strand swamps, although cattle rarely venture into the swamp interiors.

Beekeeping practices may have serious effects on pollinator ecology. Exotic honeybee colonies are maintained in or near many strand swamps, where they can rely on abundant melaleuca nectar when other food is scarce. How this affects native pollinators and the reproduction of native plants is unknown. Beekeeping also poses hazards to black bears, since beekeepers sometimes shoot bears who foil their electric fences and raid their hives.

Management

Land Protection

Preservation of headwaters systems, remaining high-quality natural buffers, and flowing water swamps situated in intact landscape matrices is the highest land protection priority.

Table 1 lists conservation lands that protect important flowing water swamps. There is currently an effort to get a bill through the Florida legislature mandating Florida Division of Forestry involvement in the management of all State lands. Proponents of this legislation are seeking to write into it a provision that would permit logging of mature timber, including old-growth cypress.

Regulatory Mechanisms

The natural resource conservation elements of county comprehensive plans, county and State development permitting policies, pollution control and vegetation management regulations, and DEP and water management district water resource protection and wetlands permitting procedures help protect flowing water swamps. Underfunded enforcement programs limit the effectiveness of these regulations, however.

Restoration Projects and Programs

Historically, most wetlands restoration efforts have been directed at marsh ecosystems. Only within the past 15 to 20 years have there been significant attempts to restore forested wetlands (Clewell and Lea 1990). Given the timeframe necessary for forest regrowth, most of these projects are still too new for critical evaluation.

Forested wetland restoration efforts have been focused on two types of situations: reforestation of lands cleared for agriculture and subsequently abandoned (where the main objective is to establish a forest canopy) and restoration of wetlands cleared for surface mining projects (where the objective

has been to replace the full spectrum of tree species and undergrowth components), with considerable attention given to establishing the appropriate hydrology and hastening soil development (Clewell and Lea 1990).

Based on a review of forested wetlands restoration projects, Clewell and Lea (1990) have identified six critical factors which interact to determine whether or not a project will be successful. They are hydrology, substrate stabilization, rooting volume, soil fertility, control of noxious plants, and herbivore control.

Specifically, cooperation among engineers, hydrologists, and soil scientists must be encouraged to ensure that water delivery timing, depth, and quality are synchronous with the natural systems being emulated (Clewell and Lea 1990). Flood tolerance varies widely among different species and among different size classes within species and is also dependent upon stage of the growing season (Bedinger 1979). Newly planted vegetation is particularly susceptible to water stress.

Topographic relief should be planned with substrate stabilization in mind as project sites are often open and subject to erosion which hinders the establishment of trees and undergrowth (Clewell and Lea 1990).

Soil volume must be considered as roots need an adequate volume of soil to anchor themselves and exploit moisture and nutrients (Clewell and Lea 1990). Rooting volume may be limited by depth to the wet season water table and mechanical resistance where soil density has been increased by compaction caused by heavy equipment at project sites (Clewell and Lea 1990).

Soil fertility varies considerably with the project site. Fertilization is usually necessary to prevent trees from languishing so long as saplings that they are suppressed by weeds (Clewell and Lea 1990).

Control of noxious plants is necessary where their proliferation threatens to suppress desirable species. Certain tall weed species may be beneficial as shelter for young trees (Clewell and Lea 1990).

Nutrient enrichment problems from sewage have been cleaned up in the Shingle Creek area of Osceola County.

On a regional scale, restoration of pine flatwoods and prairie buffers is more important to flowing water swamps than wetland restoration in itself. Proper watershed management is critical.

Management Strategies and Techniques

SWFWMD has budgeted funds for research into biological control of skunk vine. Japanese climbing fern is promptly treated with herbicide when detected on SJWMD lands.

