

GUIDE TO THE  
NATURAL COMMUNITIES  
OF FLORIDA

Prepared by the  
Florida Natural Areas Inventory  
and  
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## INTRODUCTION

This document presents the hierarchical classification of 81 Natural Communities that has been developed by the Florida Natural Areas Inventory (FNAI) and identified as collectively constituting the original, natural biological associations of Florida. A Natural Community (NC) is defined as a distinct and reoccurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment.

The levels of this classification become increasingly more complex and finely subdivided. At all levels, however, there are overlaps between types because of overlapping species distributions and intergrading physical conditions. At the broadest level, the Natural Communities are grouped into seven Natural Community Categories based on hydrology and vegetation. Terrestrial Natural Communities are upland habitats dominated by plants which are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10% of the growing season. Palustrine Natural Communities are freshwater wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10% or more of the growing season. Lacustrine Natural Communities occur in non-flowing wetlands of natural depressions lacking persistent emergent vegetation except around the perimeter. Riverine Natural Communities are natural, flowing waters from their source to the downstream limits of tidal influence, and bounded by channel banks. Subterranean Natural Communities occur below ground surface. Estuarine Natural Communities are subtidal, intertidal, and supratidal zones of coastal water bodies, usually partially enclosed by land but with a connection to the open sea, within which seawater is significantly diluted with freshwater inflow from the land. Marine Natural Communities occur in subtidal, intertidal, and supratidal zones of the sea, landward to the point at which seawater becomes significantly diluted with freshwater inflow from the land. A second level of the hierarchy splits the Natural Community Categories into Natural Community Groups, such as Xeric Uplands, Coastal Uplands, Floodplain Wetlands, and so forth.

The third level of the classification, Natural Community Types, is the level at which Natural Communities are named and described. Natural Communities are characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire. They are named for their most characteristic biological or physical feature. The Natural Communities can be further subdivided into Plant Communities that are based on the dominant vegetation. These subdivisions are not presented in this document.

The arrangement of Natural Communities by Natural Community Groups and the arrangement of the Groups by Natural Community Types is given in the Table of Contents. The Natural Community classification hierarchy, the descriptions, and the ranks are all part of a dynamic system that will change as new information is acquired. Because of the relative paucity of data on many Natural Communities and the continuing development of

the system, the information presented here should not be considered as final, but as a current,

nontechnical introduction subject to change. Appendices 1 and 2 refer the common names used in this document to scientific names.

Table 1 shows the relative ranks of the NCs. FNAI uses several criteria to determine the relative rarity and threat to each community type; these are translated or summarized into a global and a state rank, the G and S ranks, respectively. Most G ranks for NCs are temporary pending comparison and coordination with other states using this methodology to classify and rank vegetation types. (Contact Florida Natural Areas Inventory for most recent natural community ranks.) A few NCs and several Plant Communities occur only or mostly in Florida and can be considered endemic to Florida. (See J.W. Muller *et al.* 1989. "Summary Report on the Vascular Plants, Animals and Plant Communities Endemic to Florida". Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program, Technical Report No. 7.) The only opportunity for protection of these communities is in Florida and they should be given special consideration in Florida's protection efforts.

Numerous classification schemes exist for the state of Florida. All of these are more or less subjective and incorporate the observer's biases. The construction and usefulness of these classifications depends on the purpose for which they were constructed and the purpose for which they are used. To facilitate comparisons among these schemes, Appendix 3 relates some of those vegetation classification schemes that concern the vegetation of the entire state. The various classification schemes recognize different numbers of vegetation types, ranging from 10 terrestrial and palustrine types in for the Kuchler system to 81 for the FNAI classification, which includes marine and estuarine types.

In actual practice, the FNAI classification is perhaps more often useful in undisturbed, or relatively undisturbed, vegetation than in disturbed sites, and in "potential natural vegetation" rather than existing vegetation. As with most vegetation classifications, the lines between types are often obscure in the field because of the overlap of species and the intergradation among species and physical features. For these reasons, and others, probably no single example of a community type will precisely match all the specifics given in these descriptions.

One of the advantages of the FNAI classification is that it is flexible and dynamic. It will change as additional data are accumulated. Ultimately, it will be desirable to locate several examples of each type, perhaps in different portions of the state, to serve as reference examples so that users of the classification can have real examples to which to refer.

