SOUTHWEST DISTRICT
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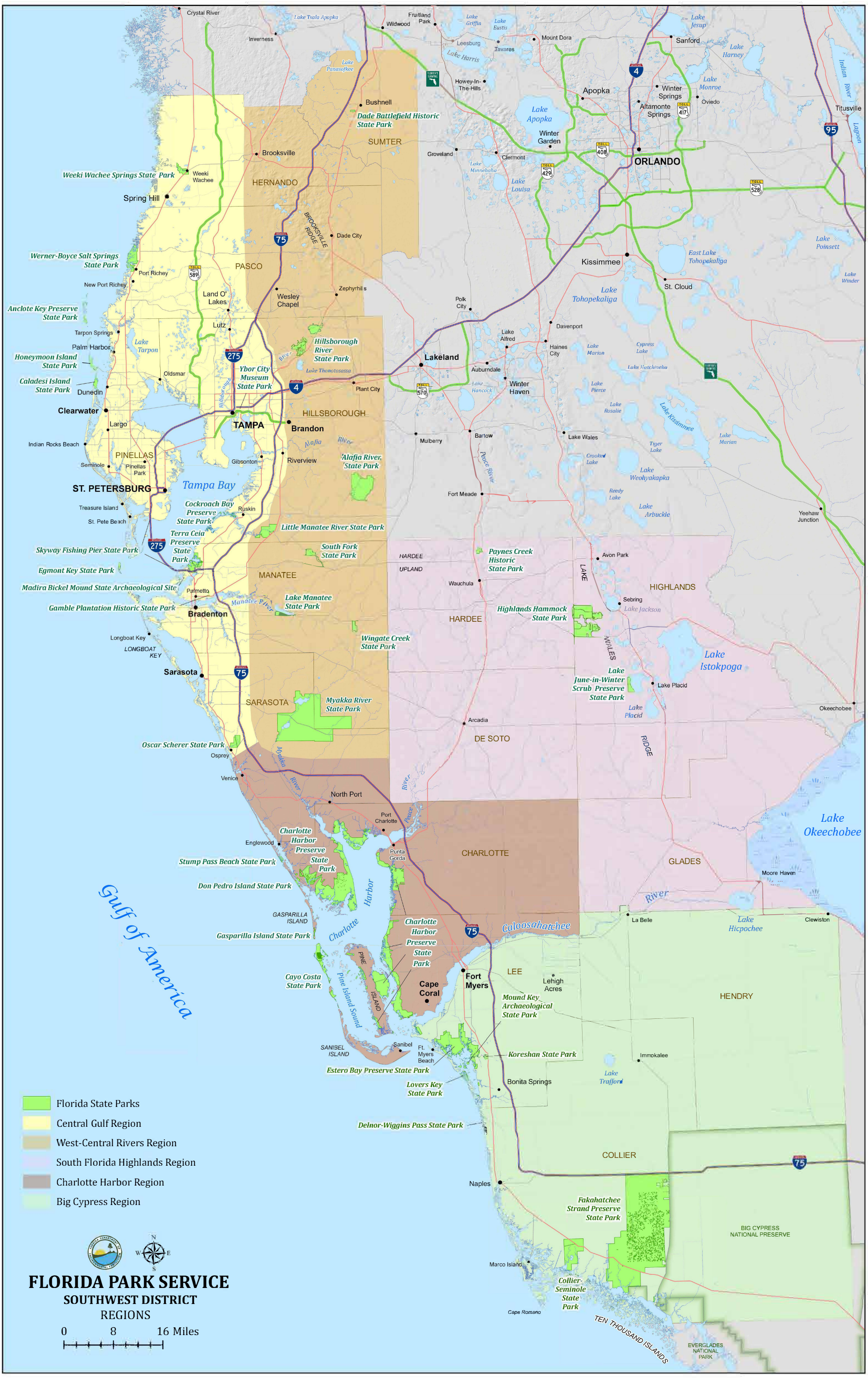
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SOUTHWEST DISTRICT

REGIONS OF THE SOUTHWEST DISTRICT

Covering over 13,000 square miles and ranging nearly 300 miles from north to south, the Florida Department of Environmental Protection's (DEP) Division of Recreation and Parks (DRP) Southwest District is home to a variety of natural landscapes including springsheds, prominent ridges, bay systems, barrier islands, dry prairies and subtropical forests. Excellent examples of these natural landscapes are preserved in the district's 36 state parks which are grouped into five regions based on common geography and natural resource characteristics.

Central Gulf Region

The Central Gulf Region comprises portions of Hernando, Pasco, Pinellas, Hillsborough, Manatee and Sarasota counties. The region is largely dominated by the sprawling metropolis of Tampa and other large coastal cities, including St. Petersburg, Bradenton and Sarasota. Another high population center is Spring Hill, a census-designated place of rapid commercial and residential sprawl located between Weeki Wachee Springs State Park and Werner-Boyce Salt Springs State Park in the region's north. As the region's name implies, most of the parks are coastal in nature consisting of barrier islands, estuarine marshes, mangrove forests and other natural communities associated with the Gulf maritime environment. The barrier island parks of Caladesi Island, Honeymoon Island and Anclote Key represent the northernmost extent of the Peninsular Coastal Lowlands which includes a chain of barrier islands stretching from Sanibel Island in the south to Anclote Key in the north. Egmont Key State Park, located at the mouth of Tampa Bay, is a component of this barrier chain. Cockroach Bay Preserve State Park, Terra Ceia Preserve State Park, Madira Bickel Mound State Archaeological Site and Gamble Plantation Historic State Park are in estuarine settings — the two preserves protecting large portions of Tampa Bay's southeastern shoreline. Ybor City Museum State Park and Skyway Fishing Pier State Park are in the urban centers of Tampa and St. Petersburg respectively. Situated at the southern end of this region is Oscar Scherer State Park, a unit largely comprised of xeric uplands and pine flatwoods in proximity to the Gulf.

West-Central Rivers Region

The West-Central Rivers Region spans portions of Sumter, Hernando, Pasco, Hillsborough, Manatee and Sarasota counties. Apart from Dade Battlefield Historic State Park, all the region's parks protect portions of West Central Florida river corridors. Hillsborough River State Park consists of two separate tracts, both serving critical roles in preserving upper reaches of the Hillsborough River. These tracts, along with other contiguous conservation lands, comprise a significant biodiversity preserve while protecting the water supply for the greater Tampa metropolitan area. Alafia River State Park was largely acquired to begin restoring a portion of the upland watershed of the river following decades of phosphate mining. Utilizing the altered topography, the park has become a destination for off road cycling and equestrian trail users. Little Manatee River and South Fork state parks are located along the Little Manatee River. Both protect sizable portions of watershed comprised of a variety of riverine and upland natural communities. Continuing south, Lake Manatee State Park provides resource-based recreation opportunities including access to Lake Manatee, a Class I water (municipal water supply) reservoir for the City of Bradenton and much of Manatee County. To the east, Wingate Creek State Park protects the

important headwaters of the Myakka River. Located downstream, Myakka River State Park is one of seven Civilian Conservation Corps (CCC) developed units within the Florida Park Service.

With 12 miles of the only state-designated Wild and Scenic River, over 15,000 acres of globally rare dry prairie and exceptional wildlife abundance, Myakka River State Park is a premier unit within the Florida State Park system.

South Florida Highlands Region

This interior planning region encompasses DeSoto, Glades, Hardee and Highlands counties, and is named for the notable highlands of the Lake Wales Ridge Complex. The region's three parks are situated along the prominent Lake Wales Ridge or the adjacent Hardee Upland Province. Located in the Hardee Upland at the confluence of Paynes Creek and the Peace River, Paynes Creek Historic State Park preserves the site and associated history of notable events following the Second Seminole Indian War. The park also protects segments of both riverine systems while providing resource-based recreation with an emphasis on river access. Highlands Hammock State Park is another of the CCC developed parks established in the 1930s. The park is located southwest of the City of Sebring and straddles the geomorphological divide of the Lake Wales Ridge and the Hardee Upland lending to its diversity of natural communities ranging from xeric uplands to old-growth forested wetlands. Lake June-in-Winter Scrub Preserve State Park is located approximately eight miles west of the Town of Lake Placid and occupies the entire western side of Lake June-in-Winter. The park protects one of the few remaining tracts of high rolling scrub along the southern Lake Wales Ridge.

Charlotte Harbor Region

Encompassing Charlotte Harbor and surrounding portions of Charlotte and Lee counties, this region is home to barrier islands, peninsulas and estuaries that provide important habitats and buffering of the Gasparilla Sound-Charlotte Harbor Aquatic Preserve. The vast Charlotte Harbor Preserve State Park lines much of Charlotte Harbor and both the Gasparilla and Pine Island Sounds, protecting not only estuarine nurseries but adjacent pine forests and scrub. The region's Gulf islands are at the south end of the Peninsular Coastal Lowlands barrier island chain. Beginning in the south, Cayo Costa State Park protects the majority of Cayo Costa Island as well as portions of North Captiva Island. Moving north, Gasparilla Island State Park is located just across Boca Grande Channel, preserving the island's history such as the Port Boca Grande Lighthouse. Continuing north, Don Pedro Island State Park is located near the midpoint of Don Pedro Island while Stump Pass Beach State Park is located just across Stump Pass Inlet at the far southern end of Manasota Key. The four parks preserve some of the last remaining examples of natural areas along the region's barrier islands and spits.

Big Cypress Region

Extending north to the Caloosahatchee River, south to the Ten Thousand Islands and west to the Everglades, the Big Cypress Region is home to barrier islands, vast estuaries, intriguing cultural sites and the world's largest strand swamp. Estero Bay Preserve State Park, Mound Key Archaeological State Park, Koreshan State Park, Delnor-Wiggins Pass State Park and Lovers Key State Park are located along or near the coast in the region's northwest corner. Serving as an estuarine buffer, the expansive marshes, salt flats and pine flatwoods of Estero Bay Preserve State Park protect the waters of the adjacent Estero Bay Aquatic Preserve. Nearby, Mound Key Archaeological State Park holds keys to Florida's ancient inhabitants, while Koreshan State Park tells the story of an industrious set of pioneers and their unique

beliefs. Lovers Key State Park, located on Black Island, preserves white sandy beaches, mangrove lined lagoons and tropical maritime hammock. The natural communities of Delnor-Wiggins Pass State Park are home to coastal wildlife in the vicinity of the Cocohatchee River. At the south end of the region are Collier-Seminole State Park and Fakahatchee Strand Preserve State Park. Collier-Seminole State Park protects a sizable portion of the great mangrove swamp of south Florida as well as diverse uplands that buffer the estuarine waters of the Ten Thousand Islands. At nearly 80,000 acres, Fakahatchee Strand Preserve is the largest state park in Florida and boasts the world's largest strand swamp, a haven for wildlife including many species endemic to south Florida.

SOUTHWEST DISTRICT GEOGRAPHY

Encompassing 15 counties, the Southwest District of the Florida State Park System extends north to the high hill country of the Brooksville Ridge, south to the Ten Thousand Islands and vast Everglades, and east to the Lake Wales Ridge. Several of the state's largest rivers are found within the district, including the Peace River and the Caloosahatchee River, the latter a highly altered riverine system that is part of the Okeechobee Waterway, the only water link across Florida, from the Gulf to the Atlantic Ocean. The coastline consists of bays and inlets, expansive salt marshes, salt creeks, mangrove swamps and barrier islands with white sand beaches. Two of the bay systems located in the district rank as the largest in Florida. Tampa Bay covers roughly 400 square miles and is surrounded by Hillsborough and Pinellas counties. The 40-mile-long bay is partly shielded from the Gulf on the west by the Pinellas Peninsula, where elevations reach 110 feet above mean sea level (msl). The smaller "interbay" peninsula extends southward toward the middle of the bay, forming Old Tampa Bay to the west and Hillsborough Bay to the east. Major rivers that drain into Tampa Bay include the Hillsborough, Alafia, Manatee and Little Manatee rivers. Charlotte Harbor is located 63 miles to the south and is surrounded by Charlotte and Lee counties. This bay system covers roughly 270 square miles, and its sprawling watershed covers a land area 10 times as large including portions of seven counties. This watershed includes the Myakka, Peace and Caloosahatchee rivers — all three draining into Charlotte Harbor.

The barrier-inlet system of the district includes 30 barrier islands and related inlets that extend 186 miles from Anclote Key in the north to Sanibel Island in the south. This barrier complex is one of the most morphologically diverse barrier island systems in the world, although manipulations over the past century include hundreds of miles of engineered channels and canals linking the massive developments of Punta Gorda, Cape Coral and Marco Island with the bays and ultimately the Gulf.

Population centers of the Southwest District have historically been concentrated in large coastal cities such as Tampa, St. Petersburg, Bradenton, Sarasota, Punta Gorda, Fort Myers and Naples; however, sprawling residential and commercial development in recent decades has resulted in suburban infill between these cities. Moving east through the interior of the district, inland counties are comparatively sparsely populated, with traditional land uses including agriculture, silviculture and mining.

SOUTHWEST DISTRICT GEOLOGY

The igneous and metamorphic rocks that form Florida's deep foundation were originally part of the ancient megacontinent, Gondwana. Over 250 million years ago, Gondwana collided with another megacontinent, Laurasia, to form the supercontinent of Pangea. Many millions of years later, tectonic motion began to break apart Pangea, with the basement rocks of Florida rifting from the African plate and remaining connected to the block of Laurasian rock that would become North America. It was upon these very old, African-born basement rocks that the sedimentary rocks of the Florida Platform (now 2–3 miles thick in some places) would begin to accumulate via the near-constant deposition of calcium carbonate from the skeletons of marine organisms.

Certain factors created the environment that was ideal for these organisms to thrive. The first two were warm water temperatures and shallow ocean depths where sunlight could reach benthic animals on the seafloor. The third was water clarity. During this vast span of time from the Late Cretaceous through the Oligocene — over a hundred million years — a channel known as the Gulf Trough, or Suwannee Straits, separated the Florida Platform from what is now continental North America (Randazzo and Jones 1997). Strong currents through the trough prevented sediments from the continent from reaching the platform, ensuring clear sunlit waters where marine organisms could thrive. Protected by the Gulf Trough, carbonates began to accumulate across the Florida Platform. Two major sedimentary rock units, or formations, that were deposited during this geologic span of time are the Avon Park and Ocala limestone strata. Avon Park Formation limestones and dolostones are the oldest rocks that can be found exposed at Florida's surface, and they sometimes contain well-preserved seagrass fossils indicative of their shallow water formation. In the Southwest District, the Avon Park Formation is closest to the surface beneath the relatively thin Hawthorne group and more recent organic sediments of the Green Swamp. The Ocala Limestone was deposited during the late Eocene over 35 million years ago and is a widespread Florida formation that is rich in invertebrate fossils, including the single-celled foraminifera. Other species of the Eocene represented in the fossil record of these formations include sea turtles, sea snakes, primitive dugongs (manatee-like creatures), toothed whales, fish, sharks and rays. The Eocene age Avon Park and Ocala Limestones are the main rock formations that make up the Floridan aquifer. The earlier Paleocene and Cretaceous age formations (Lake City Formations) have their own distinctive fossil fauna. Remains of ammonites and crinoids, bryozoans, brachiopods, bivalves and larger foraminifera have been recovered from deep wells that penetrate these much older strata.

By the Mid to Late Miocene Epoch, sediments eroding south from the continent had largely filled the Gulf Trough, allowing sand and clay from the Appalachians to spill onto the Florida Platform and be deposited on top of the carbonate rocks that had formed in the prior eras. The subsequent effects of several forces — coastal (erosion and deposition by coastal currents and wind during cycles of sea level rise and fall), karstic (dissolution of limestone by groundwater) and fluvial (riverine) processes — on the land's surface have shaped the topography, soils, hydrology and vegetation of the present-day landscape (Upchurch et al., 2019).