Timber harvest in cypress swamps ranges in intensity from clearcutting to thinning. The most frequently prescribed silvicultural systems are clearcutting and seed-tree cutting. There is no clear evidence that any method is significantly superior for assuring subsequent cypress regeneration, but it is clear that a seed source must be left on or adjacent to the site, that severe fires following a harvest can prevent regeneration, and that profound changes in hydroperiod, water levels, soil aeration, and/or understory vegetation can hinder seed germination and seedling survival (Brandt and Ewel 1989). When an isolated cypress stand is harvested, seed trees must be left or sufficient light must be available to assure

coppice production (sprouting from the stump). In larger swamps, clearcutting is acceptable if the harvest is conducted in small blocks to ensure good seed distribution from trees on the edges. Where cypress is selectively removed, cypress seedlings and saplings are likely to be outcompeted by more shade-tolerant hardwoods and coppicing may not be reliable.

Planting cypress will hasten the establishment of a new stand. Seedlings should be tall enough to escape inundation and should be protected from herbivory (Brandt and Ewel 1989).

Informal roads and trails can create wide muddy swaths and gullies through wetlands. Various types of web mats can be used to stabilize such trails. Geoweb has been used successfully for this purpose on SJWMD lands in Osceola County.

Tracks from recreational vehicles, logging trucks, and other machinery can create deep ruts in soft wetland soils. As water levels subsequently rise and fall, fish and other organisms may be trapped within these pools, which affects the food chain by influencing mobility of predators and prey. Mosquitoes have been observed to be more numerous under such circumstances (Wharton *et al.* 1976).

Synonymy Tables:

FLOODPLAIN SWAMP

Kuchler	113/Southern floodplain forest
Davis	7/Cypress swamp forests 8/Swamp forests, mostly of hardwoods
NRCS	17/Cypress swamp 21/Swamp hardwoods
Myers & Ewel	Freshwater swamp forests-floodplain forests
SAF	101/Bald cypress 102/Bald cypress-tupelo 103/Water tupelo-swamp tupelo
FLUCCS	613/Gum swamp 621/Cypress

Other synonyms include river swamp, bottomland hardwoods, seasonally flooded basins or flats, oak-gum-cypress, elm-ash-cottonwood, NWTC Zones II - III, slough, backswamp, and oxbow.

Synonymy Tables: *cont.*

FRESHWATER TIDAL SWAMP

Kuchler	113/Southern floodplain fForest
Davis	7/Cypress swamp forests 8/Swamp forests, mostly of hardwoods
NRCS	17/Cypress swamp 21/Swamp hardwoods
Myers & Ewel	Freshwater swamp forests-floodplain forests
SAF	73/Southern red cedar 74/Cabbage palmetto 101/Bald cypress 102/Bald cypress-tupelo 104/Sweetbay-swamp tupelo-redbay
FLUCCS	613/Gum swamp 615/Stream and lake swamps 621/Cypress 624/Cypress-pine-cabbage palm

Other synonyms include tidewater swamp and rivermouth swamp.

SLOUGH

Kuchler	113/Southern floodplain forest
Davis	7/Cypress swamp forests
NRCS	17/Cypress 21/Swamp hardwoods
Myers & Ewel	Freshwater swamp forests-sloughs and strands
SAF	101/Bald cypress
FLUCCS	621/Cypress

Other synonyms include flag pond, gator hole.

Synonymy Tables: cont.

STRAND SWAMP

Davis	7/Cypress swamp forests
Kuchler	113/Southern floodplain forest
NRCS	17/Cypress swamp
Myers & Ewel	Freshwater swamp forests-sloughs and strands
SAF	101/Bald cypress
FLUCCS	621/Cypress

Other synonyms include cypress dome or pond, cypress head, gum pond, cypress gall, and pine barrens pond.

Where Florida Game and Fresh Water Fish Commission's (GFC) Cypress Swamp or Hardwood Swamp communities occur in more-or-less linear systems with flowing water, they can be categorized as Pond Swamps.

