Seepage Swamps

FNAI Global Rank:	G3/G4
FNAI State Rank:	S2/S4
Federally Listed Species in S. FL:	5
State Listed Species in S. FL:	38

Seepage swamps are forested wetlands characterized by saturated soils rather than periodic inundation. They include baygalls at the base of seepage slopes, bayheads in peat-filled depressions or at the downstream ends of Everglades teardrop islands, and hydric hammocks on low sand or limestone rises within periodically inundated wetland systems. Many of these systems have been drained and converted to agricultural uses. Much of the classic baygall that once fringed the tip of the Lake Wales Ridge was cleared so that the rich muck soil could be used for growing caladiums and gladiolias. Many seepage swamps have been damaged by hydrological alterations that have lowered the groundwater table or by pollution from agricultural or urban runoff. Water level manipulations in the Everglades have stressed bayheads with excess surface water in some situations and allowed them to dry out and lose their soil to peat fires in others. Large numbers of cabbage palms (*Sabal palmetto*)are removed from hydric hammocks for landscaping. Restoration of hydrological regimes and preservation of natural landscape buffers are the most critical long-term needs for preservation of seepage swamps.

Synonymy

Seepage Swamps include FNAI's hydric hammock, baygall, and bog (bayhead); NRCS's wetland hardwood hammocks, and shrub bog and; Society of American Foresters' (SAF) southern red cedar, cabbage palmetto, slash pine-hardwood, sweetbay-swamp, and tupelo-redbay. Synonymies for each of these communities are provided in the snynonymy tables at the end of the account. Note that some of these definitions include northern types that do not occur in South Florida.

Distribution

Baygalls originally occurred in linear bands below seepages in the northern part of South Florida where topographic relief is sufficient to create slopes. (Most of them have now been so fragmented that linear patterns are seldom evident except where baygalls form a transition zone between uplands and floodplain wetlands along streams.) Bayheads are scattered throughout the regional landscape, but are most abundant in areas with numerous cypress domes (like the Green Swamp), where they represent an advanced stage of dome succession with peat accumulation in the absence of severe fire. They are also abundant in the Everglades, where they characteristically grow on organic soil built up downstream of limestone-based hardwood hammocks. Hydric hammocks also occur throughout the region, but tend to be more extensive where they are associated with river floodplains (Figure 1).

Description

Topography and Geology

Baygalls typically develop at the base of a slope where seepage maintains a saturated peat substrate. Bog-type bayheads occur on acidic peat soils that have accumulated in a depression. The peat may fill the depression or be an island or isolated mass floated into position by high water. Hydric hammocks occur on low, flat, wet sites where limestone is often at or near the surface.

Soils

Baygall and bayhead soils are typically composed of peat with an acidic pH (3.5 to 4.5). Hydric hammocks generally grow on sands with considerable organic material that, although generally saturated, are inundated only for short periods following heavy rains.

Vegetative Structure

Baygalls and bayheads are dense evergreen forests or shrub thickets with a spongy understory of sphagnum moss and ferns. The canopy is composed of tall, densely packed, generally straight-boled evergreen hardwoods dominated by sweetbay (*Magnolia virginiana*), swamp bay (*Persea palstris*) red bay (*Persea borbonia*), and loblolly bay (*Gordonia lasianthus*). There is typically a more or less open understory of shrubs and ferns and a ground surface of sphagnum mats interlaced with convoluted tree roots.

Hydric hammocks are open forests dominated by cabbage palms and laurel oaks (*Quercus laurifolia*) mixed with other hardwoods. They often have minimal understory and a floor carpeted by fallen palm fronds.

Vegetative Composition

In baygalls and bayheads, the typical plant species include: red bay, sweetbay, loblolly bay, red maple (*Acer rubrum*), slash pine (*Pinus elliottii*), wax myrtle (*Myrica cerifera*), dahoon (*Ilex cassine*) gallberry (*Ilex coriacea*), Virginia willow (*Itea virginica*), buttonbush (*Cephalanthus occidentalis*), coco plum (*Chrysobalanus icaco*), laurel greenbrier (*Smilax laurifolia*), poison ivy