**Table 1:** Florida Natural Areas Inventory Global (G) and State (S) ranks for Natural Communities

TERRESTRIAL

XERIC UPLANDS

G3 S2 Sandhill  
 G2 S2 Scrub  
 G3 S3 Xeric Hammock

COASTAL UPLANDS

G3 S2 Beach Dune  
 G3 S2 Coastal Berm  
 G3 S2 Coastal Grasslands  
 G1 S1 Coastal Rock Barren  
 G3 S2 Coastal Strand  
 G3 S2 Maritime Hammock  
 G2 S2 Shell Mound

MESIC UPLANDS

G3 S2 Slope Forest  
 G1 S1 Upland Glade  
 G5 S3 Upland Hardwood Forest  
 G4 S4 Upland Mixed Forest  
 G3 S3 Upland Pine Forest

ROCKLANDS

G1 S1 Pine Rocklands  
 G2 S2 Rockland Hammock  
 G2 S2 Sinkhole

MESIC FLATLANDS

G2 S2 Dry Prairie  
 G4 S4 Mesic Flatwoods  
 G3 S3 Prairie Hammock  
 G3 S3 Scrubby Flatwoods

PALUSTRINE

WET FLATLANDS

G4 S4 Hydric Hammock  
 G3 S3 Marl Prairie  
 G4 S4 Wet Flatwoods  
 G3 S2 Wet Prairie

PALUSTRINE (CONT.)

FLOODPLAIN WETLANDS

G4 S3 Bottomland Forest  
 G4 S3 Floodplain Forest  
 G3 S2 Floodplain Marsh  
 G4 S4 Floodplain Swamp  
 G3 S3 Freshwater Tidal Swamp  
 G3 S3 Slough  
 G4 S4 Strand Swamp  
 G4 S3 Swale

BASIN WETLANDS

G4 S4 Basin Marsh  
 G4 S3 Basin Swamp  
 G2 S1 Bog  
 G4 S4 Depression Marsh\*

LACUSTRINE

G3 S2 Clastic Upland Lake  
 G2 S1 Coastal Dune Lake  
 G2 S1 Coastal Rockland Lake  
 G4 S3 Flatwoods/Prairie Lake  
 G4 S4 Marsh Lake  
 G4 S2 River Floodplain Lake  
 G3 S2 Sandhill Upland Lake  
 G3 S3 Sinkhole Lake  
 G4 S3 Swamp Lake

RIVERINE

G4 S2 Alluvial Stream  
 G4 S2 Blackwater Stream  
 G3 S2 Seepage Stream  
 G2 S2 Spring-run Stream

SUBTERRANEAN

G3 S2 Aquatic Cave  
 G3 S2 Terrestrial Cave

SEEPAGE WETLANDS

G4 S4 Baygall

G3 S2 Seepage Slope

MARINE AND ESTUARINE

MINERAL BASED

G3 S3 Consolidated Substrate

G5 S5 Unconsolidated Substrate

FAUNAL BASED

G2 S1 Coral Reef

G3 S3 Mollusk Reef

G2 S1 Octocoral Bed

G2 S2 Sponge Bed

G1 S1 Worm Reef

MARINE AND ESTUARINE (cont.)

FLORAL BASED

G3 S2 Algal Bed

G2 S2 Seagrass Bed

G4 S4 Tidal Marsh

G3 S3 Tidal Swamp

COMPOSITE SUBSTRATE

G3 S3 Composite Substrate

\*G3 S2 *Coastal Interdunal Swale*

\*G3 S3 *Mesic Hammock*

Definition of Global (G) element ranks:

- G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very little remaining area, e.g., <2,000 acres) or because of some factor(s) making it especially vulnerable to extinction;
- G2 = Imperiled globally because of rarity (6-20 occurrences or very little remaining area, e.g., <10,000 acres) or because of some factor(s) making it very vulnerable to extinction throughout its range;
- G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range, 21 to 100 occurrences;
- G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery;
- G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery;
- G? = uncertain Global rank.

Definition of State (S) element ranks:

- S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very little remaining area) or because of some factor(s) making it especially vulnerable to extinction;
- S2 = Imperiled in state because of rarity (6-20 occurrences or little remaining area) or because of some factor(s) making it very vulnerable to extinction throughout its range;
- S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences);
- S4 = Apparently secure in state, although it may be rare in some parts of its state range;
- S5 = Demonstrably secure in state and essentially ineradicable under present conditions;
- S? = uncertain State rank.