The following GAP categories can be classified as Pond Swamps when they occur in more-or-less round and isolated basins or depressions:

18	I.B.2.N.(d,e)...	Cold-deciduous temporarily or seasonally flooded/saturated forest (=swamp forest)
19	I.B.2.N.e.180	<i>Taxodium ascendens</i> Forest Alliance
20	I.B.2.N.f.060	<i>Taxodium distichum</i> semipermanently flooded Forest Alliance
21	I.C.1.N.c....	Seasonally flooded tropical or subtropical semi-deciduous forest
23	I.C.3.N.c....	Seasonally flooded mixed needle-leaved evergreen - cold-deciduous forest (=mixed swamp forest)
29	II.A.2.N.b....	Seasonally flooded temperate broad-leaved evergreen woodland
32	II.B.1.N.d.010	<i>Taxodium ascendens</i> Tropical Woodland Alliance

Where the following GAP category occurs within or adjacent to another Flowing Water Swamps type, it may also be included in this community:

36	III.A.1.N.c.030	<i>Myrica cerifera-Ilex cassine</i> Shrubland Alliance
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Table 1. Proposed conservation lands important to flowing water swamps

PROPOSED CONSERVATION AREA	NOTES ON FORESTED WETLANDS	NOTES ON CONSERVATION PROPOSAL
Alafia River Corridor		SWFWMD Project, part of an interlocal agreement between SWFWMD and Hillsborough County's Environmental Land Acquisition and Protection Program (ELAPP)
Atlantic Ridge Ecosystem	Includes outstanding baygalls and some forested sloughs	1997 CARL Bargain 2, SFWMD Project
Catfish Creek		1997 CARL Priority 22, SFWMD Project
Charlie Creek System	Drainages along the main channel of Charlie Creek and tributaries (Bee Branch, Buckhorn Creek, Little Charley Bowlegs Creek and Old Town Creek) form a series of swamps and sloughs. This system drains into the Peace River.	SWFWMD Project
Charlotte Harbor	Site includes strands and domes in a flatwoods matrix, but melaleuca invasion is a major problem.	1997 CARL Priority 14
Corkscrew Regional Ecosystem Watershed		1997 CARL Bargain 8, SFWMD Project
Cypress Creek/Trail Ridge	Cypress and pine have been logged out of hydric hammocks and basin swamps north of SR 70 and flows from Cypress Creek, which historically passed under SR 70, have been routed west through a ditch along the north side of the highway. Most of the historic slough remains intact south of SR 70, where very little logging or ditching has been done. The Carlton lands include an impressive stand of virgin cypress (FNAI Basin Swamp EOR #066). There are bayheads and cypress domes and a band of hydric hammock (Van Swearingen Creek) in the Trail Ridge area along the west side of Bluefield Road.	SWFWMD Project
Fakahatchee Strand		1997 CARL Mega/Multiparcel 5
Fisheating Creek	Habitats include cypress slough/mied hardwood swamp forest, emergent marshes, willow thickets, baygalls, and openwater ponds and runs. New CARL boundaries include valuable matrix of dry and wet prairies, baygalls, and cutthroat seeps. Feral hogs are a problem.	SWFWMD
Green Swamp	There are good strand swamps with hydric hammock islands on the Jahna property owned by sand mining company, but associated uplands have been cleared. The Overstreet tract in the southwest corner of the site has cypress domes, cypress strands, hydric hammocks, and floodplain swamps, which drain into Little Gator Creek, then into the Withlacoochee River.	1997 CARL Priority 20 and 1997 CARL LOF 1, SJWMD SOR and P-2000 Project, SWFWMD Project.

Table 1. cont.

