

Vegetative Communities

Vegetative communities in Big Cypress National Preserve are mostly hydric, sub-tropical forested systems. Mesic forests occur mostly in the northern part of the preserve (mostly north of I-75), where pine flatwoods and hardwood hammocks are common. These communities are less common to the south, but occur as flatwoods or hardwood islands surrounded by wetlands, or tropical hardwood hammocks near the coast. Virtually all other communities in the preserve are hydric, and are forested (swamps) or are dominated by ground cover (marshes or wet prairies). Communities near the coast, and influenced by tides, are dominated by mangrove swamps or salt marshes. Gunderson et al. (1982) classified communities in Big Cypress in four major associations: 1- pine habitats; 2- mixed hardwood associations; 3- freshwater swamps; and 4- marshes and prairies, based on vegetative assemblages outlined by Davis (1943), Craighead (1971), McPherson (1973), and Duever et al. (1979). These authors identified communities within the major assemblages primarily by dominant vegetation and physiognomy. This treatment of vegetative communities will consider communities similarly, and will include differences in physical ecological components of the communities.

The Big Cypress National Preserve general management plan and environmental impact statement (NPS 1991) included a comprehensive description of vegetative resources. Since then, vegetation has been re-classified by Welch et al. (1999) to provide consistency with the mapping of other public lands in the southern Florida region. The largest changes were that some areas formerly classified as marsh, such as those in the Stairsteps Unit, are now described as prairie. The current classifications of vegetation within the preserve are shown in the Vegetation Classes map. The ecology of the vegetative communities in the preserve has changed little since the publication of the General Management Plan. Therefore, the appropriate sections of the General Management Plan are incorporated by reference to help define the vegetative communities in this document.

Cypress Forests

Swamp communities that are dominated by bald cypress (*Taxodium distichum*) trees may be considered cypress forests. These communities assume differences in response to competition and abiotic factors, so that several types of cypress forest can be identified. In southern Florida, cypress strands, cypress domes, mixed hardwood and cypress swamps, and dwarf (hatrack) cypress communities are common.

Cypress forests typically occur where solution holes and concomitant collapse of near-surface limestone caprock has occurred. Limestone caprock is usually only a few inches beneath the ground surface, and is common throughout much of the area. This fracturing and re-arrangement of the limestone results in a depression of the substrate, so that the ground surface in the solution hole is closer to the water table than the surrounding area. The breaks in the limestone also allow the roots of large plants to

penetrate well below the soil surface, so trees are able to become established. Since the substrate surface is near to, or below, the water for most of the year (i. e., has a long hydroperiod) trees that are adapted to long hydroperiods survive and dominate these communities. In our area, bald cypress trees are the common dominants in these hydric communities. As cypress and other trees (see Mixed Hardwood and Cypress Strand) become established, the leaves and branches that are shed from the trees collect in the solution hole depression. The soil surface is under water most of the time so that little oxygen is available for decomposing organisms. In the submerged part of the community, microbes that are able to live without oxygen break down organic detritus by way of anaerobic metabolism. Anaerobic decomposition is much less efficient than aerobic decomposition, so that the detritus is broken down slowly. As a result, organic material in the soils of these communities often becomes a thick mantle on the substrate surface.

This slow decomposition and build-up of organic material tends to increase the acidity of the water in these communities. When the decomposition of organics occurs, humic acids are released as metabolic by-products of decomposition; this tends to lower the pH (acidify) of the surface water in these communities. Whatever oxygen is dissolved in the water is quickly used by decomposers for aerobic respiration, and carbon dioxide is produced as an aerobic metabolic by-product. The carbon dioxide is quickly dissolved in the water, and forms carbonic acid. Anaerobic decomposition also produces substances such as methane and hydrogen sulfide that dissolve in the water to increase the hydrogen ions in solution. All of these additions of hydrogen ions to the surrounding water tend to create an acidic surface water solution. Limestone (calcium carbonate) is soluble in acidic solutions and neutralizes acidity as it dissolves. Limestone is very common in the substrate surrounding the cypress forests, and the solution becomes quickly neutralized, so the pH of the water in these systems is often around 7.0 (neutral). However, as the surface water migrates slowly beneath the soil surface, through the organic soil, it becomes acidified. When it flows slowly into the solution hole, the limestone remaining from the caprock collapse is dissolved, and the solution hole may become larger over time. Sand is not affected by this surface water, so that often the mineral soil beneath the organic layer of cypress swamps is fine sand with organic particles. Also, the dissolution of limestone results in a surface water solution that is saturated with calcium. This is important in the formation of marl, a soil component of prairies that is produced by microbial periphyton communities.