Although there is a trend in the age of surficial geology in southwest Florida of formations generally decreasing in age moving from north to south, the ages of surface strata and unconsolidated materials in the Southwest District vary significantly creating somewhat of a mosaic signature of geologic time. The oldest surface strata in the district occurs near the coast in Hernando and Pasco counties, where Oligocene age (23- to 34-million-year-old) Suwanee Limestone reaches the surface in springs and other karst features. Suwanee Limestone of similar age is also exposed along the shoals and banks of the upper Hillsborough River in Hillsborough County as well as near the surface in eastern Hernando County in proximity to Brooksville. Slightly younger limestones from the early Miocene Epoch (20–23 million

years ago) are exposed along lower sections of the Hillsborough River and in portions of western Manatee County. Portions of the hard-rock phosphate deposits of Florida occur in eastern Hernando County as well as much farther south in Hardee County. These phosphate-containing limestones were also formed during the early Miocene Epoch when phosphate-rich sediments derived from the waste products and skeletons of sea creatures, as well as phosphate precipitated from seawater, settled to the bottom of very shallow seas.

By the Late Miocene-Early Pliocene (10–2.5 million years ago) a global cooling trend led to the development of large polar ice caps. The climate was marked by episodes of glacial-interglacial cycles where continental ice sheets waxed and waned across much of North America. The resulting lower sea levels weakened strong currents, contributing to the final "filling in" of the Gulf Trough.

Concurrently, powerful North American rivers, swollen by meltwater during periods of glacial retreat, carried massive sediment loads, contributed to the "filling in" of the trough and blanketing the Florida platform with siliciclastic sediments (quartz-based sand, silt and clay).

The siliciclastic sediment supply began to decrease in the late Pliocene (roughly 3–4 million years ago), allowing for the deposition of the Tamiami Formation in south Florida, consisting of soft limestone and marl. The Tamiami Formation is at or near the surface across nearly all of Fakahatchee Strand Preserve State Park. This geologically younger limestone is particularly susceptible to erosion. The further decrease in siliciclastic sediments in the Pleistocene Epoch (2.6 million to 12,000 years ago) allowed for the deposition of calcium carbonate in the vast shallow lagoon that submerged the southern peninsula. Also occurring during the Pleistocene was the deposition of the Caloosahatchee and Fort Tompson Limestone formations that today lie just beneath the surface of the Everglades.

Lake Wales Ridge

The Lake Wales Ridge is the oldest and highest ridge in Florida, stretching about 100 miles from Clermont in the north to its southern terminus approximately 18 miles south of Lake Placid. Having formed over two million years ago during the Pleistocene Epoch, the ridge is a remnant of ancient beach and dune systems that were created by the rising and falling oceans associated with the ice ages. During the inundation periods of central and south Florida, only a narrow chain of islands protruded above water. It is the remnant of those islands that comprise the present-day Lake Wales Ridge.

The ridge is composed primarily of coarse clastic sands (bits and grains of eroded rocks which are unchanged from their parent materials). This sandy ridge has been dissected by streams and "straightened" on its flanks by coastal erosion during past interglacial periods when the ocean level was much higher than today. The ridge has likely persisted due to the presence of clayey, gravely, coarse quartz sand which has limited, but not completely prevented, dissolution of the underlying scarps. Local relief is quite pronounced along the ridge with elevations ranging from 150 to 305 feet above msl.

Karst Features and the Springs Coast

Geology of the Springs Coast Watershed at the north end of the district is characterized by porous limestone bedrock with waterfilled conduits and large caves known as karst landscape. Limestone rocks exposed at most of the Springs Coast springs, including Weeki Wachee Springs, belong to the Suwannee Limestone stratum. The Suwannee Limestone in this region is a tan to light brown fossiliferous limestone deposited 34–28 million years ago in the warm marine waters of the early Oligocene Epoch.

Surface and groundwater dissolves limestone more easily than most rocks, which leads to an increased number of openings and connections between the surface and the groundwater. At Weeki Wachee

Springs and other springs in the Springs Coast Watershed, these are direct connections into the Floridan aquifer system. Sinkholes, springs and stream-to-sink water bodies are characteristic topographic features within this karstic landscape and are all present within Weeki Wachee Springs State Park.

Stratigraphy

The limestone beneath Florida is divided into rock formations which are the basic units used in stratigraphy, the branch of geology pertaining to the layers of sedimentary rock that have accumulated over geologic time. The limestone layers that comprise the Florida platform belong to distinct formations depending on age, composition and location. The most recent widespread formation is identified as the Hawthorn Group. This stratigraphic unit includes several geologic formations in Florida that formed during the late Oligocene to Pliocene age (23–5.3 million years ago) and is characterized by phosphate-rich limestones. Beneath the Hawthorn group is the Suwannee Limestone formation, which formed during the Oligocene age (34–23 million years ago). The Suwannee Limestone consists of either white to cream colored calcium carbonate rock or tan colored dolomitized rock where magnesium has replaced calcium to form magnesium carbonate. Below the Suwannee Limestone is the Ocala Formation, which formed during the Eocene age (56–34 million years ago). The Ocala Limestone consists of nearly pure calcium carbonate limestone with occasional dolostones. It is at or near the surface within much of the Ocala Karst Geomorphological District which extends south into the Springs Coast Watershed, and its dissolution accounts for the area's abundant springs, sinkholes and other karst features. The oldest limestone stratum in the Southwest District is the Avon Park Formation (deposited during the early Eocene), although it does not reach the surface here. Older Cretaceous and Jurassic bedrocks lie beneath the Avon Park Formation but do not reach the surface anywhere in the state.

Environmental Geology

Geology and geomorphology of an area not only affect soil hydrology and chemistry, but can also influence physical landform, thus significantly influencing the vegetation. As an example, broad flat formations of near surface limestones overlain with siliciclastic deposits of quartz-based sands across much of the Southwest District result in poorly drained soils that support south Florida slash pine flatwoods.

Rising oceans that inundated nearly all of central and south Florida during an interglacial period roughly two million years ago, formed and delineated a chain of sand islands that persist today as the Lake Wales Ridge, characterized by deep sand entisols containing minimal organic content such that are essentially unaltered from the parent rocks from which they originally eroded. Although nearly 85% of the native vegetation has been removed from the Lake Wales Ridge to make way for agriculture and development, these Aeolian (wind eroded) soils of the Lake Wales Ridge once supported a vast strip of scrub and xeric pinelands.

Among the most apparent influences of underlying geology on natural community evolution occurs where the Tamiami Limestone Formation lies at or just beneath the surface in the southwestern part of the district. Surface water containing carbonic acid from rainwater dissolves narrow fissures in the limestone and causes them to grow into wider basins. Over time, the accumulation of sediments within these basins supports trees and other woody vegetation, eventually leading to the formation of closed canopy forests of Bald cypress, subtropical hardwoods and palms known as strand swamps. Varying stages of this evolution of biogeology can be observed at Fakahatchee Strand Preserve State Park, ranging from a thin line of cypress trees meandering through an early (narrow) crack in the limestone to the largest strand swamp in the world.

SOUTHWEST DISTRICT GEOMORPHOLOGY

Geomorphology is the study of landforms and their origins, probing the physical features of the land surface and their relation to the underlying geologic structures. The boundaries of the Southwest District overlap with four of the 10 geomorphological districts described in the Florida Geomorphology Atlas. The geomorphological districts and provinces that contain park units within the Southwest District are described below. Each Southwest District region is also referenced for each province.

Geomorphological Districts and Provinces

Ocala Karst District

The Ocala Karst District encompasses a large swath extending from the Georgia border south along and inland from the Gulf Coast, where it terminates at Tampa Bay. The multiple provinces making up this district are diverse but generally characterized by karst features resulting from dissolution of the underlying Ocala Limestone, and, to a lesser extent, the Suwannee Limestone. Numerous sinkholes, sinking streams (a river that disappears underground) and swallets of inland portions of this district make it a key area for recharge of the Floridan aquifer. Where the land surface intersects with the Floridan aquifer system potentiometric surface, springs are also abundant, especially near major rivers, escarpments and the coast. In large part, these springs and other karst features of the Ocala Karst District — many of which are protected and showcased in state parks — contribute to Florida's global geological significance.

Although the provinces making up the Ocala Karst District are geologically similar, they are nonetheless varied. Level, poorly drained karst plains occurring near the coast give way to the Bell and Brooksville ridges, where ancient shoreline processes created spits, sand bars and dune fields that are now being modified by dissolution of the underlying limestone. East of the ridges, the district generally consists of rolling hills punctuated by sinkholes and other karst landforms.

Tsala Apopka Plain

Region: Central Gulf Coast

The Tsala Apopka Plain Province is a moderately flat, inland karst plain lying east of the Brooksville Ridge and crossed from south to north by the Withlacoochee River. Sinkholes, sinkhole lakes and other large karst features occur throughout the province. Eocene Ocala Limestone is the oldest stratum affecting landforms in most of the region and is responsible for the karst features in the landscape. However, there are some places where the Avon Park Formation is near the surface. There is a thin mantle of Quaternary undifferentiated sediments over the limestone throughout the province, and in some areas Miocene undifferentiated Hawthorn Group, Pliocene-Pleistocene reworked Cypresshead sediments or Quaternary beach ridge and dune sediments occur.

Green Swamp Province

Region: Central Gulf Coast

The Green Swamp Province is a relatively flat area in southeastern Hernando, eastern Pasco, southern Sumter, southwestern Lake, northern Polk and northeastern Hillsborough counties. The province is characterized by abundant cypress swamps that are the headwaters of the Withlacoochee and Hillsborough rivers. The Eocene age Ocala Limestone stratum rises near the surface beneath the entire Green Swamp Province, forming an area with a high potentiometric surface. Essentially, the top of the Floridan aquifer is very much available to both receive rainwater for recharge and discharge groundwater as a source for the formation of surface streams. The province generally increases in

Crystal River Karst Plain

Tsala-Apopka Plain

Lake Apopka

Brooksville Ridge

Swamp

OCALA KARST DISTRICT

Land O' Lakes Karst Plain

Green

Pinellas Ridge

Tampa Bay

Lake Kissimmee

Bombing Range Ridge

BARRIER ISLAND SEQUENCE DISTRICT

LAKES DISTRICT

Osceola Plain

Hardee

Peninsular

Lake Wales Ridge Complex

Lake Istokpoga

PEACE RIVER DISTRICT

Upland

Coastal

Okeechobee Plain

Lake Okeechobee

Gulf of America

Lowlands

Charlotte Harbor

Valley

Caloosahatchee

Caloosahatchee River

EVERGLADES DISTRICT

Everglades

Immokalee Rise

Big Cypress

Everglades

Florida State Parks

Geomorphological Districts

Geomorphological Provinces

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FLORIDA PARK SERVICE

SOUTHWEST DISTRICT

GEOMORPHOLOGY DISTRICTS & PROVINCES

0 10 20 Miles

elevation from west to east, ranging from 40 feet above msl in the southwest to more than 180 feet above msl in the eastern part of the province, toward the boundary with the Lake Wales Ridge Complex.

Land O'Lakes Karst Plain Province
Region: Central Gulf Coast
The Land O'Lakes Karst Province is a coastal karst plain spanning portions of Hernando, Pasco and Pinellas counties. This area is marked by coastal springs, dry sinkholes and shallow depressions, as well as relict sand dunes, formed during the preceding interglacial period when sea levels were higher than today. Where they have been spared from development, these relict dunes support scrub and xeric pineland. All these geomorphological characteristics are exemplified at Weeki Wachee Springs State Park, located along the U.S. Highway 19 corridor in Hernando County.

The Land O'Lakes Karst Plain is underlain by Eocene Ocala Limestone and Oligocene Suwannee Limestone. The Pliocene undifferentiated (Hawthorne Group) stratum overlies the carbonate sediments in parts of the province. The abundance of more recent Quaternary undifferentiated sediments (dune ridge sands) have been important to the formation and persistence of ancient dune fields. Elevations in the Land O'Lakes Karst Plain range from mean sea level at the Gulf coastline to 140 feet msl. Ninety percent of the land surface is below 85 feet in elevation. The highest elevations are along the ancient dune fields near the coast, or similar topographic features adjacent to the Brooksville Ridge.

<u>Lakes District</u>
The Lakes District occupies much of central peninsular Florida. It is a geomorphically complex district with numerous, north-south trending ridges separated by valleys and large lakes. The district also includes an important segment of the St. Johns River valley and the headwaters of the Peace and Ocklawaha rivers. The Lakes District extends into the Southwest District along Lake Wales Ridge in Polk and Highlands counties. Consistent with other areas within the Lakes District, the landscape is shaped by the thick layer of Pliocene to Pleistocene undifferentiated sediments that overlie the Eocene Ocala Limestone and Oligocene Suwannee Limestone strata. These deep sands, reworked during alternating cycles of sea level rise and fall, comprise the district's prominent sandhills and scrub ridges.

Lake Wales Ridge Complex Province
Region: South Florida Highlands
Southernmost of the Lakes District provinces, the Lake Wales Ridge Complex is a prominent linear highland running from southern Lake County to southern Highlands County. The oldest geologic units at the land surface are coarse clastic soils (sands essentially unaltered from the eroded parent rocks) and are part of the Hawthorne Group. These materials extend to great depths, providing a durable base that has helped sustain the topography of the Lake Wales Ridge over geologic time. In most areas, more recent Pliocene-Pleistocene Cypresshead Formation dune sands are at the surface and form the high rolling hills that characterize the Lake Wales Ridge from Clermont to Lake Placid. Underlying the deep sands are Eocene Ocala Limestone and Oligocene Suwannee Limestone strata.

The influence of sea level fluctuations on the development of the Lake Wales Ridge Complex is evident by the straight north-south orientation, nearly parallel with the Atlantic Coastline. The ridge complex was largely created by coastal and aeolian processes that occurred approximately two million years ago during a time of much higher sea level, when the remainder of central and south Florida were underwater. Since then, the ridge has been extensively modified by fluvial and karst erosional processes. The most obvious karst landforms on the Lake Wales Ridge are numerous sinkholes and sinkhole lakes.

The size of the sinkholes and sinkhole lakes in the valleys and on the ridges is often large because of the thickness of the sand cover over the limestone.

Other significant karst features are present in the upper part of the Peace River valley in vicinity of Paynes Creek Historic State Park. This area of the Lake Wales Ridge Complex contains several swallets, some of which are in-channel siphons and others capturing water only during high-flow conditions.

Peace River District

The Peace River District covers a vast portion of the Southwest District including portions of Pinellas and Hillsborough counties in the north, portions of Polk and Highlands counties in the east, and portions of Glades, Hendry and Lee counties in the south. The oldest geologic stratum usually affecting the land surface is the Oligocene-Pliocene Hawthorn Group. This limestone containing stratum thickens southward through the district. Dissolution and associated rock-collapse sinkholes occur in these southern areas and are examples of cenotes (sinkholes with a relatively wide-open connection to aquifers). Warm Mineral and Little Salt springs in southern Sarasota County are the best-known examples.

The landscape of the Peace River District is relatively flat with limited relief. Gradual elevation changes occur from higher elevations in the eastern part of the district to lower elevations along Tampa Bay and the Gulf coast. Relatively impermeable, siliciclastic sediments of the upper Hawthorne Group limit recharge and allow the development of numerous rivers and streams. These rivers and streams are incised to varying degrees, the result of fluvial erosion.

The barrier islands, from Anclote Key in the north to Sanibel Island in the south, are the products of longshore processes during the Holocene sea level transgression. The estuaries in the district have extensive, low-energy shorelines that were historically mixed tidal marsh and mangrove swamp. Tampa Bay and Charlotte Harbor are major estuaries formed by fluvial erosion and karstification during periods of low sea level. These bays were backfilled with sediments during later periods of higher sea level. Both estuaries have complex geological histories that reflect numerous sea level fluctuations over geologic time. Discharge from the Hillsborough, Alafia, Little Manatee and Manatee rivers formed the now-drowned valley of the Tampa Bay estuary. The Myakka and Peace rivers contributed to the development of Charlotte Harbor.