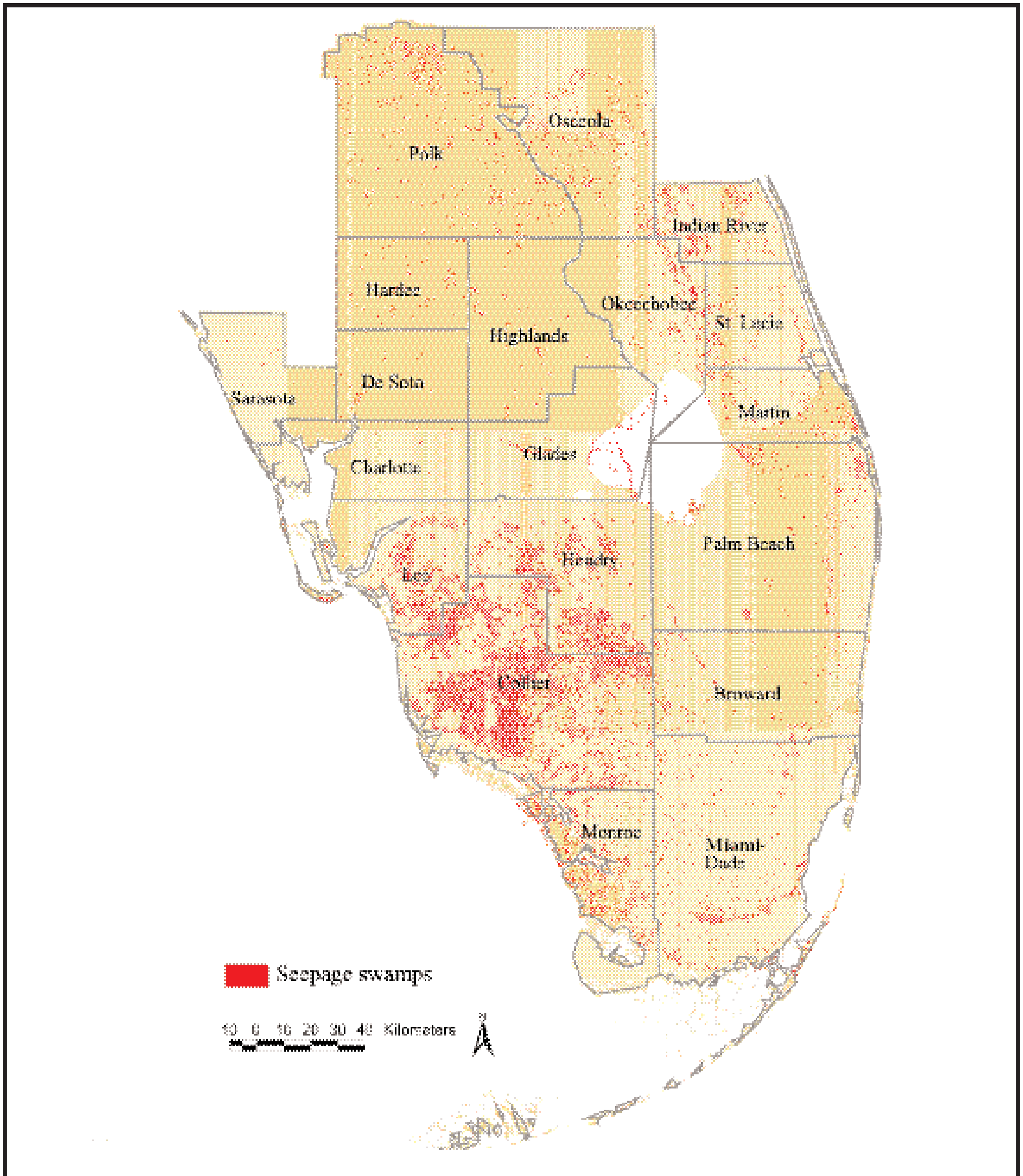

Figure 1. The occurrence of seepage swamps in South Florida (adapted from USGS-BRD 1996)

(*Toxicodendron radicans*), cinnamon fern (*Osmunda cinnamomea*), chain fern (*Woodwardia* spp.), netted chain fern (*Woodwardia areolata*), and sphagnum moss.

Typical hydric hammock plants include cabbage palm, laurel oak, red maple, swamp bay, sweetbay, water oak (*Quercus nigra*), dahoon, myrsine (*Rapanea punctata*), sugarberry (*Celtis laevigata*), wax myrtle, saw palmetto (*Serenoa repens*), poison ivy, royal fern (*Osmunda regalis*), peppervine (*Ampelopsis arborea*), rattan vine (*Berchemia scandens*), Virginia creeper (*Parthenocissus quinquefolia*), and several species of ferns.