Cypress Domes

Cypress domes are small, relatively discrete areas of freshwater swamp dominated by bald cypress (*Taxodium distichum*) trees. These areas are nearly circular, and often surrounded by marl prairies or herbaceous marsh community with few trees. The name 'cypress dome' is derived from the appearance of the cypress communities that commonly occur in association with these solution holes and associated substrates. The domed shape of these communities is produced by taller cypress trees growing near the center of the community and progressively shorter trees occurring near the peripheral areas. The centers of the dome communities and their associated solution hole substrates are apparently conditions that support the growth of cypress trees, with marginal growth

conditions in the peripheral areas. Near the centers of the domes, the soils are usually composed of a thick layer of organic material, subtended by a sandy mineral layer. The central parts of cypress domes often contain standing water year-round. Closer to the edges of the solution holes, the organic mantle on the soil surfaces is thinner and more likely to be subtended by sands with some limestone. Hydroperiods in these areas are also long, but they are not likely to be submerged during the dry season. In the margins of cypress domes, the community becomes transitional with the surrounding marl prairies, so that nutrient-rich organic material is not common in the soils, and the soils often become desiccated during the dry season. Limestone usually occurs near the substrate surface, so trees are often unable to establish root systems beneath this layer of rock. This substrate is marginal for cypress trees, so that the trees that survive in this area are usually less robust and attain a smaller stature than those near the wetter central part of the dome. Also, since the trees in this marginal area are scattered and do not form a complete canopy, sufficient sunlight reaches the ground to support a substantial grass community, similar to that found in the adjacent prairies. Dry season fires are common in prairie communities and they are carried into the cypress ecotone by the grassy ground cover. These fires ordinarily don't kill the cypress trees, but can damage them enough to slow their growth. Thus, a difference in habitat conditions occurs, from a moist, nutrient-rich substrate with almost no fires near the center of the dome to a seasonally dry, nutrient-poor substrate with frequent fires at the periphery. The result is a community that supports tall, vigorous trees near the center of the dome with progressively shorter, less vigorous trees toward the margins.

In many cypress domes, the centers of the domes have no trees. In these communities, the solution hole is too deep in the center for cypress trees to become established, and open water is common. Some support alligator flag (*Thalia geniculata*), willow (*Salix caroliniana*) or other plants that can tolerate deeper water, but trees seldom occupy these areas. As these deeper solution holes almost always hold water year-round, they are important refugia for aquatic animals. Alligators (*Alligator mississippiensis*) are common in these holes, especially during the dry season.

Cypress Prairie

These are communities that are ecotonal (transition) communities between short grass prairies and cypress-dominated swamp communities, and typically contain elements of both prairies and cypress swamps. Cypress prairies are usually dominated by graminoid ground cover made up of species common in prairies, such as muhly grass (*Muhlenbergia capillaris*), or saw grass (*Cladium jamaicense*). Bald cypress (*Taxodium distichum*) trees are common in these prairies, but seldom attain a large size. This is partly because the limestone caprock that is a common component of substrates in our area, is close to the soil surface, and inhibits the establishment and growth of cypress trees. Small solution holes or fractures that perforate some areas of the caprock beneath prairies allow cypress trees limited growth. This results in limited area for cypress trees to grow, so that they are able to become established, but remain small. These trees may persist for several decades, but do not get large; these trees are termed 'dwarf' or 'hatrack' cypress.