Hardee Upland Province

Regions: West-Central Rivers, South Florida Highlands

The Hardee Upland Province is a broad, elevated plain between the Lake Wales Ridge Complex Province (Lakes District) to the east and the Peninsular Coastal Lowlands Province to the west. The northeastern part of the Hardee Upland Province, in vicinity of Alafia River State Park, has notable hills reaching 180 feet in elevation. Topography in this northern portion of the province has been dramatically altered by the mining of phosphate. The Central Florida Phosphate District and Southern Extension Phosphate District occur largely within the province. The topography becomes progressively flatter moving south and west.

Surface streams such as the Alafia, Little Manatee and Manatee rivers are numerous due to the relatively impermeable Hawthorn Group stratum that occurs near the land surface throughout much of the province. Most of the streams within the Peace River District have their headwater within the Hardee Upland Province for this very same reason.

Peninsular Coastal Lowlands Province
Regions: Charlotte Harbor, West Central Rivers, Central Gulf Coast
The Peninsular Coastal Lowlands Province forms the western part of the Peace River District. The province occurs from the Anclote Keys of Pinellas and Pasco counties to Sanibel Island and northern Lee County. It extends eastward to include western Hillsborough, western Manatee, most of Sarasota and Charlotte, southwestern DeSoto and Glades counties and northwesternmost Hendry County.

Regions adjacent to the coast exhibit evidence of planation — a gradual leveling and lowering of once irregular land-surface due to coastal marine erosion during periods of higher sea level. The greatest variability in elevation along the eastern side of the province, specifically within the river valleys, which drain to the west and south. Increase in local relief along the river corridors is a result of incision during periods of lower sea level. Elevations in the Peninsular Coastal Lowlands Province generally vary from sea level to 60 feet above msl. Ninety percent of the elevations are between sea level and 45 feet above msl.

The most common karst features in the province are cover-subsidence sinkholes that form in the wide-spread tertiary-Quaternary shelly sediments. The abundance of these sinkholes increases to the south, becoming especially numerous in southern Sarasota and northern Charlotte counties. There are also a small number of deep, water-filled, rock-collapse sinkholes located in portions of the province where the Hawthorn Group limestone stratum is near the surface. These deep sinkholes are cenotes that likely originate in the Eocene age Ocala limestone. Warm Mineral and Little Salt springs in Sarasota County are the best-known examples. Interestingly, stalactites and stalagmites (dripstone formations) are present on the walls of Warm Mineral Springs as deep as 30 meters below present water level, indicating that that these areas of the sinkhole were part of a terrestrial cave system during a past period of extended glaciation when sea levels were much lower than present day.

The barrier islands in the Peninsular Coastal Lowlands Province consist of at least 30 islands and associated inlets stretching from Lee County in the south to Pinellas County in the north.

Pinellas Ridge Province
Region: Central Gulf Coast
The Pinellas Ridge Province, located in Pinellas County, is an isolated ridge surrounded by lowlands. The province is almost surrounded by the Peninsular Coastal Lowlands Province (described above). Elevations within the Pinellas Ridge Province range from sea level along St. Joseph Sound to over 100 feet above msl. Ninety percent of the elevations in the province range from approximately 20–80 feet above msl. The higher elevations along the ridge are the result of aeolian sand deposition along the immediate shoreline during a past period of higher sea level.

<u>Everglades District</u>
The Everglades District includes all of Collier, Broward, Miami-Dade and Monroe counties. Almost all of Hendry County lies within the district. The southern two-thirds of Lee County and parts of Okeechobee, Highlands, Glades, Martin, St. Lucie and Palm Beach counties also lie within the district.

This large area is comprised of some of the most recently deposited strata and correspondingly youngest landscapes in Florida. All strata and any veneer of overlying sediments were deposited in the Pliocene-Pleistocene and Holocene epochs respectively. Many areas are characterized by wetlands; others include Pleistocene to Holocene carbonate islands and coastal ridges. Drainage in much of the district consists of surface water sheet flow, predominantly from north to south. All the provinces in the

district share several characteristics: (1) they are geologically young, (2) their landforms are closely related to Pliocene-Pleistocene coastal and marine shelf sedimentation and Holocene wetland development and (3) drainage is largely by way of sloughs, sheet flow in wetlands and poorly defined stream systems.

Drainage in the Everglades District reflects the elevations of the land surfaces of the provinces. With a few exceptions, pre-development drainage was by sheet flow and through sloughs (wetlands). The dominant flow of water through the central and eastern Everglades District has historically been from north to southwest. Flow beginning in the Kissimmee River valley would discharge to Lake Okeechobee, then over the low, natural sills on the south side of the lake, and finally as sheet flow through the Everglades Province. During the rainy season and high-water events, excess water could also flow west through Lake Hicpochee and Lake Flirt into the upper reaches of the Caloosahatchee River, and rarely to the east toward the St. Lucie River. Former Pleistocene tidal channels through the Atlantic Coastal Ridge Province, known as the transverse glades (Hoffmeister, 1974), also carried overflow from the Everglades eastward to the Atlantic Ocean. Where the flow through the transverse glades was in well-defined channels, river names, such as the Miami River, were applied. Drainage projects during the last 100 years have altered these natural drainage systems resulting in channelized rivers and numerous canals.

Big Cypress Province
Region: Big Cypress
The Big Cypress Province is primarily located within Collier County and includes areas of southern Lee and Hendry counties and small areas of Broward, Miami-Dade and Monroe counties. The Pliocene Tamiami Formation underlies the entire Big Cypress Province. The Tamiami Formation includes limestone and shelly sand facies, both of which control karst development. Throughout the nearly 80,000-acre Fakahatchee Strand Preserve, the Tamiami Formation is overlain by a calcitic mud (locally termed marl). These areas support seasonally inundated grasslands called marl prairies. Areas within the Fakahatchee Strand Preserve where the marl veneer and the underlying Tamiami limestone have eroded support various stages of strand swamp.

Tertiary-Quaternary shelly sediments occur in the northwestern and northeastern parts of the province. Outliers of the Tertiary-Quaternary shelly sediments exist in much of the province. The Pleistocene Miami Limestone occurs in the southeastern part of the province (Scott et al., 2001).

Caloosahatchee Valley Province
Region: Big Cypress
Located in central Lee, northern Hendry and southern Glades counties, this narrow province corresponds with the pre-development of the Caloosahatchee River valley. It includes the wetlands and lakes to the east that once drained overflow water from the Everglades and Lake Okeechobee to the Caloosahatchee River. Drastic alterations of the Caloosahatchee River began in the mid-19th century and entailed transforming the once meandering stream into a straight and deep channel via dredging. This included dynamiting a mile of exposed Tamiami limestone shoals along the upper most stretch of the original river that began just west of what was once a much larger Lake Hicpochee. Today the river is connected to Lake Okeechobee by the Caloosahatchee Canal.

Tertiary-Quaternary shelly sediments and Quaternary sediments occur where the province meets the estuaries of the Gulf such as the southern tracts of Estero Bay Preserve State Park. Coastal development has altered much of the river mouth coastline, but remnants of mangrove forests remain on conservation lands.

SOUTHWEST DISTRICT HYDROLOGY

Rivers and Watersheds

Numerous rivers, their associated watersheds and lakes lie entirely or partially within the Southwest District. The most significant rivers are introduced below and are depicted along with watersheds and major lakes in the district reference map. Watersheds in the Southwest District refer to land areas that drain to major rivers or ultimately to bay systems via hydrology which is largely defined as the movement of water in relation to land. Water moves within a watershed either along the surface, or below ground. Surface flow occurs within channelized streambeds or via sheet flow – the latter of which occurs during or following rain events. Subsurface flow occurs within aquifers, or just beneath the ground surface along confining layers such as clays and hardpans. Watershed boundaries can change over time depending on droughts or groundwater consumption.

Weeki Wachee River: The Weeki Wachee River originates at Weeki Wachee Springs, a first magnitude spring producing more than 117 million gallons of crystal-clear water per day. Numerous smaller springs are part of the Weeki Wachee Springs complex and contribute to the river's flow. The river flows 12 miles westward through Weeki Wachee Springs State Park and along the northern edge of the Weeki Wachee Wildlife Management Area before meeting the Gulf. The river's watershed is closely aligned with the Weeki Wachee Springshed, covering approximately 260 square miles in southern Hernando County, including a portion of the City of Brooksville and a small portion of northern Pasco County. The Mud River is the only tributary, emptying into the Weeki Wachee where the stream widens as it approaches the Gulf. The lower portion of the river is tidally influenced as it nears the Gulf.

Pithlachoscotee River: The Pithlachoscotee River drains approximately 195 square miles in parts of Hernando and Pasco counties. This blackwater stream originates at Crews Lake near Fivay Junction and flows southwest through Pasco County to the Gulf at New Port Richey. Jumping Gully and Five Mile Creek are the principal tributaries to Crews Lake and to the river, respectively. The Pithlachoscotee River is tidally influenced along its mid and lower sections.

Anclote River: The Anclote River drains approximately 100 square miles in Pasco and Pinellas counties. Originating in the cypress swamps west of Connerton, the stream flows southwest for approximately 30 miles before emptying into the Gulf just north of Tarpon Springs. Tributaries along the upper section of the river include Cross Cypress Branch, Sandy Branch and South Branch. Hollin Creek joins the river farther downstream at the north end of Salt Lake. The river is a component of the greater Coastal Pinellas/Anclote Watershed which contains 66 named lakes/ponds, 18 named rivers/streams/canals and three named bays.

Hillsborough River: This iconic river originates in the forested wetlands of the Green Swamp — a Designated Area of Critical State Concern for watershed protection, aquifer recharge and wildlife refugia. The stream winds for 57 miles before reaching Tampa Bay where it serves as the primary source of water for the City of Tampa. While the river begins as a tannin-stained blackwater stream, it receives significant input from spring runs along its winding course, improving clarity. The most significant spring source along its upper reach is Crystal Spring, a second magnitude spring that contributes approximately 30 million gallons of clear water to the river each day. The spring is vital to the river, particularly during drought periods when input from sheet flow and ephemeral tributaries diminishes.

Oklawaha
Lake Apopka
Withlacoochee River South
Wekiva River
Cape Canaveral
Crystal-Pithlachascotee
Upper St. Johns
Withlacoochee
Anclote River
Hillsborough
Tampa Bay
Alafia
Alafia River
Little Manatee River
Little Manatee
Manatee River
Manatee
Kissimmee
Vero Beach
Lake Istokpoga
Kissimmee River
Sarasota Bay
Myakka River
Peace
Northern Okeechobee Inflow
Florida Southeast Coast
Myakka
Peace River
Western Okeechobee Inflow
Lake Okeechobee
Gulf of America
Caloosahatchee
Caloosahatchee River
Charlotte Harbor
Big Cypress Swamp
Everglades
Lake Kissimmee

Watershed Boundaries
Florida State Parks
Elevation (Feet)
190
150

FLORIDA PARK SERVICE - SOUTHWEST DISTRICT
Watersheds, Lakes, Rivers

N
0 10 20 Miles

This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

The river's watershed is extensive, covering approximately 675 square miles spanning portions of Hillsborough, Pasco and Polk counties. Upper sections of the river contain rapids where swift moving water flows over limestone shoals and between exposed rock outcroppings. The most notable of these sections occurs within Hillsborough River State Park, although there are smaller rapids upstream as far as Crystal Spring. Major tributaries include Blackwater Creek, Flint Creek, Indian Creek, New River, Two Hole Branch, Basset Branch, Hollomans Branch, Cypress Creek and Trout Creek.

Alafia River: The North and South Prongs of the Alafia River both originate in western Polk County near the unincorporated towns of Pierce and Bradley Junction, respectively. The North Prong flows through rural areas and various conservation lands while the South Prong flows past active phosphate mining operations before passing through Alafia River State Park. The north and south prongs converge in Hillsborough County's Alderman's Ford Conservation Park to form the Alafia River proper. The river's watershed is approximately 418 square miles, draining large portions of Polk and Hillsborough counties to Tampa Bay at Gibsonton. Major tributaries, in addition to the North and South Prongs, include Buckhorn Creek, English Creek, Fishhawk Creek, Little Fishhawk Creek and Turkey Creek.

Alafia is a native word meaning "river of fire" likely due to the once abundant underwater pebble phosphate that presented a fiery glow under certain atmospheric and natural lighting conditions. Many of the lands surrounding the river, including what is today, Alafia River State Park, were mined for phosphate via open-pit and dragline mining practices, significantly altering natural watershed function. Additionally, phosphate spills, the largest of which occurred in 1997, have resulted in temporary impacts to fish and other wildlife in the river. Most recently, Tampa Bay Water and Tampa Bay Estuary Programs have partnered with DEP and the Southwest Florida Water Management District to restore portions of the Alafia watershed, including areas within the state park.

Little Manatee River: The Little Manatee River originates in the forested wetlands east of Fort Lonesome in eastern Hillsborough County. The stream flows through sandhill and bottomland forest for much of its roughly 40-mile course, picking up flow from several tributaries including Alderman Creek, Howard Prairie Branch, Pierce Branch, Carlton Branch, Gully Branch, Dug Creek, Cypress Creek and Curiosity Creek, as well as the South Fork of the Little Manatee River. Approximately 2 miles of the South Fork flows through South Fork State Park.

The river widens and is tidally influenced as it approaches Tampa Bay. The majority of the river's roughly 244-square-mile watershed falls within Hillsborough and Manatee counties and includes areas with significant alterations associated with phosphate mining.

Manatee River: The Manatee River watershed spans approximately 360 square miles, most of which is located within Manatee County. The headwaters of the East Fork of the Manatee River are in the Manatee County Duette Preserve — 21,000 acres of pine flatwoods, forested wetlands, oak scrub and dry prairie. Specifically, the East Fork originates in the basin marshes and basin swamps in the preserve's north tract. The river's North Fork originates in vicinity of phosphate mining lands just north of the Duette Preserve. Both Forks flow through the county preserve for approximately seven miles before their confluence. A dam was built to impound the river near Manatee County's Rye Park in 1964, creating Lake Manatee as a Class I water intended as a municipal reservoir to serve regional water needs. The river continues past the dam for another 20 miles before emptying into the mouth of Tampa Bay at Emerson Point Preserve. The last 10 miles is estuarine in nature and tidally influenced.

Myakka River: The Myakka River originates near the Hardee-Manatee County line and flows for approximately 72 miles through portions of Manatee, Sarasota and Charlotte counties before emptying into Charlotte Harbor. A 34-mile stretch of the river in Sarasota County was designated as a state Wild and Scenic River by the Florida Legislature in 1985. This stretch includes all 12 miles through Myakka River State Park, which serves as a sanctuary for an array of native wildlife. Species richness and overall abundance within and along the portion of the river through the park is among the highest of any location in Florida. The river flows through two large floodplain lakes, Upper Myakka Lake (958 acres) and Lower Myakka Lake (564 acres), both located within Myakka River State Park.

The river's watershed is large, spanning approximately 600 square miles, including many tributary streams. The last 15 miles widen, gradually becoming more estuarine in nature with tidal influence.

Peace River: The Peace River originates at the confluence of Peace Creek and Saddle Creek near the City of Bartow in Polk County. The river flows south through the cities of Fort Meade in Polk County and Arcadia in DeSoto County on its 106-mile course south to Charlotte Harbor. The riverbed is largely exposed limestone along the upper and middle stretches while the bottom along the lower stretch consists of sand and clay. Limestone boulders and outcrops are common along nearly the entire river course. Spanning nine counties, the greater Peace River watershed is over 2,000 square miles, among the largest in southwest Florida. This watershed extends north into the Green Swamp, a designated Area of Critical State Concern that contributes to the river's headwaters. Major tributaries of the Peace River include Bowlegs Creek, Paynes Creek, Charlie Creek, Joshua Creek and Horse Creek.