Wildlife Diversity

Typical baygall and bayhead animals include Florida black bear *(Ursus americanus floridanus),* southeastern shrew, short-tailed shrew *(Blarina brevicauda),* squirrel treefrog *(Hyla squirella),* little grass frog *(Pseudacris ocularis).*

Hydric hammock animals include gray squirrel (*Sciurus carolinensis),* flycatchers, warblers, and green anole (*Anolis carolinensis).*

Wildlife Species of Concern

Federally listed species that depend upon or utilize the seepage 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.

The **Florida black bear** is state listed as threatened. This species utilizes a wide variety of extensively forested landscapes, including pine flatwoods, hardwood and cypress swamps, cabbage palm forests, sand pine scrub, and mixed hardwood hammocks (Maehr 1992). The black bear has a large home range, low population density, and a low reproductive rate. These characteristics make it particularly vulnerable to habitat loss and fragmentation. Poaching and highway collisions are also issues of special concern. Because the Florida black bear's diet varies temporally and geographically (Maehr and Brady 1982a, 1984a, 1984b), timber management and prescribed burning schedules need to be evaluated.

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 1996).

Limpkins (*Aramus guarauna*)are found along the wide and well-vegetated shallows of rivers and streams statewide, as well as around lakes in peninsular Florida and in marshes, broad swales, strand swamps, sloughs, and

Limpkin. *Original photograph by Betty Wargo.*

impoundments in South Florida (Rodgers *et al*. 1996). Their diet consists of apple snails, other snails, freshwater mussels, lizards, insects, frogs, worms, and crustaceans. Nesting occurs in a mat of aquatic vegetation. Because apple snails depend on freshwater quality and abundance for the health of their forage plants and their own physiological needs, altered hydrology, pollution, and exotic plant proliferation are the notable threats to snail populations (Rodgers *et al*. 1996). The limpkin's apparent dependence on the apple snail is its chief vulnerability. The limpkin will probably remain locally wherever apple snails are abundant. Limpkins forage by sight and touch when wading on the bottom or by walking on dense mats of floating vegetation. Natural seepage swamps provide optimal water depths for limpkin foraging. The State of Florida has designated the limpkin as a species of special concern.

Plant Species of Concern

Plants considered as imperiled by FNAI and Florida Department of Natural Resources (1990) that occur in bayhead or hydric hammock communities include: star anise (*Illicium parviflorum*), hand fern (*Cheiroglossa palmata*), ray fern (*Actinostachys pennula*), ghost plant (*Lephaimos parasitica*), auricled spleenwort (*Asplenium auritum*), terrestrial peperomia (*Peperomia humilis*), and Tampa vervain (*Glandularia tampensis*).

Hand fern *(Cheiroglossa palmata)* grows as epiphytes in the "boots" (leaf bases) of cabbage palms, where it thrives on the warm humid atmosphere of the hydric hammock. Without this warmth and humidity, it is vulnerable to droughts and freezes. The fires that typically maintain cabbage palm stands usually destroy hand ferns, however. This means that hydric hammocks with hand ferns must be carefully managed so that the burning necessary for maintenance of the palm groves does not eliminate the ferns. It also suggests that these ferns might be reintroduced to hammocks where such sensitive fire management is now feasible.

Ecology

Hydrology

Baygalls are fed by seepage from upslope communities, although downslope high water tables may also contribute to soil saturation where they are located along floodplains.

The hydrologic regime of bog-type bayheads is dominated by capillary action that draws water up from below. Significant surface flooding is rare in these hydrologically stable systems.

Hydric hammocks typically flood for brief periods seasonally, but the hydroperiod seldom exceeds 60 days per year. If the water table is lowered, a hydric hammock will gradually change into a mesic system. If the hammock is flooded for more extended periods than normal, many trees will eventually die and be replaced by more hydrophytic species.

Fire

Since baygalls rarely dry out enough to burn, the normal fire interval in these communities is probably 50 to 100 years or more. After a fire, bay trees usually resprout from the roots and replace themselves, but severe fires may change a baygall into a different community. If only a small amount of surface peat is removed, this may become a wet flatwoods community. If the ground surface is lowered considerably, willows may invade, followed by a cypress-gum community. With recurrent fire, the site will become a shrub bog.