Cypress Strand

Cypress strands are swamps that are dominated by cypress (*Taxodium distichum*) trees, similar to Cypress Domes (see above: Cypress Dome). The primary difference is that a strand is an elongate or linear feature, rather than a small, discrete, dome shaped community. Strands are generally much larger than domes, and so may be more diverse and biologically complex. Strands often contain hardwood trees that are adapted for hydric conditions, such as pop ash (*Fraxinus caroliniana*) or red maple (*Acer rubrum*). Shrub layers are sparse, but may consist of scattered dahoon holly (*Ilex cassine*), myrsine (*Rapanea punctata*), or swamp dogwood (*Cornus foemina*). Ground cover may be nearly absent, as hydroperiods are often long, or it may be ephemeral and appearing during the dry season; swamp fern (*Blechnum serrulatum*) is a common ground cover dominant in strands.

The substrates of these communities are often slightly lower than the surrounding communities, and are flow ways of inland swamps. Soils are mostly a thick layer of organic detritus subtended by sand or sand with limestone. Substrates are inundated or saturated with water nearly year-round.

Mixed Hardwood and Cypress Swamps

Cypress swamps that contain significant populations of hardwood trees that co-dominate the tree canopy with bald cypress trees are often referenced as mixed hardwood and cypress swamps. Red bay (*Persea borbonia*), sabal palm (*Sabal palmetto*), pond apple (*Annona glabra*), or laurel oak (*Quercus laurifolia*) commonly co-dominate these communities (also, see above: Cypress Strand). Epiphytes are common in these communities, as greater tree diversities result in greater diversities of substrates available to epiphyte establishment. Several bromeliads (*Tillandsia* spp., *Guzmania monostachia*) and orchids, such as epidendrums (*Epidendrum* spp), and ghost orchids (*Polyradicion* (*Polyrrhiza*) *lindenii*) are found on the trunks and branches of these trees. Epiphytic ferns, such as shoestring fern (*Vittaria lineata*) and golden serpent fern (*Phlebodium aureum*) are common on the trunks of sabal palms. Vines, including poison ivy (*Toxicodendron radicans*), several grapes (*Vitis* spp.) and ratan vine (*Berchemia scandens*) are also common components of the tree canopy. These swamp communities are usually diverse, and may represent a stage of community succession later than the bald cypress-dominated community.

Marshes

Marshes are wetland communities that are dominated by herbaceous plants and occasional shrubs. These communities are typically inundated nearly year-round, and have substrates with a thick organic mantle on the surface. Marshes are usually

dominated by herbaceous species, but a marsh that is dominated by grasses or sedges may be considered a graminoid marsh. Grasses usually occur in areas with some part of the year without standing water, but related graminoids (grass-like plants) may be common in areas with prolonged hydroperiods. The graminoid that is probably most common in such areas is saw grass (*Cladium jamaicense*). Saw grass is a sedge (Cyperaceae) that is commonly found in wetlands with various depths to limestone, often with a significant organic peat layer covering the limestone. This organic layer is usually derived from sawgrass. Other similar communities that are dominated by different grass-like plants may also be graminoid marshes, and would be identified by the graminoid that is the dominant ground cover plant.

Marshes are commonly dominated by broad-leaved plants, such as pickerel weed (*Pontederia cordata*), cat-tail (*Typha domingensis* or *T. Latifolia*), or duck potato (*Sagittaria* spp.). These wetlands have comparatively deep water (1.5 – 2.0 m) during the wet season, and persist as aquatic communities year-round or well into the dry season. These deeper areas provide refugia for fish during dry seasons, when few places are under water, and also tend to concentrate populations of fish and other aquatic animals as water levels decrease with dry weather. Many wading birds, such as wood storks (*Mycteria americana*) and American egrets (*Casmerodius albus*) depend on these concentrated prey populations, to find sufficient food for nesting and brood rearing.

Hardwood Hammock

Hardwood hammocks are communities that occur on slightly elevated areas, so that the soils are generally drier than the surrounding wetlands. This results in a more mesic (intermediate between wet and dry) community than most of the surrounding area. Hammocks are usually small (1 ha. or less) areas that are surrounded by other communities; in our area, the surrounding community is typically a wetland swamp or prairie. These slightly elevated areas are typically sandy areas that may have been deposited during an interglacial era. Some hammocks are sites of pre-Columbian human habitation, where Calusa Indians had temporary habitation sites. Some of these sites appear to have been augmented by prehistoric people, but most were probably areas that were used part of the year for subsistence hunting and gathering.