Caloosahatchee River: The Caloosahatchee River is located within the Coastal and Heartland National Estuary Partnership, a partnership between citizens, elected officials and resource managers that works to protect and restore the water and wildlife habitat in Central and Southwest Florida. The Caloosahatchee River Basin is a 425 square mile watershed that spans from Lake Okeechobee to San Carlos Bay and contains 62 named lakes/ponds, 92 named rivers/streams/canals and two named bays. This prominent southwest Florida river is among the most highly altered rivers in the United States. Major stream course and streambed alterations intended to drain adjacent wetlands and improve lands for agriculture targeted the headwaters and upper portion of the river in the 1880s. Prior to these alterations, the river originated in a geologic basin known as Lake Flirt about 2 miles east of LaBelle. The Lake Flirt basin was elevated 10 feet above the main river valley to the west, creating nearly a mile of limestone rapids along the river's far upper reach. Ephemeral marshes once linked Lake Flirt to Lake Okeechobee via a series of large lakes. Today, only a relict portion of Lake Hicpochee, the largest of these lakes, still exists. By the end of the 1880s, the Atlantic and Gulf Coast Canal and Okeechobee Land Company of Hamilton Disston had dredged a canal from Lake Okeechobee to the headwater of the Caloosahatchee at the western end of Lake Flirt. Additionally, the adjacent four-mile stretch of rock-bottom along the uppermost segment of the river, including the nearly one mile of rapids, was dynamited to deepen the channel. These alterations contributed to several disastrous flood events in the 1920s, prompting the U.S. Army Corps of Engineers and the precursor to the South Florida Water Management District to construct the Herbert Hoover Dike around Lake Okeechobee, straighten the channel of the Caloosahatchee and construct drainage canals and pumping stations to remove excess water from the river floodplain. The river was thus transformed from a meandering stream to a straight dredged channel.

More recent decades have brought blue-green algae into the Caloosahatchee as high waters in Lake Okeechobee must be released. Restoration work north of the lake along the Kissimmee River and its vast floodplain should help hold back flow into Lake Okeechobee and reduce the need for releases of algae and nutrient laden water into the Caloosahatchee River. Restoring the natural meandering bends to waterways like the Kissimmee River and Caloosahatchee River keeps water in riparian systems longer, allowing natural processes to purify the water.

Aquifers

Roughly 90% of Florida's drinking water supply is dependent on aquifers, which are underground storage areas that collect water that seeps down from the surface. The Floridan aquifer system is an important groundwater aquifer that underlies much of the state of Florida as well as southern portions of Alabama, Georgia and South Carolina. This is an extremely productive aquifer that consists of porous limestones from the Eocene epoch, predominantly the Ocala Limestone. Extensive recharge of the Floridan aquifer occurs in the northern third of the Southwest District via downward percolation of rainwater through porous sandhills like those of the Brooksville Ridge and extensive wetlands such as Green Swamp. These recharge areas also provide natural filtration of pollutants.

While much of Florida gets potable water from the deep Floridan aquifer, the lower two-thirds of the Southwest District relies heavily on the Intermediate Aquifer System for drinking water supplies. This aquifer is made up of permeable layers of sand, shell and limestone and is separated from both the underlying Floridan aquifer and the overlying surficial aquifer by confining layers of clay. This aquifer system starts in Hillsborough and Polk counties and extends south through Collier County. The Intermediate aquifer system is the main source of water supply for Sarasota, Charlotte and Lee counties where the underlying Floridan aquifer contains brackish water.

The top of the intermediate aquifer system slopes gently southward and southwestward. Its top is highest in western Polk County and lowest in southern Charlotte County. South of Charlotte County, the top of the aquifer system becomes flatter, then rises slightly. In places, the Intermediate Aquifer System can be divided into two aquifers, the Tamiami-upper Hawthorn and the lower Hawthorne-upper Tampa aquifer, separated in most places by an unnamed confining unit. The aquifer system thickens southward from Polk County into Charlotte County, then thins farther south in Collier County as the lower Hawthorn-upper Tampa aquifer becomes predominantly a clay matrix with little permeability. The Tamiami-upper Hawthorne aquifer is the principal water-yielding part of the intermediate aquifer system in Glades, Hendry, Charlotte, Lee and Collier counties.

Ground water flow between the Intermediate and overlying Surficial aquifers occurs where upper confining clay layers are locally absent, and the two aquifers are in direct hydraulic contact. In most cases water first moves downward from the surficial aquifer system, into the Intermediate aquifer, before rising once again to feed surface waters. Some water, however, percolates downward through the lower clay confining layer to recharge the underlying Floridan aquifer. Locally, in western Charlotte and Lee counties, some water leaks upward from the Floridan to the intermediate aquifer.

The potentiometric surface of an aquifer, the height to which the water in the aquifer would rise if it was unconfined, is an indication of the general direction of groundwater flow. The lateral direction of water movement in the Intermediate aquifer system is outward in all directions from two recharge areas in southwestern Polk County, where the potentiometric surface is more than 120 feet above msl. From these points, lateral flow is toward major surface streams and the Gulf. Anomalies to this

subsurface flow occur where water is withdrawn to serve municipal needs and are marked by depressions in the potentiometric surface. Two such locations correspond with pumping stations in western Sarasota County.

Withdrawals of freshwater from the intermediate aquifer system total approximately 298 million gallons per day in Southwest Florida. Roughly 10% is for public supply, 6% for domestic and commercial uses, and 78% for agriculture. The remaining 6% is for industrial, mining and thermoelectric-power uses.

Springs and Springsheds

There are over 1,000 known springs in Florida, among the largest — if not the largest — concentrations of freshwater springs in the world. The Southwest District extends north into the Springs Coast Watershed — a watershed region in the Southwest Florida Water Management District that includes springs, rivers, lakes and vast coastal wetlands. The Springs Coast has over 200 documented springs, including five first-magnitude springs that collectively discharge more than a billion gallons of water per day. These springs include Rainbow Springs, Crystal River/Kings Bay, Homosassa Springs, Chassahowitzka Springs and Weeki Wachee Springs. These springs support diverse ecosystems, abundant wildlife and provide stable water temperatures for overwintering manatees. Groundwater —largely from inflows at an escarpment to the east — flows west and emerges from springs near the coast, including Weeki Wachee Springs at the north end of the district.

Springsheds, the basins that contribute groundwater to a particular spring, are challenging to delineate. Through dye trace studies and other methods, understanding which areas contribute to specific springs is growing but still imperfect. Delineation of springsheds is important for protecting springs from contamination and for ensuring the maintenance of adequate minimum flows at the springs and in the waterways they feed. Dye trace studies have shown that movement from surface conduits to springs can be rapid, in some cases more than 1 mile per day.

Springsheds can fluctuate over time depending on the effects of drought, rainfall and groundwater pumping. As an example, increased groundwater pumping to meet the growing municipal water needs of ever-expanding suburban areas in Hernando County such as Spring Hill can impact the flow from Weeki Wachee Springs, particularly during periods of below average rainfall. Due to impacts from pollutants and groundwater consumption, DEP has been tasked with the development of Basin Management Action Plans (BMAP). The Weeki Wachee BMAP area consists of over 300 square miles located in southern Hernando County, including a portion of the City of Brooksville, and northern Pasco County. The BMAP area contains the Weeki Wachee Springs Group which is composed of a single, large main spring and numerous smaller springs spread over an area of nearly 5 square miles. Weeki Wachee Spring is the primary source of the Weeki Wachee River and the largest spring (by discharge) in the group. The BMAP area also contains the Magnolia–Aripeka Springs Group: Mud Spring, Salt Spring, Wilderness Spring (collectively referred to as the “Wilderness-Mud-Salt Springs Group”) and Jenkins Creek Spring, which are located within the Outstanding Florida Water boundaries of the Weeki Wachee riverine system.

<u>Reverse Flow and Brownouts</u>

If the back pressure from the river exceeds the flow from a spring, the spring can reverse flow and act as a swallet, or estavelle, as tannic river water causes a “brown out” with a dramatic reduction in visibility and light penetration. This typically occurs during high base flow periods and, in some springs, can be tidally related or result from heavy flood events. Brownouts are a natural occurrence, but due to reduced flows in many springs throughout the state, may occur more frequently than historically. These

back floods can cause diebacks of submerged aquatic vegetation and troglobitic animals, especially if prolonged.

Submerged Aquatic Vegetation

Documented increases in nutrient concentrations in the Upper Floridan aquifer over time (Cohen, 2007) have led to increased nutrients in springs throughout the state. This, in turn, is a partial explanation for plant community changes in springs and spring-run streams. The diverse assemblages of submerged aquatic vegetation, including vascular plants, that were historically common are now largely macroalgae-dominated systems. There has been widespread reduction in water clarity as well due to chlorophyll from overgrowth of phytoplankton. Many springs in the state have undergone similar changes in recent decades. Even where submerged macrophytes persist, periphyton can smother macrophytes, and large-scale macrophyte die-offs have occurred (Wetland Solutions Inc., 2010).

Saltwater Intrusion

With increases in sea levels, coastal natural communities and groundwater resources are undergoing impacts due to intrusion of seawater. Where the Floridan aquifer meets saltwater at the coast, a wedge of saltwater protrudes into the aquifer, with the interface between the saltwater and the less dense fresh groundwater increasing with depth further inland. As groundwater supplies decrease due to drought and groundwater extraction, this wedge moves inland, and the zone of mixing saltwater and freshwater moves upward. This affects both wetland natural communities and groundwater supplies. Shifts in coastal natural communities may occur as sea levels change and less salt-tolerant species experience increased mortality from increases in salinity. Coastal springs and drinking water supplies are also affected as the saltwater wedge moves inland and affects springsheds and wellfields.

SOUTHWEST DISTRICT NATURAL COMMUNITIES BY LAND COVER TYPE

The following is a summary of the Florida Natural Areas Inventory natural communities found collectively within the Southwest District state parks. These natural communities are categorized under more general land cover types. While many, such as mesic flatwoods and basin swamp, are common across the district, others, such as spring-run streams and rockland hammock, occur sparingly at the northern and southern ends of the district respectively. Spanning nearly 300 miles along Florida's western Gulf coast, the district includes more temperate natural communities in the north such as upland hardwood forest and mesic hammock, while the south end supports a vast subtropical landscape including strand swamp, marl prairie and glades marsh.

Hardwood Forested Uplands

Mesic Hammock

Mesic hammock is a closed-canopy evergreen forest generally found in relatively flat areas with sandy soil. Dominant trees are live oak (*Quercus virginiana*) and cabbage palm (*Sabal palmetto*); other commonly encountered trees in the northern part of the Southwest District include southern magnolia (*Magnolia grandiflora)* and pignut hickory (*Carya glabra*). In southern parts of the district, gumbo limbo (*Bursera simarouba*) and satinleaf (*Chrysophyllum oliviforme*) are occasional. A shrub layer of saw palmetto (*Serenoa repens*) is typically present. Other common shrub species include American beautyberry (*Callicarpa americana*), wild olive (*Cartrema americanum*), marlberry (*Ardisia escallionoides*), white stopper (*Eugenia axillaris*), Spanish stopper (*Eugenia foetida*), pigeon plum (*Coccoloba diversifolia*), and wild coffees (*Psychotria tenuifolia* and *Psychotria nervosa*). Herbs are generally sparse but may include bracken fern (*Pteridium sp.*), partridgeberry (*Mitchella repens*), and in cases where hammocks have expanded due to lack of fire, occasional flatwoods species. Several species of imperiled airplants and epiphytic ferns can be found in this community.

In the district's parks, mesic hammock is often found on slight elevations above marshes, prairies or floodplains, or as a transitional zone between fire-dependent communities and wetland areas.

Mesic hammock is not generally considered to be fire-dependent, although occasional fires may creep into or through hammocks, especially those that occur as small islands in open, frequently burned communities.

Rockland Hammock

Rockland hammock is a hardwood forest dominated by tropical trees and shrubs that occurs in areas where limestone is near the surface. The canopy and shrub layers are dominated by a variety of species that reach their northern limits in South Florida. These include marlberry, gumbo-limbo, satinleaf, pigeon plum, white stopper, inkberry (*Exothea paniculata*), Guiana plum (*Drypetes lateriflora*), strangler fig (*Ficus aurea*), Simpson's stopper (*Myrcianthes fragrans*), Jamaica dogwood (Piscidia piscipula), devil's claw (*Pisonia aculeata*), gulf graytwig (*Schoepfia chrysophylloides*), royal palm (*Roystonea regia*), myrsine (*Myrsine cubana*), willow bustic (*Sideroxylon salicifolium*) and false mastic (*Sideroxylon foetidissimum*). More temperate species that occur in rockland hammock include swamp bay (*Persea palustris*), cabbage palm, laurel oak (*Quercus laurifolia*), occasional live oak and tallowwood (*Ximenia americana*). Herbaceous species are generally sparse, although some rare terrestrial ferns can be present; there is typically a wide variety of epiphytes.

In at least one location in the Southwest District, a hammock resembling tropical thorn scrub occurs. This is a low-statured scrubby hammock dominated by spiny tropical species such as saffron plum.

Upland Hardwood Forest

Upland hardwood forest is a mixed evergreen-deciduous forest found on rolling uplands. This community is rarely found south of the northern peninsula; in the Southwest District it is mapped in only a single park.

An example of this community found in the Southwest District occurs between the high dry uplands and the wetter bottomland forest. It is a closed canopy forest of hardwoods with a canopy of several large oak species, pignut hickory and southern magnolia. The midstory includes American holly (*Ilex opaca*), wild olives, sparkleberry, cabbage palm, red bay, tough bully (*Sideroxylon tenax*) and tallowwood. The groundcover is sparse, with a thick layer of leaf litter. Other occasional plants include sarsaparilla vine (*Smilax pumila*), saw palmetto, black cherry (*Prunus serotina*), American beautyberry and persimmon (*Diospyros virginiana*).

This community occurs on well-drained to mesic, generally sandy or loamy soils where there is often a clay or calcareous component. It is typically found only in locations protected from fire. The high relative humidity maintained by the tree canopy and the compactness of the leaf layer generally prevent fire from entering this community, although fires may burn into the edges from adjacent communities.

Xeric Hammock

Xeric hammock is a closed-canopy forest dominated by sand live oak (*Quercus geminata*) with a shrub layer often consisting of saw palmetto, rusty staggerbush (*Lyonia ferruginea*), sparkleberry (*Vaccinium arboreum*), deerberry (*Vaccinium stamineum*) and wild olive. Herbaceous species are often sparse, but can include sandyfield beaksedge (*Rhynchospora megalocarpa*), witchgrasses (*Dichanthelium* sp.), composites such as goldenrod (*Solidago* sp.) and legumes such as Elliott's milkpea (*Galactia elliottii*).

This community occurs on deep sand substrates, often in the fire shadow resulting from lakes or topographic features. This community differs from most other communities of sandy xeric conditions in that it is not fire-dependent; it is generally a late successional stage of scrub, scrubby flatwoods or sandhill where fire has been excluded, and species characteristic of scrub (e.g., Chapman's oak, *Quercus chapmanii*) or sandhill (e.g., turkey oak, *Quercus laevis*) may be present.

Xeric Uplands (High Pine and Scrub)

Sandhill

Sandhill is an open savanna of widely spaced longleaf pine (*Pinus palustris*) and/or south Florida slash pine (*Pinus elliotti var. densa*) with a dense groundcover of wiregrass (*Aristida beyichiana*), other grasses, forbs and legumes. The midstory, when present, is generally open and consists of one or more deciduous oaks (turkey oak or bluejack oak, *Quercus incana*). Shrubs are sparse and low-growing, and can include saw palmetto and pawpaws (*Asimina* sp.). A diverse groundcover is present that is generally dominated by southern wiregrass, and often includes gopher apple (*Geobalanus oblongifolius*), pineywoods dropseed (*Sporobolus junceus*), lopsided Indiangrass (*Sorghastrum secundum*), bluestems (*Andropogon* spp.), oblongleaf twinflower (*Dyschoriste oblongifolia*), silkgrasses (*Pityopsis spp.*), blazing stars (*Liatris* spp.), coastalplain honeycomb-head (*Balduina angustifolia*), milkweeds (*Asclepias* spp.), milkpeas (*Galactia* spp.), snoutbeans (*Rhynchosia* spp.) and scurf hoary-pea (*Tephrosia chrysophylla*).