Fire frequency in bog-type bayheads is highly variable. In shrub bogs they may normally occur every 3 to8 years, whereas in woody bayheads every 50 to 150 years is probably a more reasonable estimate.

Because of their damp soils and the sparseness of herbaceous ground cover, hydric hammocks rarely burn. Those with abundant cabbage palms are an exception, however. In these communities, the flammable palm fronds readily carry fires that favor survival of the fire-resistant palms over other components of the hammock flora. This feedback loop results in the palm-dominated hammocks that characterize fire-maintained prairie landscapes.

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 seepage 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 the forested wetland communities, 54 percent of the areas of abundant cabbage palms and 38 percent of the original wetland hardwood forests remain. The percentage of these remaining forested wetlands in Florida that have been protected through public ownership to be managed as natural areas are as follows: 18 percent of the areas of abundant cabbage palms and 15 percent of the wetland hardwood forests (Cox *et al*. 1997).

Using 1985 to 1989 Landsat satellite imagery for Florida, another mapping analysis estimated that managed areas protect 58 percent of remaining shrub swamps, 25 percent of bay swamps, and 25 percent of 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 5.9 percent of its hydric hammocks and 1 percent of its bayheads during that 5-year period (Duever *et al*. 1992).

In the Lake Placid-Sebring area, 607 ha (1,500 acres) of Lake Wales Ridge baygall has been converted to caladium production (Miller 1997).

Changes in the landscape matrix affect seepage swamps. Conversion of adjacent lands to pastures, farm fields, citrus groves, and residential developments interferes with normal interactions between habitats.

Development of much of the surrounding landscape has increased the amount of runoff that must be absorbed by the remaining wetlands. Drainage of irrigated agricultural lands into seepage swamps can change the hydrological regime to one dominated by flooding, rather than saturation, and lead to vegetation changes resulting in eutrophic hardwood swamps.

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.

Borrow pits, surface mines, and wellfield drawdowns can lower water tables and impact seepage swamp hydrology. Conversely, bayheads may be transformed into swamps, and hydric hammocks may lose their upland flora components when weir levels are set too high.

Exotic species invasion is an increasing problem in drained and/or disturbed seepage swamps. Exotic plants reported from this community include: melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), Japanese climbing fern (*Lygodium japonicum*), and skunk vine (*Paederia foetida*).

Exotic animals include: hog (*Sus scrofa*), Cuban treefrog (*Osteopilus septentrionalis*), and walking catfish (*Clarias batrachus*).

Although the species that grow in seepage swamps are generally not in demand for timber, many materials are occasionally harvested from these habitats. Deer, hogs, and other game animals are hunted here, which affects herbivore-vegetation and predator-prey relationships. Collection of medicinal herbs is increasing in all habitats and may impact seepage swamp vegetation.

The Seminole and Miccosukee Indians have traditionally used various materials from these ecosystems, including cabbage palm fronds for chickee roofing and “swamp cabbage” (hearts of palm) for food. Swamp cabbage has also been part of the traditional diet of the Cracker settlers and their descendents.

Removal of cabbage palms for landscaping has become an increasingly common practice. Large numbers of mature palms are dug from South Florida hydric hammocks and shipped to urban areas as far away as south Texas.

Cattle grazing to some degree impacts the outer edges of many seepage swamps, although cattle rarely venture far into these habitats.

Beekeeping practices may have serious effects on pollinator ecology. Exotic honeybee colonies are maintained in or near many seepage swamps. 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. Since seepage swamps are important bear habitat, such interactions are of particular significance in these areas.

Management

Land Protection

Preservation of seepage swamps in intact landscape matrices with secure hydrological regimes is the highest land protection priority. Table 1 lists conservation lands that protect important seepage swamps.

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 pond swamps. Underfunded enforcement programs limit the effectiveness of these regulations, however. Better enforcement of existing regulations is more critical than enactment of new ones.

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 that 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 1978). 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, however (Clewell and Lea 1990).

Management Strategies and Techniques

Note that SWFWMD has budgeted funds for research into biological control of skunk vine (Kelley 1998) and that Japanese climbing fern is promptly treated with herbicide when detected on SJWMD lands.

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.

Synonymy Tables:

HYDRIC HAMMOCK

Kuchler	113/Southern floodplain forest
Davis	8/Swamp forests
	12/Hardwood forests
SCS	12/Wetland hardwood hammocks
Myers & Ewel	Temperate hammocks-hydric hammocks
SAF	73/Southern red cedar
	74/Cabbage palmetto
FLUCCS	617/Mixed wetland hardwoods

Other synonyms include Gulf hammock.