Hammock are usually dominated by hardwood trees with sabal palms. Near the coast, these hammocks are protected from frosts by the thermal inertia of the adjacent Gulf of Mexico, so that tropical hardwoods dominate these hammocks. Many of these hammocks are located on shell mounds that were constructed by the Calusa Indians. These shell mounds are middens, composed mostly of discarded mollusk shells. The soils of these mounds are very porous and subject to desiccation during the dry season, but are apparently fertile, as they support a high diversity of tropical hardwoods, including, gumbo limbo (*Bursera simaruba*), mastic (*Mastichodendron foetidissimum*), and poison wood (*Metopium toxiferum*). Soils that support tropical hardwoods are often shelly, while sandy soils often support oak trees; soils that support sabal palms are often sandy with shells mixed in. In these coastal systems, the wetland community that surrounds these hammocks is usually an intertidal mangrove forest.

Hammocks that occur inland are usually surrounded by freshwater wetlands; these may be swamps (wetlands dominated by trees) or wet prairies (wetlands dominated by herbaceous ground cover). Inland hammocks are usually dominated by live oak (*Quercus virginiana* or *Quercus laurifolia*) trees with understories made up of cocoplum (*Chrysobalanus icaco*), snowberry (*Chiococca alba*), and beauty berry (*Callicarpa americana*). Ground cover is sparse, usually consisting of tufted grasses such as bluestem (*Andropogon virginicus*). Epiphytes are common, especially on the branches of oak trees, where resurrection fern (*Polypodium polypodioides*) and many bromeliads (*Tillandsia* spp.) grow. Many epiphytes also occur on the trunks and bootjacks (leaf bases that remain for some time on the palm trunk) of sabal palms, such as shoestring fern (*Vittaria lineata*), and golden serpent fern (*Phlebodium aureum*). Vines, such as poison ivy (*Toxicodendron radicans*), several grapes (*Vitis* spp.), and pepper vine (*Ampelopsis arborea*) are common canopy components. Elevated areas with sandy soils and limestone near the substrate surface often support cabbage palm (sabal palm) hammocks. These hammocks are usually not especially diverse, and have few trees other than sabal palms forming the tree canopy. Shrubs are uncommon, and ground cover is sparse. Vines and epiphytes may occur on the palm trunks, but these are also usually sparse.

Herbaceous Prairie

Prairie communities in our area are typically seasonally inundated, short grass communities. Herbaceous broad-leaved plants are common components of these communities, but do not usually dominate them. Graminoids (herbaceous grasses or grass-like plants) such as muhly grass (*Muhlenbergia capillaris*), blue maidencane (*Amphicarpum muhlenbergianum*), or south Florida bluestem (*Schizachyrium rhizomatum*) often dominate these prairies. Prairie communities often develop in areas with limestone caprock near the ground surface. In these communities, the thin layer of soil above the caprock does not support trees, so that vegetation is limited to ground cover. These areas are inundated for part of the year, and receive much sunlight, so that algae and cyanobacteria proliferate in the water. These autotrophs, and other associated microbes, form periphyton, a microbial community that is common in prairies. Periphyton is important as an early link in the wetland food web, and as a substrate-generating component of prairie communities. Photosynthetic activity of the periphyton autotrophs changes the pH of the surrounding water (see above: Cypress Domes), so that calcium carbonate is precipitated from the water to form marl, a fine calcium carbonate mud that is typical of prairie substrates.

Prairie communities may occur on many soils, but are often found on frequently flooded fine sands or calcium carbonate marls; limestone is commonly near the soil surface in prairie areas. Soil types that often support prairie communities are: Pennsuco silt loam; Ochopee fine sandy loams; Hallandale and Boca fine sands; Kesson muck, frequently flooded; Estero and Peckish soils, frequently flooded (Liudahl et al. 1998). The preserve will minimize the effects of wheeled off road vehicles in areas with, but not limited to, the following soils as indicated in Liudahl et al (1998): Pennsuco silt loam; Ochopee fine sandy loams; Hallandale and Boca fine sands; Kesson muck, frequently flooded; Estero and Peckish soils, frequently flooded.