Sandhills are mostly found on well-drained, nutrient poor sand ridges remaining from ancient shoreline systems. They require fire approximately every one to three years to prevent proliferation of woody species and reductions of the groundcover due to shading. Fires are generally more effective in controlling woody encroachment when they occur during the natural lightning season and are lightning season fires are required by some species to flower or produce seeds. Healthy examples of these communities have a very diverse groundcover, which typically is more depauperate in areas where fire suppression, agriculture or silviculture have been part of the historic management. Many of the perennial herbaceous species' characteristic of sandhills are unlikely to recolonize after soil disturbance, so areas with a history of intensive use typically require restoration. In the Southwest District, sandhills often occur in conjunction with scrub and scrubby flatwoods, and species from these communities may be a common component, especially where fire has been excluded.

This community provides habitat for numerous imperiled species including gopher tortoise (*Gopherus polyphemus*), eastern indigo snake (*Drymarchon couperi*) and southeastern American kestrel (*Falco sparverius paulus*).

Scrub

This evergreen shrub-dominated community is found on xeric, nutrient poor soils of sand ridges and in fire shadows. The shrub layer consists of evergreen oaks — sand live oak, myrtle oak (*Quercus myrtifolia*), scrub oak (*Quercus inopina*) and Chapman's oak) — often with *Lyonia* spp. and other sclerophyllous shrubs. Herbaceous cover is sparse, typically in open sandy patches between shrubs.

Several variants of the scrub community exist. Scrub dominated by oaks is referred to as "oak scrub," whereas the "rosemary scrub" variant, which may occur on the most xeric, nutrient-poor sites includes the needle-leafed Florida rosemary (*Ceratiola ericoides*). "Sand pine scrub" areas are similar to other scrub types, with the addition of a sparse to dense overstory of sand pine (*Pinus clausa*).

Scrub is nearly endemic to Florida but varies somewhat in composition throughout the state. The Lake Wales Ridge supports extensive areas of scrub representing the oldest communities in the state and harbors many rare endemic species; scrub in parks closest to the ridge protect several of these unique plants. In contrast, scrub found in coastal areas of the district have fewer endemic species, although large-plumed beaksedge (*Rhynchospora megaplumosa*), unique to southwest Florida, is found in this community. Even away from these high centers of endemicity, scrub is important habitat for several rare and/or imperiled species, including Florida scrub-jay (*Aphelocoma coerulescens*) and gopher tortoise.

Scrub is highly fire-dependent, but by contrast to other fire-type communities in Florida, it burns less frequently and with higher intensity. Fire return intervals in scrub may range from five years to over 50 years; oak scrub is thought to have typically burned every five to 20 years, whereas rosemary scrub every 10 to 40 years and historic inter-fire intervals in sand pine scrub likely exceeded 10 years. Optimal management of scrub for Florida scrub-jays requires that fire (or mechanical treatments) occur often enough to maintain average shrub heights of 4–5.5 feet and provide scattered sandy openings.

Freshwater Forested Wetlands

Basin Swamp

Basin swamps are typically large wetlands in irregularly shaped basins with a peat substrate. The canopy generally consists of pond cypress (*Taxodium ascendens*) and/or swamp tupelo (*Nyssa biflora*), sometimes with other mixed hardwoods such as red maple (*Acer rubrum*), dahoon (*Ilex cassine*), swamp

bay, sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), swamp laurel oak, sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*) and Florida elm (*Ulmus americana var. floridana*). The understory may be open or relatively dense, with species such as Virginia willow (*Itea virginica*), fetterbush (*Lyonia lucida*), southern bayberry (*Morella cerifera*) and common buttonbush (*Cephalanthus occidentalis*) occurring. Herbs are typically sparse, but most commonly include various ferns, grasses and sedges; emergent aquatic plants such as pickerelweed (*Pontedaria cordata*) can occur in frequently flooded pools. Airplants (*Tillandsia* spp.), resurrection fern (*Pleopeltis michauxiana*) and occasional other epiphytes are common on canopy trees. These swamps are seasonally inundated in most years and may have still or flowing water, although they do not receive significant inflow from rivers.

Basin swamps can be found in a variety of settings; some occur as isolated wetlands in flatwoods landscapes, whereas others occur as a mosaic with other forested wetlands, or surrounding lakes or marshes.

Fire may be occasional or rare, depending on the landscape; for example, the edges of basin swamps in flatwoods landscapes may be exposed to frequent fires, whereas basin swamps intermixed with bottomland forests or hydric hammocks rarely, if ever, burn.

Basin swamps are very similar to dome swamps in composition, but basin swamps are generally larger, less exposed to fire, and typically have more peat accumulation. Floodplain swamps are also similar in composition, although the hydrology of floodplains favors bald cypress (*Taxodium distichum*) rather than the pond cypress found in basin swamps. Basin swamps are generally replaced in extreme south Florida by strand swamps.

Strand Swamp

Strand swamp is a generally shallow forested wetland occupying a trough in a limestone plain. Bald cypress is typically the dominant overstory tree; the understory is generally a mix of temperate and tropical species, including red maple, pond apple (*Annona glabra*), laurel oak, strangler fig and bays. Florida royal palm occurs in this community in the Fakahatchee Strand. Other characteristic species include giant leather fern (*Achrosticum danaeifolia*) and other ferns, and epiphytic bromeliads and orchids, which can be especially diverse, including several imperiled species.

Older, well-developed examples of this community develop a deep peat substrate, especially in the deepest central portions.

Flooding of these communities is annual and varies seasonally. Fire may be frequent at the edges but rarely affects the central portion of these swamps; however, these rare fires may be necessary to maintain cypress dominance.

Baygall

Baygalls are forested wetlands that typically occur at the bases of slopes or in depressions where they are fed by groundwater seepage from the surrounding landscape. These peat-filled wetlands are often saturated, but only occasionally inundated. These swamps normally have a closed canopy of evergreen trees, consisting of some combination of loblolly bay, sweetbay and/or swamp bay, although slash pines (*Pinus elliottii*) may also be common or dominant. A dense shrub layer, often dominated by fetterbush, is generally present; vines such as laurel greenbriar (*Smilax laurifolia*) are common. Herbs, when present, can consist of species such as lizard's tail (*Saururus cernuus*) and ferns.

These swamps are most easily distinguished from other forested wetlands by the dominance of evergreen bay species and by their position in the landscape. The shady, saturated conditions found in baygalls normally prevent fire from entering this community. While many baygalls have no well-defined drainage, they can give rise to seepage streams.

Bottomland Forest

Bottomland forest is a deciduous or mixed deciduous-evergreen forest generally found in broad shallow depressions, often at slight elevations above river or creek floodplains or as a fringe around basin swamps. The canopy can consist of a wide variety of tree species, including water oak, sweetgum, laurel oak, sweetbay, red maple and live oak. Cypress and tupelo can be present but are not dominant. The understory and shrub layers can contain American hornbeam, dwarf palmetto (*Sabal minor*) and southern bayberry. Herbs can be sparse to abundant and often include witchgrasses and sedges (*Carex* spp.). This community is occasionally inundated but usually not for long periods.

Bottomlands are distinguished from mesic hammock by the dominance of mixed mesophytic and hydrophytic trees rather than evergreen oaks and cabbage palm, and by the general absence of upland species such as southern magnolia and pignut hickory. They differ from hydric hammock by a relative lack of cabbage palm. Relative to basin, strand and floodplain swamps, these communities lack cypress or swamp tupelo as dominant. Fire is rare in bottomland forests.

Dome Swamp

Dome swamps occupy small to large shallow isolated depressions within fire-maintained communities. They often occur in flatwoods landscapes over much of the state but are scattered among marl prairies in the southwestern part of the district. Typically, the canopy consists of pond cypress and/or swamp tupelo; other tree species such as red maple or sweetbay may be present but are usually not dominant. The density of shrubs can vary from sparse to moderately dense, depending in part on fire history. Fetterbush, dahoon, and southern bayberry are among the most common shrub species. Various herbaceous plants such as Virginia chain fern (*Woodwardia virginica*), sedges, beaksedges (*Rhynchospora* sp.) and grasses such as panicgrass (*Coleataenia* spp.) can occur; floating or submerged aquatic species may be found in deeper zones in some dome swamps. Dome swamps are seasonally inundated and typically have still water and no well-defined inflow or outflow.

Fires in adjacent communities occasionally burn into the edges of dome swamps or across them, which likely contributes to the characteristic domed profile, with larger, older trees in the center where fire is less frequent, and smaller trees at the margins.

Dome swamps dominated by swamp tupelo are sometimes known as “gum ponds.” These may result from differences in the surrounding fire and hydrologic conditions, and while not common in the Southwest District, they can occur. Dome swamps dominated by tupelo can also result from historic logging of cypress, or from succession of marsh communities.

Hydric Hammock

Hydric hammocks are mesic to hydric forests found in low flat areas, typically where limestone is near the soil surface or where soils have high shell content. Characteristic canopy trees of this community are live oak, laurel oak and cabbage palm; eastern red cedar (*Juniperus virginiana*), another characteristic component of this community, is not consistently present in hydric hammocks of the Southwest District parks. Several epiphytic plants are also common, including Spanish moss (*Tillandsia usneoides*), giant

airplant (*Tillandsia utriculata*), golden polypody (*Phlebodium aureum*), shoestring fern (*Vittaria lineata*), resurrection fern and Florida butterfly orchid (*Encyclia tampensis*). Smaller trees and shrubs can include Walter's viburnum (*Viburnum obovatum*) and southern bayberry. Vines are common, including greenbriers (*Smilax* spp.) and poison ivy (*Toxicodendron radicans*). This community is found in level, poorly drained areas in shallow depressions, and sometimes just inland of coastal communities. It may be frequently saturated due to poor drainage, or if flooded, normally only for short periods.

Hydric hammock is not considered a fire-dependent community, although it can burn rarely to occasionally depending on the size and landscape context. Cabbage palm is highly tolerant of fire, but red cedar is susceptible to burning and generally not found in recently burned hammocks.

Some hydric hammock in this region consists of the coastal hydric hammock variant. Due to salinity, these hammocks have a somewhat less diverse canopy consisting of cabbage palm, red cedar and live oak, and are often found adjacent to salt marsh or other coastal communities. Isolated hammocks found in hydric conditions amidst marsh systems, generally dominated by cabbage palm and live oak, are known as prairie hydric hammocks, and are frequent in some Southwest District parks.

Hydric hammock can be difficult to distinguish from other similar communities, particularly bottomland forest. Prevalence of cabbage palm is often a good indicator of hydric hammock.

Floodplain Swamp

Floodplain swamps are hydric forests that are frequently to permanently inundated and typically have a canopy of bald cypress and/or tupelo, with other wetland trees often mixed in the canopy. They occur along rivers, creeks, and spring runs, where they are found at the edges of waterways as well as in backwaters and low areas behind levees. Midstory and groundcover are often sparse, but among the species that can be found are Carolina ash (*Fraxinus caroliniana*), buttonbush and dahoon holly in the midstory, and savannah panicum (*Phanopyrum gymnocarpon*), climbing aster (*Symphyotrichum carolinianum*) and ferns in the groundcover. Fire is generally rare in this community. Near river mouths along the Gulf Coast, this community is replaced by mangrove swamp or salt marsh as salinity increases.

Coastal Uplands

Beach Dune

Beach dune communities consist of the earliest suite of species that colonize and stabilize the upper beach and foredune. These are open, herbaceous communities; sea oats (*Uniola paniculata*) are the most characteristic species, often accompanied by other salt-tolerant grasses and herbs that commonly include bitter panicum (*Panicum amarum*), seashore paspalum (*Paspalum vaginatum*), beach elder (*Iva imbricata*) and sea purslane (*Sesuvium portulacastrum*). Woody species are generally absent, although the rare beachberry (*Scaevola plumieri*) can be found in beach dunes. Species in this community are normally either tolerant of burial or able to recolonize quickly, as sand is continually deposited by wind action.

Beach dunes grade into marine unconsolidated substrate on the seaward side, and into coastal strand, coastal grassland, or interdunal swale on the landward side. This community is important nesting habitat for several imperiled birds, including snowy plover (*Charadrius nivosus*), American oystercatcher (*Haematopus palliatus*), black skimmer (*Rynchops niger*) and least tern (*Sternula antillarum*), and also is used for nesting by sea turtles. Due to relatively gentle wave action, dunes on the southwest coast of Florida are typically lower in height than dunes in other parts of the state.

Fire is not common in this community, as the adjacent beach provides no opportunity for ignitions on the seaward side, and the often patchy vegetation can limit the spread of any fires that do occur.

Coastal Grassland

This herbaceous community occupies the transitional zone between beach dunes and more inland communities dominated by woody plants. Coastal grasslands are dominated by salt-tolerant grasses and herbs; typical species include sea oats, bitter panicum, camphorweed (*Heterotheca subaxillaris*), saltmeadow cordgrass (*Spartina patens*) and erect pricklypear (*Opuntia stricta*).

These communities are most readily distinguished from beach dune by their position inland from the immediate coastline and by the presence of a variety of grasses and forbs, such as bluestem grasses and camphorweed, in addition to the pioneer dune-building grasses such as sea oats.

Some coastal grasslands of the Southwest Florida coast are distinctive due to the presence of hairy gramma (*Bouteloua hirsuta*), which can be prevalent here but is absent elsewhere in the state. Other species present include beach creeper (*Ernodea littoralis*) and Gulf Coast Florida lantana (*Lantana depressa var. sanibelensis*).

Coastal Berm

Coastal berm is a short forest or shrub thicket found on long narrow storm-deposited ridges of loose sediment formed by a mixture of coarse shell fragments, pieces of coralline algae, and other coastal debris. These ridges parallel the shore and may be found on the seaward edge or landward edge of the mangroves or further inland depending on the height of the storm surge that formed them.

In Florida, this community is limited to the low energy shorelines of South Florida and the Florida Keys. Structure and composition of the vegetation is variable depending on the elevation of the substrate and time since the last storm event. Although cabbage palm, sea grape (*Coccoloba uvifera*) and marsh elder (*Iva* sp.) are generally present, tropical species usually make up a large component of the community. The most stable berms may be similar to rockland hammock, with trees such as gumbo-limbo, but generally have a greater proportion of shrubs and herbs. Shrubs that can be present include Spanish and white stopper, myrsine, marlberry, white indigoberry (*Randia aculeata var. aculeata*) and saffron plum (*Sideroxylon celastrinum*).

In general, these communities are best distinguished not by their flora, but by its occurrence on a ridge of storm deposited coarse calcareous sediment.

Coastal Strand

Coastal strand is a short-statured, salt-pruned shrub community occurring on the xeric sand soils of stabilized coastal dunes; it generally develops just inland from sea oats-dominated beach dune communities. Plants commonly occurring include saw palmetto, sea grape, Florida swamp privet (*Forestiera segregata*), cabbage palm, saffron plum, coin vine (*Dalbergia ecastaphyllum*), Hercules' club (*Zanthoxylum clava-herculis*), erect pricklypear, yellow necklace pod (*Sophora tomentosa var. truncata*) and strangler fig. On the inland side, this community can grade into flatwoods, maritime hammock, coastal interdunal swale, mangrove swamp or salt marsh.

Soils of coastal strands are generally shelly sands that are somewhat alkaline. This community is dynamic, particularly in barrier island systems due to the erosional and depositional processes of island building.

Fire is not common in coastal strand, and it is generally not considered a fire-dependent community. However, the natural fire frequency in this community is not well-understood. Fire may have historically interacted with salt spray to maintain large areas of coastal strand vegetation.