PROPOSED CONSERVATION AREA	NOTES ON FORESTED WETLANDS	NOTES ON CONSERVATION PROPOSAL
Jack Creek	The forested wetlands along Jack Creek are dominated by a mixture of evergreen trees such as loblolly bay, sweetbay, and magnolia, along with red maple, blackgum, and cypress.	SWFWMD
McDaniel Ranch	This site includes major cypress strands including two virgin stands grading into a large area of hydric hammock in a healthy mosaic with expanses of marsh and wet prairie. The best natural areas are concentrated along the western and southern edges.	SWFWMD conservation easement project. The McDaniel family will retain ownership and management responsibility with rights to use for timber management, cattle grazing, lease hunting, and eco-tourism.
Myakka River	The project includes a 4.5 mile stretch of the Myakka River and its forested floodplain.	SWFWMD Project
Myakka River/Charlotte Harbor		SWFWMD Project, includes 9,900 acres jointly acquired through the CARL program.
North Fork St. Lucie River	Greater than 80 percent of this site is floodplain wetlands, including hardwood swamp, hydric hammock, sawgrass marsh, and mangrove types.	1997 CARL Bargain 20, SWFWMD Project
Okaloacoochee Slough	Wet flatwoods and hydric hammocks, dominated by live oaks and cabbage palms, fringe sawgrass. Recommended management is continued native range grazing with no pasture improvement or fertilization.	1997 CARL Bargain 14, SWFWMD Project
Osceola Pine Savannas	This is an area of old beach ridges and intervening swales, with high quality longleaf pine flatwoods interrupted by cypress strands, cypress domes, and wet prairies.	1997 CARL Priority 24
Peace River Corridor		SWFWMD Project
Ranch Reserve	Headwaters of Blue Cypress Creek. Includes high quality cypress strands, cypress domes, and hydric hammocks in a flatwoods matrix.	1997 CARL LOF 4, SJWMD SOR and P-2000 Project. Conservation easements are key to protection strategy.
RV Griffin Reserve		SWFWMD Project, supports existing facilities of Peace River/Manasota Regional Water Supply Authority
Save Our Everglades	Natural communities include cypress forest, pine flatwoods, hammock, mixed swamp forest, wet and dry prairies and freshwater marsh. Serves as the headwaters to the Fakahatchee Strand.	1997 CARL Mega/multiparcel 3

Table 1. continued

PROPOSED CONSERVATION AREA	NOTES ON FORESTED WETLANDS	NOTES ON CONSERVATION PROPOSAL
Six Mile Cypress II	Cypress swamp, interspersed with numerous openwater sloughs and fringed with pine flatwoods, transitional hardwoods, wet prairies, and melaleuca stands.	SFWMD
South Fork St. Lucie River		SFWMD Project, Martin County, FCT
Upper Econ Mosaic	Econlockhatchee River swamp.	1997 CARL Priority 26
Upper Lakes Basin Watershed	Reedy Creek Swamp is an extensive area of mixed hardwood/cypress swamp running for nearly 25 miles through western Osceola County, from the boundary of the Reedy Creek Improvement District to Cypress Lake. It includes the Huckleberry Islands and totals more than 30,000 acres. Lake Marion Creek is in Polk County and flows from Lake Marion north and then southeasterly to Lake Hatchineha. The project area totals approximately 17,300 acres, 3,800 of which are within the Southwest Florida Water Management District. Most of the project is forested swamp and needs no restoration. Reedy Creek Swamp has been fairly well protected because of its large size and inaccessibility. Unless high-density urban encroachments or damaging silviculture operations are permitted in the future, the swamp should be able to buffer itself. Exotic vegetation is not a problem, and it does not appear that hydrologic restoration will be necessary. The natural habitats within the Lake Marion Creek area are generally in good condition, although development has destroyed some scrub areas. The size of the property and the deep swamps allows the interior portions to remain buffered from activities along the ridge.	SFWMD Project, SFWMD envisions assistance from SWFWMD and CARL.
Upper Peace River Corridor		SWFWMD Project

Table 2. Managed areas important to flowing water swamps

MANAGED AREA	MANAGING ENTITY
Avon Park Air Force Range	DOD
Collier-Seminole State Park	DEP
Corkscrew Swamp Sanctuary	NAS
Fakahatchee Strand State Preserve	DEP
Florida Panther National Wildlife Refuge	FWS
Jonathan Dickinson State Park	DEP
North Fork St. Lucie Aquatic Preserve/ North Fork St.Lucie River State Buffer Preserve	DEP and SFWMO

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Restoration of Flowing Water Swamps

Restoration Objective: Prevent further reduction in area of flowing water swamps, protect all remaining high quality habitat, and restore and manage protected lands to maintain ecological processes and biodiversity, including normal hydroperiods and flow regimes.