BAYGALL

Kuchler	112/Southern mixed forest
Davis	2/Pine flatwoods
	8/Swamp forests, mostly of hardwoods
SCS	12/Wetland hardwood hammocks
	22/Shrub bog
Myers & Ewel	Freshwater swamp forests-titi swamps, bayheads
SAF	85/Slash pine-hardwood
	104/Sweetbay-swamp, tupelo-redbay
FLUCCS	611/Bay swamps
	614/Titi swamps

Other synonyms include seepage swamp, bayhead, bay swamp, sandhill bog.

Synonymy Tables: *cont.*

BOG (INCLUDES BAYHEAD):

Kuchler	112/Southern mixed forest
Davis	8/Swamp forests, mostly of hardwoods?
SCS	22/Shrub bog
Myers & Ewel	Freshwater swamp forests-shrub bogs
FLUCCS	310/Herbaceous

Other synonyms include bog swamp, shrub bogs, evergreen shrub bogs, wet scrub/shrub systems.

GFC's Bay swamp can be considered roughly equivalent to seepage swamps.

The following GFC's GAP analysis categories are included within Seepage Swamps:

3	I.A.3.N.f.010	*Magnolia virginiana-Chrysobalanus icaco forest* Alliance (which is included in FNAI's Bog)
9	I.A.4.N.e.020	Sabal palmetto-*Quercus virginiana* temporarily Flooded Forest Alliance (equivalent to the fire-maintained version of FNAI 's hydric hammock
53	III.C.2.N.e.	Saturated mixed evergreen-cold-deciduous shrubland
22	I.C.2.N.c.	Seasonally flooded mixed broad-leaved evergreen-cold-deciduous forest (equivalent to FNAI's hydric hammock)

Where associated with the above types, the following GFC's GAP analysis community may also be classified under seepage swamps:

36	III.A.1.N.c.030	*Myrica cerifera-Ilex cassine* Shrubland Alliance

Table 1. Proposed conservation lands important to seepage swamps

Proposed Conservation Area	Notes on Forested Wetlands	Notes on Conservation Proposal
Allapattah Flats	The southwest corner of this site incorporates a major hydric hammock with tropical components to the flora. This area has been affected by grazing and soil subsidence.	1997 CARL Bargain 15, SFWMD Project
Atlantic Ridge Ecosystem	Includes outstanding baygalls and some forested sloughs.	1997 CARL Bargain 2, SFWMD Project
Bright Hour Watershed	Mostly dry prairie with some basin swamps and a classic 100-acre baygall with gordonia. Six major slough systems within the proposed acquisition make up much of the headwaters of Prairie and Shell creeks.	SWFWMD Group "C" Project (Land to be evaluated)
Catfish Creek		1997 CARL Priority 22, 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.	SFWMD Project
Fisheating Creek	Habitats include cypress slough/mixed 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.	SFWMD Project
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
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 Project
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.	SFWMD 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.

Table 1. ***cont.***

Proposed Conservation Area	Notes on Forested Wetlands	Notes on Conservation Proposal
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, SFWMD 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, SFWMD Project
Oslo Riverfront Conservation Area		SJWMD SOR and P-2000 Project, Indian River County
Parker-Poinciana	Includes mesic flatwoods, a large cypress/bay head, logged-over flatwoods, and hydric hammock along the Lake Hatchineha shoreline	SFWMD
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.
Upper Lakes Basin Watershed	Reedy Creek Swamp is an extensive area of mixed hardwood/cypress swamp running for nearly 40.2 km (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 12,141 ha (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 7,001 ha (17,300 acres), 1,538 ha (3,800 acres) 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.

Table 2. Managed areas important to seepage swamps

MANAGED AREA	MANAGING ENTITY
Avon Park Air Force Range	DOD
Collier-Seminole State Park	DEP
Three Lakes Wildlife Management Area	GFC
Triple N Ranch Wildlife Management Area	GFC

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Restoration of Seepage Swamps

Restoration Objective: Prevent further reduction in area of seepage swamps in South Florida, protect all remaining high quality habitat, and restore and manage protected lands to maintain ecological processes and biodiversity. Restoration and maintenance of water sources and hydrological regimes is critical.

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) seepage 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.

The reserve design must include appropriate linkages between major systems and incorporate the matrix of habitats necessary to maintain interactions between communities.