Maritime Hammock

Closed-canopy evergreen forests on stabilized coastal dunes are known as maritime hammock. These communities are xeric to mesic, with excessively drained soils, but litter layer and closed canopy maintain higher relative humidity. The marine influence limits the canopy to more salt-tolerant species, generally consisting of live oak, cabbage palm, red bay (*Persea borbonia*) and red cedar; in southern parts of the District, more tropical species can be found in the canopy, including Jamaican dogwood. The understory often contains a mix of tropical species and more temperate ones, including sea grape, white stopper, southern bayberry, myrsine and buttonwood (*Conocarpus erectus*). The herbaceous layer is generally sparse to absent, although ferns can be common in some locations.

This community is generally similar to mesic hammock or the coastal variant of hydric hammock; however, some examples in the Southwest District that are associated with mesic flatwoods may have a pronounced pine and saw palmetto component. Fire is not typical in maritime hammock.

Shell Mound

This community occurs on ancient shell deposits left by Native Americans. Shell mound communities are normally closed canopy forests of mixed hardwoods. In most of the district, shell mounds are predominantly vegetated by tropical species, although eastern red cedar and live oak are present in the northernmost examples of the district. Common species include gumbo-limbo, Spanish and white stopper, Florida swampprivet, strangler fig, saffron plum, Jamaican dogwood and marlberry. Rare species found in this community in the Southwest District include iguana hackberry (*Celtis iguanaea*), spiny hackberry (*Celtis pallida*) and southern lip fern (*Cheilanthes microphylla*).

Due to their elevation above the surroundings, flooding is not typical, and the relatively high humidity and closed canopy provide protection from fire; however, many former examples of this community have been destroyed by excavation for roadbuilding materials or damaged by archaeological looting.

Pine Flatwoods

Mesic Flatwoods

Mesic flatwoods are open savannas of widely spaced pines, generally lacking a midstory, but with a rich layer of low shrubs and herbs; in the southern peninsula, the canopy can consist of longleaf pine inland, slash pine (particularly near the coast), or South Florida slash pine. Common shrubs include saw palmetto, gallberry (*Ilex glabra*), shiny blueberry (*Vaccinium myrsinites*) and tarflower (*Bejaria racemosa*); herbaceous species include wiregrass, other bunchgrasses such as lopsided indiangrass, and wildflowers such as false vanillaleaf (*Carphephorus odoratissimus*) and yellow milkwort (*Polygala rugelii*).

These communities require extremely frequent fire (every two to four years); natural fires historically occurred predominantly during the late spring and early summer. Without frequent fire, encroachment of hardwoods and overgrowth of shrubs reduces biodiversity and increases wildfire risk.

Mesic flatwoods vary greatly across the parks in the Southwest District; broad expanses of mesic flatwoods at some inland locations are generally similar to those found in other parts of the peninsula,

while examples in coastal barrier island parks are often less diverse and share many attributes with maritime hammock with which they can intergrade.

Dry Prairie

Dry prairie is a low-statured shrub and grass-dominated community that occurs in level areas in a restricted range in south-central Florida. Dominant shrubs, which include saw palmetto, dwarf live oak (*Quercus minima*), gallberry, shiny blueberry and others, are interspersed with grasses and forbs, including southern wiregrass, bottlebrush threeawn (*Aristida spiciformis*), witchgrasses and forbs such as silkgrass, yellow-eyed grasses, meadow beauties (*Rhexia* sp.) and Florida pennyroyal (*Piloblephis rigida*).

This community shares much in common with mesic flatwoods and can be difficult to distinguish from flatwoods that have been cut over, although stunted saw palmettos and the lack of pines or stumps are the hallmarks of true dry prairie. Areas that historically supported dry prairie tend to be less dissected than comparable flatwoods, suggesting that some resulting combination of higher fire frequency and flooding may explain the lack of pines. Vast expanses of dry prairie are signature natural communities at Myakka River State Park.

Scrubby Flatwoods

Scrubby flatwoods occur on slight rises above mesic flatwoods or at intergrades between flatwoods and more xeric communities. These open flatwoods have a canopy of widely spaced pines (typically longleaf or South Florida slash pine in the Southwest District) over a shrub layer dominated by saw palmetto and scrub oaks (myrtle oak, sand live oak and Chapman's oak), with wiregrass and other herbaceous species in gaps between the shrubs. The vegetation is a mix of mesic flatwoods and scrub species.

This community typically grows in relatively flat areas with sandy soils, often on slight rises in mesic flatwoods. This is a fire dependent community, with intervals between fires modestly longer than other flatwoods types (approximately every five to 15 years).

Wet Flatwoods

Wet flatwoods occur on sandy soils in level, poorly drained areas where inundation occurs annually as a result of poor drainage and a high water table. A semi-closed to open canopy of longleaf or South Florida slash pine is typical. The midstory, if present, can consist of fetterbush, loblolly bay and/or sweetbay. The shrub layer is typically sparse and open. Although saw palmetto may sometimes be present, it is never common. A lush and diverse groundcover is generally present consisting of wiregrass and other graminoids including blue maidencane (*Amphicarpum muhlenbergianum*), toothache grass (*Ctenium aromaticum*), nutsedges (*Scleria* spp.) and beaksedges. Other herbaceous plants are diverse and include milkworts (*Polygala* spp.), meadowbeauties, rosegentians (*Sabatia* spp.) and yellow-eyed grasses (*Xyris* sp.).

Wet flatwoods are a highly fire-dependent community; maintenance of the open, herbaceous structure requires fire approximately every two to four years.

In addition to "typical" wet flatwoods described above, two other variants occur in the parks in the Southwest District. Near the Gulf Coast, where limestone influences surface soil chemistry, wet flatwoods may be the "sweet flatwoods" variant, with a canopy of mixed cabbage palm and pines. In these flatwoods, hairawn muhly (*Muhlenbergia capillaris*) and sawgrass (*Cladium jamaicense*) may be

common. Near the Lake Wales Ridge, in wet flatwoods, the typical groundcover is often replaced by a dense sward of the endemic cutthroatgrass (*Coleataenia abscissa*).

Freshwater Non-Forested Wetlands

Wet Prairie

Wet prairies occur on wet (but seldom inundated) soils in flat or gently sloping areas. Such herbaceous communities are diverse; typical species include wiregrass, meadowbeauties, beaksedges, pineland rayless goldenrod (*Bigelowia nudata*), yellow-eyed grasses, Rosegentians, coastalplain St. John's-wort (*Hypericum brachyphyllum*) and myrtleleaf St. John's-wort (*H. myrtifolium*). Trees and shrubs are rare, but occasionally stunted cypress or pine sometimes occur.

Wet prairies may occur as openings among shrubs in dry prairie or flatwoods, or they may form a border around depression marshes or swamps. Due to their occurrence in highly fire-dependent landscapes, the typical historic fire return interval in wet prairies is approximately every one to three years.

Along the edges of the Lake Wales Ridge such as the eastern portion of Highlands Hammock State Park, wet prairies dominated by cutthroat grass are or were historically typical. These generally lack wiregrass but share many of the same wildflower species. In the past, some of these wet prairies (also known as "cutthroat seeps") may have been classified as seepage slope. However, the current definition of seepage slope is limited to the more dissected terrain of the panhandle and northern peninsula.

Marl Prairie

This marsh community occurs in broad low areas in extreme south Florida, where it is found on marl substrates (calcareous mud); areas of exposed limestone may also be present. Marl prairie is typically intermediate in elevation between pinelands and lower swamps or marshes. These communities are generally inundated annually, but for shorter periods than other associated wetland types.

Vegetation is generally sparse but diverse, dominated by any of several graminoid species such as hairawn muhly, spreading beaksedge (*Rhynchospora divergens*), South Florida little bluestem (*Schizachyrium rhizomatum*), black bogrush (*Schoenus nigricans*) and sawgrass, among others. Other species include rosy camphorweed (*Pluchea baccharis*), alligator lily (*Hymenocallis palmeri*), starrush whitetop (*Rhynchospora colorata*) and narrowleaf yellowtops (*Flaveria linearis*). The relative influence of saltwater and fresh water can influence species composition, with sawgrass being more indicative of freshwater influence, and species such as Gulfcoast spikerush (*Eleocharis cellulosa*) becoming more common where salinity is higher.

Most typically, trees are absent from this community, although in some areas, stunted pond cypress is a notable component.

Basin Marsh

Basin marshes are herbaceous wetlands occurring in large depressions with peat or sand substrate, in fluctuating lake basins or at lake margins, or as marshy inclusions in non-fire-dependent communities.

These marshes are variable in their composition but generally have grassy zones that can contain maidencane (*Panicum hemitomon*), sawgrass and/or sand cordgrass (*Spartina bakeri*); whereas deeper areas within the marsh can be populated with pickerelweed (*Pontederia cordata*), white water lily (*Nymphaea odorata*), American lotus (*Nelumbo lutea*), bulltongue arrowhead (*Sagittaria lancifolia* subsp. *lancifolia*) and spatterdock (*Nuphar advena*). Beggarticks (*Bidens* spp.) can be common. Woody

plants such as coastalplain willow (*Salix caroliniana*) and buttonbush often occur in sporadic patches, sometimes on floating islands of organic material, but may also become the dominant vegetation in mucky, unburned marshes.

Basin marshes are important as foraging habitat for wading birds, and where suitable shrubs are available, as rookery sites as well. They also provide important habitat for rare species such as Florida sandhill crane (*Grus canadensis pratensis*) and round-tailed muskrat (*Neofiber alleni*).

Fire is occasional to frequent in these communities, and where hydrological alterations have taken place, fire may be especially important to prevent conversion of the marsh to a forested wetland.

Coastal Interdunal Swale

Coastal interdunal swales are grassy or shrubby communities that develop in elongate depressions between successive dune ridges along the coast. They are different from beach dune and coastal grassland communities in that they consist of species that can at least tolerate occasional inundation; most notably, they lack sea oats. While typical species include sawgrass, hairawn muhly, bluestem grasses, seashore paspalum (*Paspalum vaginatum*), sand cordgrass and saltmarsh cordgrass (*Spartina alterniflora*), these communities are quite variable based on hydrology, depth, age of the swale and exposure to salinity.

Wetter swales may be dominated by sawgrass, cattail (*Typha* spp.) or needle rush (*Juncus roemerianus*), while others may have a mix of hydrophytic herbs; shrubby swales are likely to have a low canopy of southern bayberry and/or coastalplain willow. In swales nearest to the coast where saltwater influences are most significant, more salt-tolerant species such as seashore paspalum and marsh fimbry (*Fimbristylis spadicea*) may be prominent.

Depression Marsh

Depression marshes are generally small, isolated, often rounded depressions in sand substrate with peat accumulating toward the center, surrounded by fire-maintained communities. These herbaceous wetlands are often made up of concentric zones of vegetation that may include sand cordgrass, St. John's-worts (*Hypericum* spp.), beaksedges and blue maidencane. The deepest central zones can be dominated by maidencane, sawgrass and pickerelweed. Shrubs such as buttonbush and coastalplain willow should be only occasional, forming small central thickets or scattered around the edge.

Depression marshes are seasonally inundated and experience frequent or occasional fires. Drought, fire suppression or hydrological alterations can lead to colonization by woody species such as pines, red maple, invasive species such as Chinese tallow (*Triadica sebifera*) or Peruvian primrosewillow (*Ludwigia peruviana*) and/or willows. Impacts from grazing or from hog rooting may result in dominance by pasture grasses, invasive species, or opportunistic native plants such as redroot (*Lachnanthes caroliniana*).

Depression marshes are most commonly found in pineland landscapes, but in some coastal settings, they can occur in remnants of old coastal swale systems.

Floodplain Marsh

Floodplain marshes are seasonally inundated herbaceous communities occurring on generally sandy alluvial deposits in floodplains or along channels of creeks, rivers and spring runs. This community generally lacks trees but can have occasional to abundant shrubs such as coastalplain willow and

buttonbush. Herbaceous species can consist of southern wild rice (*Zizaniopsis miliacea*), sawgrass, maidencane, sand cordgrass and/or pickerelweed.

Depending on topographic variability, these habitats may burn occasionally to frequently (as much as every three years).

The "freshwater tidal marsh" variant of this community occurs along some creeks near the Gulf Coast, where tidal pulses of freshwater occur, as well as occasional saltwater influences during low flow periods, extreme tides and storms. These marshes often consist of a mix of freshwater and saltwater species and are generally dominated by sawgrass.

Glades Marsh

Glades marsh is a primarily herbaceous wetland found in South Florida that occurs in broad shallow channels or depressions over a substrate of peat or marl that directly overlies limestone.

This community is often a monoculture of sawgrass, but in deeper areas one or more species can be co-dominant, including maidencane, Tracy's beaksedge (*Rhynchospora tracyi*) or Gulf Coast spikerush. Other species that grow intermixed in the marsh include various other beaksedges, alligator lily, bulltongue arrowhead, pickerelweed, and in deeper holes, waterlily (*Nymphaea* sp.).

The gently sloping, poorly drained landscape underlying these communities results in a long hydroperiod of slowly flowing, shallow fresh water. This community provides habitat for a variety of imperiled species, including snail kite (*Rostrhamus sociabilis*) and a wide variety of wading birds, as well as Everglades mink (*Mustela vison evergladensis*) and round-tailed muskrat.

Natural fires are common in summer in the region, and dense stands of sawgrass readily carry fire. Fire return intervals in this community may range from three to 10 years, although under drought conditions, peat fires can occur that can facilitate colonization by coastalplain willow. With fire exclusion or a reduced hydroperiod, southern bayberry, dahoon, coastalplain willow and groundsel tree (*Baccaris halimifolia*) can invade and result in shifts in plant composition.

In the Southwest District, this community is found in the Fakahatchee Strand/Big Cypress area, where it occurs in association with marl prairies and sloughs in a mosaic of wetland communities.

Slough

Sloughs are found in the deepest central portions of strand swamps and marshes in southwest Florida. These areas are inundated by slow-moving or nearly stagnant water throughout most of the year.

Although statewide, sloughs can be variable communities, vegetation in South Florida's pond apple sloughs is characterized by the abundance of pond apple and Carolina ash trees, and southern wild rice in deeper sloughs. Epiphytes, including many imperiled species, are especially common and diverse in this community.

The long hydroperiod and humidity generally protects pond apple sloughs from fire. Alteration of hydrology can be detrimental to the community by affecting its suitability for wildlife and for epiphytes.

Marine and Estuarine Vegetated Wetlands

Mangrove Swamp

Mangrove swamp is a low-statured estuarine forested wetland that occurs on relatively flat shorelines with low wave energy. Due to tidal action, this community is typically inundated with saltwater daily. Mangrove swamp is a tropical community that is widespread and in well-developed coastal areas of the Southwest District, although it reaches its northern limit further north in Florida.

Mangrove swamp is dominated by red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*) and buttonwood. Black mangrove often occurs in the most saline areas; it and red mangrove are most tolerant of inundation, whereas white mangrove and buttonwood generally occur at slightly higher elevations at the interior or landward side of mangrove swamps. Although herbaceous species are not abundant in most mangrove swamps, at intergrades with salt marsh, the canopy is often patchy and areas of black needlerush (*Juncus roemarianus*), Gulf Coast spikerush, glassworts (Salicornia sp.) and seapurslane (*Sesuvium* sp.) may be interspersed.

These communities are important nursery grounds for a wide variety of ecologically, commercially, and recreationally important fish species, and serve as rookery sites for numerous wading and seabird species. They also are important in buffering coastal areas from storm surges.

Salt Marsh

Salt marsh is an herbaceous wetland inundated with saltwater by daily tides. This community usually has distinct zonation of densely growing graminoids depending on tidal range, often with saltmarsh cordgrass in the areas most frequently inundated, and black needlerush dominating areas above the mean high water mark. Other species include saltmarsh fimbry (*Fimbristylis spadicea*), Gulf Coast spikerush, giant leather fern, marsh elder, Christmasberry (*Lycium carolinianum*), perennial glasswort (*Salicornia ambigua)* and bushy seaside oxeye (*Borrichia frutescens*).