Restoration Criteria

The recovery objective will be achieved when: (1) a reserve design incorporating all currently protected tracts and remaining high quality habitat has been developed and implemented; (2) flowing water swamps are protected through acquisition or cooperative agreements with landowners; (3) appropriate management plans have been prepared and funded for all lands within the reserve network; (4) restoration has been successfully initiated such that ecological processes are operating normally; and (5) natural succession and restoration actions through funded management programs can be expected to re-establish community structure and biodiversity on all significant degraded sites within the reserve network.

All systems within the reserve network must have adequate natural buffers and secure headwaters. Hydrological management for normal hydroperiods and flow regimes must be assured. Mature forests and core reserve swamps must be managed to achieve old-growth characteristics. Buffer zone swamps used for timber production must be managed sustainably.

Community-level Restoration Actions

1. **Prevent further destruction or degradation of existing flowing water swamps.**
 - 1.1. **Acquire threatened flowing water swamps and their upland buffers and headwaters.**

Table 2 presents land acquisition proposals that incorporate important Flowing water swamps that should be protected.

Other important areas that should be protected include:

Bruner Cypress Swamp on Jane Green Creek in Osceola County (FNAI floodplain swamp EOR # 002). This is a stand of virgin cypress with trees up to 1.7 m (5.5 ft) dbh with swampbay, needle palm, and royal fern in the understory.

Strand swamp with virgin cypress in Hendry County, west of Cow Bone Island on Seminole Reservation lands (FNAI EOR #001).

Floodplain swamp in Lee County (FNAI EOR #027). It is dominated by pop ash with abundant epiphytes and includes a slough with a 1.5 to 3.0 m (5 to 10 ft) waterfall at the upper end.

There are many other flowing water swamps worthy of protection within local conservation systems. Natural landscapes, including healthy examples of such swamps, should be regarded as high priorities for local conservation efforts.

- 1.2. **Promote conservation easements and landowner agreements** to protect flowing water swamps and their upland buffers and headwaters.

Telegraph Swamp in eastern Charlotte County is a particularly important site in need of a formal easement or landowner agreement.

- 1.3. **Enforce regulatory protection of forested wetlands.** Lands are seldom adequately monitored to ensure compliance, and penalties and enforcement are often inadequate to motivate adherence to the law. Increased funding for regulatory monitoring and enforcement programs is needed at all levels.

- 1.4. **Prevent degradation of existing preserves.** Conservation lands should be maintained according to management plans that ensure that flowing water swamps, along with their associated wetlands, upland buffers, and headwater systems, are protected from degrading land uses.

- 1.5. **Protect flowing water swamps from pollution.** Flowing water swamps should be protected from both point-source and non-point-source pollution.

2. **Manage flowing water swamps within the context of restoration objectives.**

- 2.1. **Restore natural fire regimes.** Emphasize landscape-scale burning that permits fires to burn into the edges of wetlands naturally. Minimize swamp-edge firebreaks. Recognize the need for occasional catastrophic fires to burn into the peat to rejuvenate sloughs within strand systems.

- 2.2. **Control exotic plants and animals.** Control melaleuca invasion. Aggressively seek out and eliminate infestations of Japanese climbing fern and skunk vine. Control feral hog populations (with consideration for panther food base). Monitor other exotics in flowing water swamps and promptly initiate control programs for those that threaten to become problematic.

- 2.3. **Restore hydrology.** Within the context of regional hydrological restoration, manage flowing water swamps to maintain hydroperiods, water levels, and flow regimes within the ranges found in natural systems.

- 2.4. **Restore soils.** Restore hydrological patterns and control fire to permit accumulation of peat in drained or burned swamps. In severely degraded systems, consider increasing water and nutrient levels on a temporary basis to accelerate the soil development process.

- 2.5. **Restore ecosystem structure and composition** by manipulating existing populations of native species, augmenting populations of native species, and reintroducing extirpated plants and animals.

- 2.6. **Protect flowing water swamps from point-source and non-point source pollution.** Acquire or otherwise monitor and control buffers.

3. **Maintain flowing water swamps in a natural condition.**

- 3.1. **Provide analogs for ecosystem functions such as fire regimes.** Evaluate alternatives to catastrophic fire (dredging, *etc.*) for rejuvenation of sloughs within strand systems.