Appropriate water supplies and delivery must be assured for maintenance of normal hydrological conditions in all seepage swamps within the reserve system. Protection from unnaturally severe droughts and fires must be assured.

Community-level Restoration Actions

1. **Prevent further destruction or degradation of existing communities.**

   1.1. **Acquire threatened seepage swamps.**

   Table 2 presents land acquisition proposals that incorporate important seepage swamps that should be protected. Other important areas that should be protected include:

   Baygalls along the mangrove edge at Pelican Bay in Collier County (FNAI EORs # 007 and 008) and similar nearby sites, if any of these still exist. Such baygalls have southernmost extensions for northern plants like jack-in-the-pulpit and represent an unusual coastal variation of the community.

   Baygall in Osceola County, east of Lake Davenport (FNAI EOR #016). This site also includes diverse xeric habitats.

   Hydric hammock in Osceola County, parallel to Bull Creek (FNAI EOR #027).

   There are many other seepage 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.** Appropriate agreements should be negotiated with landowners.
- 1.3. **Enforce regulatory protection.** Wetlands are seldom adequately monitored to assure 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 assure that seepage swamps and their water sources are protected from degrading land uses.

2. **Manage seepage 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.
   - 2.2. **Control exotic plants and animals.** 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 seepage swamps and promptly initiate control programs for those that threaten to become problematic.
   - 2.3. **Restore ecosystem structure and composition** by manipulating existing populations of native species, augmenting populations of native species, and reintroducing extirpated plants and animals.
   - 2.4. **Protect seepage swamps from point source and non-point source pollution.** Design restoration projects to restore entire landscapes of integrated upland and wetland communities so that wetlands are buffered from agricultural and urban runoff.

3. **Maintain seepage swamps in a natural condition.**
   - 3.1. **Provide analogs for ecosystem functions such as fire regimes.**
   - 3.2. **Continue to control exotic plants and animals in perpetuity.**
   - 3.3. **Monitor for extirpations and extinctions,** and negative population trends of imperilled species, including pollinators, dispersers and soil organisms.
   - 3.4. **Monitor and correct for both point source and non-point source pollution.**

4. **Restore seepage swamps where they have been destroyed.** Use research conducted by the Florida Institute of Phosphate Research, the University of Florida Center for Wetlands, and others to recreate seepage swamps according to the guidelines of the Society for Ecological Restoration.
   - 4.1. **Restore ecosystem structure** including soils and soil organisms, hydrology, plants, and animals.
   - 4.2. **Restore ecosystem functions** by controlling exotics and aggressive native weeds, restoring natural fire regimes, hydrologic processes, and natural biological interactions (food webs, nutrient cycling, *etc*.)
   - 4.3. **Restore ecosystem composition** for late-succession species and rare species.
   - 4.4. **Protect seepage swamps from both point-source and non-point-source pollution.**

5. **Connect appropriate habitats.**
   - 5.1. **Connect ecological systems.** Pal-Mar, a project in northern Palm Beach and southern Martin counties, is a critical connection between J.W. Corbett WMA and

Jonathan Dickinson SP. When acquired, this would complete a 50,587 ha (125,000 acres) ecological greenway stretching from Dupuis Reserve close to Lake Okeechobee to Jonathan Dickinson SP.

5.2. **Protect/restore landscape matrix.** Preserve/restore uplands associated with seepage swamps. Change wetland permitting regulations so that upland recharge areas that feed seepage systems can be restored as wetland mitigation.

5.3. **Assure maintenance of linkages critical to key species and functions**.

6. **Conduct research.**

6.1. **Determine distribution of remaining seepage swamp habitat.**

6.1.1. **Develop strategies for gathering, synthesizing, and groundtruthing data** to permit seepage swamp types to be readily distinguished on GIS maps.

6.1.2. **Assess and supplement available data.**

6.2. **Improve reference ecosystem information regarding community composition, biodiversity, and site-to-site variability.**

6.3. **Investigate roles of pollinators, mycorrhizae, seed dispersers, and other critical or keystone species.**

6.4. **Evaluate predator-prey relationships in landscape context.**

7. **Monitor community-level processes, community structure, and community composition including rare and keystone species.**

8. **Increase public awareness.** Landowners need to be taught to recognize seepage swamps as wetlands subject to wetland regulations. Because these communities are rarely flooded, it may be difficult to understand that they are wetlands.