Sparsely vegetated areas known as salt flat may be interspersed within the marsh; these are slightly higher areas that flood only during extreme high tides or storms and become desiccated and saline. These areas have more sparse vegetation than the surrounding marsh and are often dominated by succulent marsh species such as saltwort (*Batis maritima)* and annual glasswort (*Salicornia bigelovii*), and short-statured grasses such as seashore paspalum, shoregrass (*Distichlis littoralis*) and saltgrass (*Distichlis spicata*).

Salt marsh may grade into a variety of communities on the upland side and often intergrades with (or succeeds to) mangrove forest. Salt marsh may burn rarely to occasionally from fires spreading from adjacent communities or originating in the marsh from lightning strikes.

Marine and Estuarine

Marine or Estuarine Unconsolidated Substrate

Unconsolidated substrates are generally characterized as expansive, relatively open areas of subtidal, intertidal and supratidal zones that lack dense populations of sessile plant and animal species. The sediments making up the substrate can be sand, organic materials (mud), or carbonate derived from animals (e.g., shell).

Common examples of these communities in the Southwest District parks are beaches, typically found on outer edges of barrier islands, and mud flats, which occur on the bay sides of barrier islands and in other areas protected from wave action. The densities of infaunal organisms in subtidal zones can reach the tens of thousands per square meter, making these areas important feeding grounds for many bottom feeding fish.

Mollusk Reef

Mollusk reefs are natural communities found in intertidal and subtidal zones that are characterized by dense growth of sessile mollusks. These reefs are most often dominated by American oyster (*Crassostrea virginica*), although they support a diversity of other sessile and benthic invertebrates as well; these include sponges, anemones, worms, a variety of other mollusks, crabs and amphipods.

These communities initially require a hard substrate to become established. However, once established, they can expand over time, provided that salinity and water quality conditions remain appropriate.

These communities provide shelter for larval fish and important feeding grounds for predatory fish; intertidal oyster reefs can be important feeding or roosting areas for shorebirds.

Seagrass Bed

Both marine and estuarine seagrass beds occur in the waters surrounding the Southwest District parks. These communities are typically intertidal stands of vascular plants, most typically turtle grass (*Thalassia testudinum*), manateegrass (*Syringodium filiforme*) and/or shoal grass (*Halodule wrightii*).

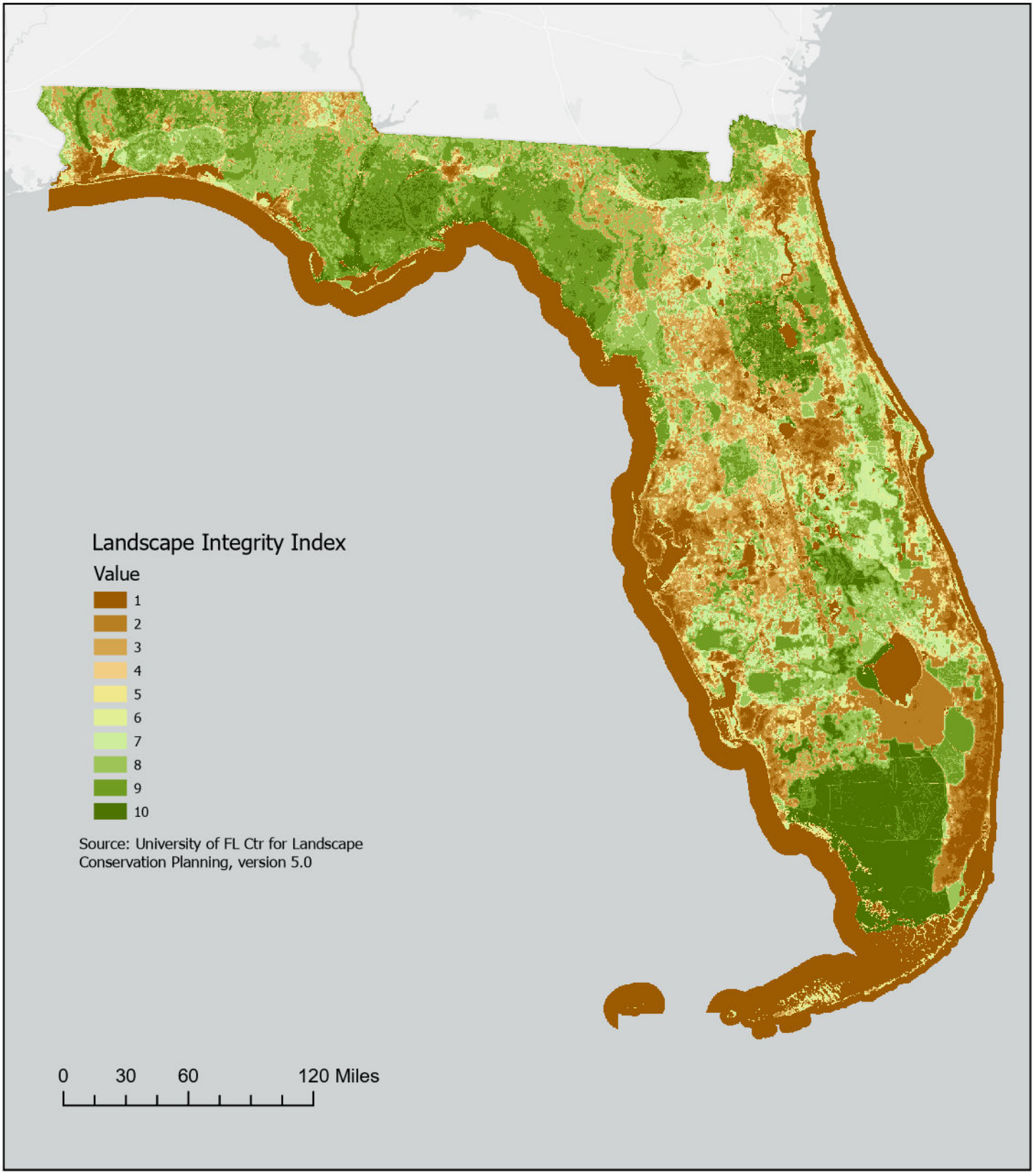
These communities typically occur on unconsolidated substrates. The presence of the plants reduces wave action, allowing sediments to settle, and the roots of the dominant plants provide stabilization; thus, seagrass beds facilitate soil accumulation where they occur.

Seagrasses and the algae that grow on them provide food for a huge variety of herbivorous animals including manatees, sea turtles and fish. In addition, seagrass beds provide shelter for invertebrates and fish, including larvae of several recreationally and commercially important fish species.

Several abiotic factors affect the ability of an area to support seagrasses, including temperature, salinity and the velocity of the current. Water clarity is especially critical, as high turbidity that prevents seagrasses from photosynthesizing can have catastrophic effects on seagrass beds within a short period of time.

SOUTHWEST DISTRICT LANDSCAPE INTEGRITY

The preceding natural communities of the Southwest District significantly contribute to the remaining collective of natural landscapes in southwest Florida. The level to which a given area's natural communities and natural processes are intact is reflected in the following landscape integrity map — a numerical and color-coded depiction of environmental condition, biological productivity and species richness across the state.


Landscape Integrity Index
Value
1
2
3
4
5
6
7
8
9
10
Source: University of FL Ctr for Landscape Conservation Planning, version 5.0
0
30
60
120 Miles

SOUTHWEST DISTRICT IMPERILED SPECIES

Every natural community type in southwest Florida, as well as some altered land cover types, can provide habitat for imperiled species, although these species are not evenly spread across the landscape. Some vicinity parks, such as Lake June-in-Winter Scrub Preserve State Park and Highlands Hammock State Park along the southern Lake Wales Ridge and Fakahatchee Strand Preserve State Park and Collier-Seminole State Park within the Everglades West Coast Watershed, lie in areas that are particularly important due to the number or rarity of imperiled and endemic species present. Other parks harbor fewer rare plants and animals due to their complement of natural communities and corresponding habitats. Even parks with few imperiled species play a crucial role in biodiversity conservation at the district and state level. The distribution of three different groups of imperiled species — species of coastal habitats (salt marsh, beach dune and mangrove swamp), species that are found in springs, spring runs and aquatic caves and species that use fire-dependent pinelands — can be analyzed as an example. Plovers, terns and terrapins are unsurprisingly tied to coastal habitats of the district's barrier islands and estuaries; cave amphipods, cave crayfish and Suwannee cooter (*Pseudemys concinna suwanniensis*) are limited to parks in the Springs Coast Watershed; and fire-dependent pineland species such as southeastern fox squirrel (*Sciurus niger niger*), hairy woodpecker (*Leuconotopicus villosus*) and gopher frog (*Lithobates capito*) are scattered throughout the district. The relative lack of overlap in the distribution of these groups of rare species emphasizes the importance of the entire suite of parks across the Southwest District for protecting biodiversity.

A few species in the Southwest District parks are unique or nearly unique to the region. One of the best examples is the Sanibel Island marsh rice rat (*Oryzomys palustris*), which survives in marsh habitats with overlapping federal and state protections on the leeward side of Sanibel Island. Another Southwest District endemic is the Blue-tailed mole skink (*Plestiodon egregious lividus*), a small brownish lizard with a blue tail that lives in portions of just three counties along Lake Wales Ridge, including sites at Lake June-in-Winter Scrub Preserve State Park and Highlands Hammock State Park. Even rarer is the Lake Placid funnel wolf spider (*Sosippus placidus*), known from only a handful of sites in Highlands County, including Highlands Hammock State Park. The Everglades mink, a disjunct population of the American mink, inhabits the southern tip of Florida, particularly the shallow freshwater marshes and swamps of the Fakahatchee Strand and Big Cypress Swamp. Another iconic species from Fakahatchee Strand Preserve State Park and Collier-Seminole State Park is the ghost orchid (*Dendrophylax lindenii*), only known to live in the strand swamps of extreme southwest Florida and a handful of sites in western Cuba. The large canopy-forming trees of Fakahatchee Strand are also favored roosting sites of the Florida bonneted bat (*Eumops floridanus*). These large bats, with wingspans of up to 20 inches, are endemic to south Florida. While the Florida panther formerly ranged from Arkansas to South Carolina, today less than 200 exist, primarily within the Southwest District.

Any summary of the district's imperiled species would not be complete without discussing the critical role of fire. The composition and structure of the district's flatwoods, sandhills, scrub and other upland communities depends on frequent, low-intensity fires — as often as every one to three years — that historically burned large areas due to lightning. A suite of grasses, wildflowers and other plants thrive in the open sunny conditions and are dependent on fire. The rich groundcover provides food for gopher tortoises, a keystone species that in turn provides habitat for hundreds of commensals, including Florida mouse (*Podomys floridanus*) and Eastern indigo snake. These open herbaceous habitats provide nesting sites for Bachman's sparrow (*Peucaea aestivalis*) and northern bobwhite (*Colinus virginianus*) and forms the base of a food web in pyric communities that supports a variety of other wildlife such as the Florida pine snake (*Pituophis melanoleucus mugitus*), Florida scrub-jay (*Aphelocoma coerulescens*) and crested

caracara (*Caracara plancus*). These unique communities, among the most diverse species in North America, once covered vast areas of the Southwest District.

Unfortunately, most native pinelands in Florida and the southeast have been replaced by other landcover in the past two centuries. By some estimates, coniferous ecosystems in the southeastern United States occupy only 2–3% of their former range. While the plants found in these communities are very resilient to fire, they do not tolerate soil disturbance, so even temporary conversion to other land uses eliminates the herbaceous groundcover. Once these sites are abandoned, the characteristic pineland groundcover species are poor colonists and rarely if ever re-establish without active restoration measures. With the loss of overstory pines and understory grasses needed to carry fire, disturbed sites usually undergo succession to low-diversity successional forests.

The pineland communities that do remain often suffer from the lack of fire. In 2019, a statewide assessment of Florida's longleaf pine ecosystems found that more than half of the sites were in poor to fair condition. When fires are excluded, the pinelands are invaded and transformed by a small number of common, fast-growing woody plants. These opportunistic species shade out the low-growing pineland plants and the layer of grasses that carry low-intensity fires. These species are replaced by densely packed hardwood leaves that prevent fires from spreading. Without fire, opportunistic plants such as laurel oak and water oak continue to proliferate, leading to the demise of the habitat. Loss of the dense cover of bunchgrasses and herbs eliminates shelter and food needed by countless species, and the proliferation of a woody understory renders the habitat unusable for the many species that rely on open structure for movement and foraging. Thus, with the exclusion of fire, pinelands are transformed from a diverse and complex community with hundreds of unique species of plants and animals to a low-diversity habitat suitable for only a few common species.

The recurrent wildfires that gave rise to these pineland habitats are neither desirable nor possible in the modern landscape. In state parks and other natural areas, careful use of prescribed fire is necessary to keep these communities suitable for the species that depend on them. When fire has been excluded for too long, or when the characteristic plants have been eliminated by past disturbances, prescribed fires are no longer possible and other restoration tools such as thinning, mowing or herbiciding are used to remove the species that have invaded. Longleaf or south Florida slash pine, along with native groundcover species must be planted to ensure that the natural process of fire can once more be used to maintain suitable habitat for many imperiled species that rely on these pinelands that are so much a part of "the real Florida."

Gopher tortoises are among the best-known species of Florida's dry pinelands and xeric communities including scrub, beach dune and coastal strand. Tortoises are considered a keystone species because their burrows provide a cool, sheltered microclimate from the Florida sun and provide many other species a place to shelter from heat, predators and fires. Species such as the gopher frog (*Lithobates capito*), Florida mouse (*Podomys floridanus*) and eastern indigo snake regularly use tortoise burrows for shelter, and several species of invertebrates have evolved to rely exclusively on gopher tortoise burrows. In all, over 350 species have been documented using gopher tortoise burrows.

Florida is well known for its beaches, but the importance of coastal state parks extends well beyond their recreational value for people. A narrow ribbon of unique natural communities extends along the coast that are important for rare and common species alike. Several species of shorebirds and seabirds nest, feed and roost on the barrier islands that line the Southwest District's coast. Many are imperiled due to loss of these habitats to coastal development. Five species of sea turtles, all federally protected, nest on these beaches. Unique subspecies of marsh wren (*Cistothorus palustris*), seaside sparrow (*Ammospiza maritima*) and mink, along with other rare animals, are found in the district's coastal salt

marshes. Dozens of species of migrating songbirds rely on the district's maritime hammocks as stopover sites, where they eat wild fruits and insects to refill their energy stores for long journeys between North America and the tropics. Beach dunes, critical for protecting inland areas from the ravages of hurricanes and tropical storms, can have some of the highest densities of gopher tortoises in any habitat. Seagrass beds are typically found along the leeward side of the district's barrier islands and are vital feeding grounds for Florida manatee (*Trichechus manatus latirostris*). Finally, shell mound communities occurring on indigenous coastal shell middens provide carbonate-rich soil conditions that support imperiled species not found in other habitats. In the Southwest District these include aboriginal prickly apple (*Harrisia aboriginum*), terrestrial peperomia (*Peperomia humilis* var. *humilis*) and spiny hackberry (*Celtis pallida* var. *pallida*).

SOUTHWEST DISTRICT INVASIVE SPECIES

Invasive Plants

Approximately 1,557 species of non-native plants have been documented in Florida. These are species that originated in other parts of the world and were brought to Florida, intentionally or otherwise, by human activity. The majority of these are not known to spread aggressively in natural areas, but 172 non-native plant taxa are listed as invasive by the Florida Invasive Species Council. These are species that not only colonize natural areas but are documented to have negative impacts. Approximately three quarters of the invasive plants on the Florida Invasive Species Council list (i.e., 130 species) have been documented in the collective parks of the Southwest District.