Mixed Hardwood-Cypress Strand

Mixed hardwood and cypress strands are swamps (wetlands dominated by trees) co-dominated by cypress and hardwood trees that are adapted for hydric conditions (see above: Cypress Strands).

Pine Forest

Pine forests occur in areas that are higher than most wetlands, so that their substrates are seldom inundated. In our area, slash pine (*Pinus elliottii*) dominates these communities. Slash pine forests are woodland communities with pine trees that are spaced several meters apart, so that an incomplete tree canopy is formed. Substrates of pine dominated communities may be mostly sand or limestone with small solution holes. Pine communities with sandy substrates typically form a pine and palmetto community, where scattered pine trees form an open (incomplete) canopy with a dense shrub layer composed mostly of saw palmetto (*Serenoa repens*). The palmetto shrub layer is usually dense so that ground cover does not become well established.

Slash pine dominated communities that occur on limestone outcrops are termed pine rockland communities. These areas also develop a palmetto shrub layer, but the densities of palmettos are usually not as dense as in the pine and palmetto communities. This allows the establishment of other shrubs and ground cover, so that pine rocklands are often more diverse than pine and palmetto communities living on sandy substrates. Pine rockland communities often contain plants that are associated with the Atlantic coastal ridge communities.

The pine and palmetto, and pine rockland communities are typically mesic communities, but frequently include extensive ecotonal (transitional) areas adjacent to wetlands. These ecotonal communities have brief or infrequent hydroperiods, and contain elements of the adjacent wetlands. Palmettos are apparently not well adapted for hydric conditions, and are not common in areas with soils that are saturated or inundated often. Slash pines, however, tolerate some hydric conditions, so that in areas with short hydroperiods, slash pines commonly live without the saw palmetto understory. In these areas, the open pine canopy allows sunlight to penetrate, so that graminoids commonly found in prairies are supported. In areas adjacent to cypress swamps, both bald cypress and slash pine trees occupy areas that are intermediate between mesic and hydric. These ecotonal communities are commonly referenced as 'hydric pine flatwoods'.

Pine Forest with Cypress Associates

This is an ecotonal forest type that is transitional between pine forests and bald cypress swamps. It is often referenced as 'hydric pine forest' (see above: Pine Forest). Through Big Cypress, changes in elevation are gradual, so that differences in

hydroperiods are not distinct between forest communities. In this case, the area between a mesic pine forest and a hydric cypress forest may be large, with gradual change from one to another. In this case, the resident trees of both hydric and mesic communities are able to tolerate the intermediate conditions between both communities, so that components of both communities are able to survive to form a significant transition community between both distinct communities. This ecotonal community is dominated by slash pine (*Pinus elliottii*) and bald cypress (*Taxodium distichum*), with graminoids commonly found in wet prairies.

Mangrove Forests

Mangrove forests (mangrove swamps) are intertidal wetlands dominated by hardwood trees that are tolerant of coastal, saline conditions. Mangrove trees are ecologically related by conditions common to coastal, tropical environments, but most are not closely related taxonomically. Three mangrove trees: red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*), a mangrove associate, are common in southern Florida. These trees make up a dense forest on much of the coast in southern Florida and form scattered tree islands farther inland, where surface waters become brackish, and seldom occur in fresh water communities. Substrates in mangrove forests are commonly organic peat, and may be several feet thick. These highly organic soils are usually submerged, so that they are anaerobic and acidic. Substrates near the coast are saline and affected by daily tides. Mangrove communities that are farther inland are affected by extreme tides, so that soil salinities may be different from coastal areas. These areas also are affected by seasonal runoff from inland freshwater systems, so that surface water and soil salinities may vary considerably with seasons. These changes in ground water and associated salt content create adverse conditions for most organisms, so that species richness in mangrove forests is usually low.

Disturbed Area

Areas that have undergone an alteration that has caused a change in community succession. This change may be caused by natural factors, such as fire, freeze, storms, extreme tides, etc., or may be caused by human activities, such as fire, introducing exotic species, earth moving, altering drainage, or altering the chemistry of water or soils.