Counties within the Southwest District range in the number of documented invasive plants. This variation in documented occurrences may be influenced by many factors, including the size of the county, its diversity of habitats, the human population and the amount of habitat fragmentation and alteration within the county. Some of the apparent differences from county to county are likely to be due to differences in scientific attention. Fewer biologists and fewer managed areas in some counties may simply result in invasive species being overlooked.

The warm wet climate in Southwest Florida is an ideal environment for many invaders from other subtropical regions of the world. Many of these species have evolved mechanisms to rapidly grow and reproduce in their native environments where resources are limited, and competition is high. Without such limitations, these species outcompete native Florida plants.

A key strategy to the long-term success of invasive plant management is to address nascent foci (i.e., smaller, satellite infestations) before tackling larger infestations (Moody and Mack, 1988). It is also important to define priorities in areas that have multiple non-native species (Gordon, et al., 2008, Stone and Andreu, 2017). Failure to do so could result in negative or nonexistent recovery to ecosystem function (Prior et. al, 2018, Stone and Andreu). The approach to invasive plant management in the Southwest District consequently includes objectives that acknowledge these challenges and the growing body of knowledge in invasive plant science. While the accompanying invasive species matrix below lists all recorded invasive plants that have been currently identified through the Southwest District, the following discussion highlights several of the higher profile species.

Brazilian peppertree (*Schinus terebinthifolius*) is widely spread, occurring to varying degrees of infestation in 35 of the park units within the district, particularly at estuarine buffers such as Terra Ceia and Charlotte Harbor preserves. Other invasive trees found throughout the district include melaleuca (*Melaleuca quinquinervia*), Australian pine (*Casuarina equisetifolia*), Silktree mimosa (*Albizia julibrissin*), camphor tree (*Cinnamomum camphora*), Chinese tallow (*Triadica* sebifera), carrotwood (*Cupaniopsis* anacardioides) and white leadtree (*Leucaena leucocephala*).

Many species of invasive vines and shrubs are well established in southwest Florida, including many state parks. Some of the well-known species include air potato (*Dioscorea bulbifera*), Japanese honeysuckle (*Lonicera japonica*), old-word climbing fern (*Lygodium microphyllum*), Japanese climbing fern (*Lygodium japonicum*), Red sesbania (*Sesbania punicea*), Caesarweed (*Urena lobata*) and a relative newcomer beach naupaka (*Scaevola taccada*) — an evergreen shrub that displaces native dune vegetation including sea oats that effectively anchor dune systems and help guard against erosion.

Cogongrass (*Imperata cylindrica*) is a widespread invasive colonial grass that is documented within 31 Southwest District parks. The most severe infestations occur within Alafia River State Park in areas dramatically manipulated by past phosphate mining activities. Other invasive grasses include

torpedograss (*Panicum repens*), natalgrass (*Melinis repens*), paragrass (*Urochloa mutica*), West Indian marshgrass (*Hymenachne amplexicaulis*) and Guineagrass (*Megathyrsus maximus*).

Another reason invasive plants proliferate is due to their lack of natural controls such as herbivores and pathogens that limit their population growth in their natural range. Efforts are ongoing to identify natural enemies for several of Florida's invasive plants to control these species without affecting native species. An early success of biological control in Florida was the 1965 release of a beetle to control alligatorweed (*Alternanthera philoxeroides*), an invasive aquatic plant. The alligatorweed beetle was successful, and while alligatorweed is still present in Florida, it is no longer the widespread problem it once was. Since then, potential biological controls have been studied for many invasive plants, including air potato, hydrilla (*Hydrilla verticillata*) and Chinese tallow, and some have been authorized for release and are established in north Florida.

After years of careful study, the air potato leaf beetle (*Lilioceris cheni*) was permitted for release starting in 2012. Both adults and larvae eat the leaves of air potato. Early research showed that the species established successfully and was capable of significantly reducing leaf cover of air potato, allowing native plants to begin to recover. The beetle has been released in all counties of Florida, as well as Georgia and Texas. Now that populations are established throughout the state, the mass rearing program of *L. cheni* is ending, with a focus now on rearing a complimentary species (*L. egena*) that eats bulbils, authorized for release in 2022. In addition to the air potato beetles, biocontrol agents for invasive plants including tropical soda apple, Brazilian pepper and Chinese tallow have been released, and additional prospective biocontrol agents are being studied. Researchers are continuing to search for biological controls to help with other invasive plants in Florida.

Invasive Animals

Of the dozens of non-native animals established in Florida, wild hogs are certainly among the most problematic. Hogs rooting in soil for food causes widespread damage to vegetation and hydrology, which can in turn affect water quality. Regardless of sex or age, hogs root for food on a regular basis, and it has been estimated that a single hog can root up almost 2 square meters per minute (Anderson et al., 2007). The aggregate impacts of this behavior on natural communities can therefore be extensive (Zengel and Connor, 2008; Chavarria et al., 2007). Unfortunately, the negative impacts of wild hogs in natural areas are not limited to rooting. Hogs are also regular predators on eggs, and both adult and juvenile animals carry diseases and disrupt hydrology by creating wallows.

Another widespread invasive animal is the domestic cat. Cats are highly efficient predators against which many native wildlife species have few defenses. The establishment of feral cat colonies, and even the presence of outdoor pets in or near parks, can reduce the parks' abilities to be sanctuaries for Florida's native wildlife.

The Cuban treefrog (*Osteopilus septentrionalis*), is well-established in southwest Florida. This large species of treefrog is a voracious predator and can eat the adults of native treefrogs. Their larvae also compete with native tadpoles.

The Argentine black and white tegu (*Salvator merianae*) is a large omnivorous lizard that adversely affects a variety of wildlife species. It is particularly known as an egg-eater, impacting ground nesting birds and perhaps gopher tortoises. The Florida Fish and Wildlife Commission (FWC) has documented

Argentine black and white tegus in nearly every county within the Southwest District, including larger populations in Hillsborough and Charlotte counties.

The history of invasive species in Florida in recent decades includes one more notable case study: the introduction of a beetle that brought a pathogen deadly to bay trees. The redbay ambrosia beetle (*Xyleborus glabratus*), native to Asia, was first found in Georgia in 2002 and appeared in northeast Florida in 2005. The female beetle bores through the bark of living trees in the Lauraceae family and constructs galleries in the sapwood. The females lay eggs in the galleries and inoculate the tree with a fungus that grows through the tree and serves as food for adult and larval beetles. Unfortunately, the fungus plugs the xylem of the tree, and the infected tree wilts and dies within a few weeks. As a consequence of the introduction of this species, mature red bay and swamp bay trees have been eliminated from hardwood forests, hammocks and swamps throughout Florida, with unknown effects on other species that depend on their leaves or fruits for food. It is suspected that the red bay ambrosia beetle was introduced through wooden packing material. The spread of this species was likely accelerated through the movement of wood from infested trees.

SOUTHWEST DISTRICT CULTURAL RESOURCES

Southwest Florida's state parks are not only rich in natural beauty but also in history. Parks such as Mound Key Archaeological State Park, Hillsborough River State Park, Paynes Creek Historic State Park, Ybor City Museum State Park, Collier-Seminole State Park, Highlands Hammock State Park and Myakka River State Park preserve structures, landscapes and stories that are integral to Florida's cultural heritage. Many of the Southwest District parks commemorate key historic events that have shaped our state's trajectory. Today, they stand as living reminders of local history, offering visitors a chance to experience the past.

Native American presence in Southwest Florida stretches back thousands of years, with the Manasota and Calusa being the most notable groups. The Manasota culture thrived in the region now known as Tampa Bay from approximately 500 B.C.E. to 900 C.E., relying primarily on the sea for survival. The Calusa inhabited the southwest coast from approximately C.E. 500 to 1800, including areas such as Naples, Fort Myers and the Everglades. While well known for their expert fishing, hunting and navigation skills, the Calusa also had a complex social structure evidenced by their construction of shell mounds, fish corrals and canals. Like the Manasota, the Calusa way of life was heavily dependent on the sea. They used fish traps, nets and canoes to catch fish and harvest shellfish, relying on these and other marine resources to sustain their communities. Their decline began in the 16th century with the arrival of Spanish explorers and continued with the influx of other southeastern natives such as the Creek and Yamasee. The introduction of diseases and conflicts significantly reduced the Calusa population. By the late 1700s, the Calusa had largely disappeared, with many survivors either migrating to Cuba or merging with other groups.

Spanish explorer Hernando de Soto played a pivotal role in the early exploration of the Tampa Bay area during his 1539 expedition to Florida. Recognized as one of the first Europeans to reach the region, de Soto's journey was marked by conflicts with Native American tribes. Despite the challenges, his travels provided valuable knowledge about the area's geography, rivers and indigenous cultures. His exploration laid the foundation for future Spanish colonization and had a lasting influence on Florida's history. Although his immediate impact was limited, de Soto's expedition sparked European interest in the Gulf Coast and the southeastern United States.

Most of the counties that make up the Southwest District are home to one or more state parks, each hosting a variety of cultural resources. Collectively, these parks represent a suite of cultural periods specific to southwest and central Florida. The following summary includes many of the Southwest District parks that preserve this geographic region's human story spanning thousands of years.

Mound Key Archaeological State Park is believed to have been the center of political and ceremonial life for the Calusa people that flourished in the area prior to European contact. The Calusa built large shell mounds and intricate structures on Mound Key, which served as a focal point for trade, rituals and governance. The state park is critical to preserving the Calusa culture and highlighting their impressive engineering and social organization.

Farther north in the Charlottle Harbor area, the Calusa constructed mounds on Cayo Costa for burials, ceremonies and long-term habitation sites. Cayo Costa was vital for fishing, trade and rituals, showcasing the Calusa's lifestyle and culture.

The Fakahatchee Strand is a unique wetland ecosystem in southwest Florida historically significant to Native American tribes, particularly the Calusa and later the Seminole. The Calusa primarily utilized the region seasonally for fishing, hunting and gathering medicinal herbs and other raw materials while the Seminole and Miccosukee migrated to the area in the latter half of the 19th century, attracted by the region's abundant resources and protective isolation.

Madira Bickel Mound, located in Pinellas County, was originally constructed approximately 2,000 years ago during the Manasota Culture; however, the complex was continually utilized across the subsequent Weeden Island and Safety Harbor cultures through the early 18th century. It is one of the largest shell mounds in the region, offering valuable insights into the ceremonial and socio-political practices of early native Florida societies.

Several Southwest District parks commemorate the long period of conflict between the United States and the Seminole Tribe. At Dade Battlefield Historic State Park, 180 Seminole warriors launched a devastating attack on a group of U.S. Army soldiers, marking the onset of the Second Seminole War. The park preserves the site of this significant event, offering visitors insight into an important chapter in U.S. and Native American history.

Paynes Creek and the Peace River hold historical significance as key locations following the Seminole Wars. The Peace River was a vital waterway for transportation and trade and served as a dividing line between the Seminole people and early settlers. An attack on a trading post near the confluence of Paynes Creek and the Peace River in 1849 prompted the construction of Fort Chokonikla. Both the raid on the trading post and the resulting U.S. Army fort are commemorated at Paynes Creek Historic State Park.

Both Anclote Key and Egmont Key played important roles in safeguarding Florida's early maritime routes. The Anclote Key lighthouse was constructed in 1887 to guide mariners around the shoals along the Pinellas coast. Egmont Key is also host to a 19th century lighthouse, as well as a Civil War era Union post and the defensive batteries of Fort Dade, which were constructed during the Spanish-American War to protect the entrance to Tampa Bay. Together, these islands highlight Florida's maritime heritage and coastal defenses of the late 19th century.

Local economies and landscapes within the West Central Rivers Region were transformed beginning in the 1880s by the discovery of phosphate reserves. Phosphate mining companies sprang up along many of the region's waterways including the Peace and Alafia rivers, where extraction of pebble phosphate from the river along with open pit mining in the surrounding uplands altered the lands and course of local history. This legacy of over a century of mining is apparent in the pronounced topography of Alafia River State Park. Linked to this mining history is Gasparilla Island State Park where Port Boca Grande, with its natural deep harbor, became the premier port where phosphate was exported to destinations around the world. Port Boca Grande played an important role in the Charlotte Harbor Region's economic growth through not only shipping but also a growing sport fishing industry.

Around this same time, Ybor City in Hillsborough County was founded by Vicente Martinez Ybor in 1886. By the early 20th century, Ybor City had grown into "the cigar capital of the world." Today it is one of only a small number of National Historic Landmark Districts located in Florida. The history of the factories where mostly Cuban cigar makers worked is preserved at Ybor City Museum State Park.

The growth of south Florida in the early 20th century is largely reflected in Collier-Seminole State Park. The massive engineering effort of constructing the Tamiami Trail across the Everglades only came to fruition though the efforts of influential developers like Barron Collier. Collier's financial and political backing were key in funding the western segment of the new highway. Relicts of this engineering feat, such as the Bay City Walking Dredge, are preserved at Collier-Seminole State Park.

Three Southwest District parks are associated with the early history of the Florida Park Service. Highlands Hammock State Park, Hillsborough River State Park and Myakka River State Park all highlight the significant contributions of the CCC during the 1930s. Highlands Hammock State Park features CCC-built trails, roads and a historic museum showcasing the CCC's role in developing Florida's first state parks. Similarly, Hillsborough River State Park was developed by the CCC with elements such as roads, trails, bridges, a campground and various buildings still in use today. Myakka River State Park, completed by the CCC in 1942, is one of the system's largest state parks and is celebrated for its rich wildlife and wild landscapes.

Located within the lower Springs Coast, Weeki Wachee Springs State Park is a time capsule to Florida's roadside attraction era of the early to mid-20th century. It is famous for its mermaid shows, which have enchanted visitors since the 1940s. The park is one of several units across the state that preserve the history of the early days of tourism prior to the current era of large theme parks.

Each park in the Southwest District holds its own historical and cultural importance, contributing to the unique character of our state. These parks each tell a distinct story, shedding light on the events that led to their creation and development. From Native American heritage to early roadside attractions, each park has its own cultural identity helping to shape and enrich the legacy of the Florida Park Service.

SOUTHWEST DISTRICT RESOURCE-BASED RECREATIONAL THEMES

The Trust for Public Land (TPL) is collaborating with public and private partners to develop the Florida Gulf Coast Trail — a 420-mile network of interconnected trails that spans Southwest Florida and includes Pinellas, Hillsborough, Manatee, Sarasota, Charlotte, Lee and Collier counties. Once the Florida Gulf Coast Trail is fully developed, it will connect to a statewide network of interconnected regional land trails from Florida's panhandle to the peninsula. TPL is currently focusing on completing **four priority trail segments**, including the Howard Frankland Bridge, Manatee Hillsborough Connector, Legacy Trail Connector and Bonita Estero Rail Trail. Planned and developed trail segments that link to Southwest District state parks are explained further in the respective Regional Introductions (see the Charlotte Harbor, Big Cypress, West-Central Rivers and Central Gulf regional introductions).

DRP's Office of Greenways and Trails' **Florida Greenways and Trails System (FGTS) Plan** identifies numerous, extensive regional trails within priority corridors in the FGTS Priority System. The Florida Gulf Coast Trail is represented within the FGTS **Statewide Priority Land Trail Corridors**, and the Office of Greenways and Trails has a **Gulf Coast Regional Trail Corridor Status map** reflecting updates on the trail's development.

SOUTHWEST DISTRICT INTERPRETIVE THEMES

- Natural communities and their importance in preserving natural domain and ecological function.
- How processes such as fire and hydrology shape and sustain southwest Florida's natural landscapes.
- The dynamics of coastal change.
- Imperiled species that call Southwest District parks home with a focus on endemism.
- Geomorphology, with an emphasis on the natural history of the Lake Wales Ridge, Fakahatchee Strand and southwest Florida's 183-mile-long barrier island chain.
- Southwest Florida's rich history, from its indigenous people to the key figures, places and events that reveal the human story in the region.