## TERRESTRIAL

**XERIC UPLANDS** - very dry, deep, well-drained hills of sand with xeric-adapted vegetation.

Sandhill - (synonyms: longleaf pine - turkey oak, longleaf pine - xerophytic oak, longleaf pine - deciduous oak, high pine). Sandhills are characterized as a forest of widely spaced pine trees with a sparse understory of deciduous oaks and a fairly dense ground cover of grasses and herbs on rolling hills of sand. The most typical associations are dominated by longleaf pine, turkey oak, and wiregrass. Other typical plants include bluejack oak, sand post oak, sparkleberry, persimmon, winged sumac, pinewoods dropseed, Indian grass, wild buckwheat, queen's delight, yellow foxglove, bracken fern, runner oak, goats rue, partridge pea, milk pea, dollarweeds, wild indigo, gopher apple, and golden-aster. Typical animals include tiger salamander, barking treefrog, spadefoot toad, gopher frog, gopher tortoise, worm lizard, fence lizard, mole skink, indigo snake, coachwhip snake, pine snake, short-tailed snake, crowned snake, eastern diamondback rattlesnake, bobwhite, ground dove, red-headed woodpecker, rufous-sided towhee, fox squirrel and pocket gopher.

Sandhills occur on hilltops and slopes of gently rolling hills. Their soils are composed of deep, marine-deposited, yellowish sands that are well-drained and relatively sterile. The easily leached soil nutrients are brought back to the surface by the burrowing habits of some sandhill animals. Sandhills are important aquifer recharge areas because the porous sands allow water to move rapidly through with little runoff and minimal evaporation. The deep sandy soils help create a xeric environment that is accentuated by the scattered overstory, which allows more sunlight to penetrate and warm the ground. The absence of a closed canopy also allows Sandhills to cool more rapidly at night and to retain less air moisture. Thus, temperature and humidity fluctuations are generally greater in Sandhills than in nearby closed canopy forests.

Fire is a dominant factor in the ecology of this community. Sandhills are a fire climax community, being dependent on frequent ground fires to reduce hardwood competition and to perpetuate pines and grasses. The natural fire frequency appears to be every 2 to 5 years. Without frequent fires, Sandhills may eventually succeed to Xeric Hammock. Unburned or cutover Sandhills may be dominated by turkey oak.

Sandhills are often associated with and grade into Scrub, Scrubby Flatwoods, Mesic Flatwoods, Upland Pine Forest, or Xeric Hammock. Sandhills were widespread throughout the Coastal Plain, but most have been degraded by timbering, overgrazing, plowing, fire exclusion, and other disturbances. Much of Florida's Sandhill communities have been converted to citrus groves, pastures, pine plantations, or residential and commercial developments. Thus, the importance of properly managing the remaining tracts is accentuated.

Scrub - (synonyms: sand pine scrub, Florida scrub, sand scrub, rosemary scrub, oak scrub). Scrub occurs in many forms, but is often characterized as a closed to open canopy forest

of sand pines with dense clumps or vast thickets of scrub oaks and other shrubs dominating the understory. The ground cover is generally very sparse, being dominated by ground lichens or, rarely, herbs. Open patches of barren sand are common. Where the overstory of sand pines is widely scattered or absent altogether, the understory and barren sands are exposed to more intense sunlight. Typical plants include sand pine, sand live oak, myrtle oak, Chapman's oak, scrub oak, saw palmetto, rosemary, rusty lyonia, ground lichens, scrub hickory, scrub palmetto, hog plum, silk bay, beak rush, milk peas, and stagger bush. Typical animals include red widow spider, scrub wolf spider, oak toad, Florida scrub lizard, blue-tailed mole skink, sand skink, six-lined racerunner, coachwhip, ground dove, scrub jay, loggerhead shrike, yellow-rumped warbler, rufous-sided towhee, Florida mouse, and spotted skunk. Scrubs of the Lake Wales Ridge are notable for the large number of narrowly endemic plants and animals that occur in them.

Scrub occurs on sand ridges along former shorelines. Some of the sand ridges originated as wind-deposited dunes, others as wave-washed sand bars. Some Scrub soils are composed of well-washed, deep sands that are brilliant white at the surface; some Scrubs occur on yellow sands. The loose sands drain rapidly, creating very xeric conditions for which the plants appear to have evolved several water conservation strategies.

Scrub is essentially a fire maintained community. Ground vegetation is extremely sparse and leaf fall is minimal, thus reducing the chance of frequent ground fires. As the sand pines mature, however, they retain most of their branches and build up large fuel supplies in their crowns. When a fire does occur, this fuel supply, in combination with the resinous needles and high stand density, ensures a hot, fast burning fire. Such fires allow for the regeneration of the Scrub community which might otherwise succeed to Xeric Hammock. The minerals in the vegetation are deposited on the bare sand as ashes, and the heat of the fire generally facilitates the release of pine seeds. As discerned from the life histories of the dominant plants, scrub probably burns catastrophically once every 20 to 80 years or longer.

Scrub is associated with and often grades into Sandhill, Scrubby Flatwoods, Coastal Strand, and Xeric Hammock. Some Xeric Hammocks are advanced successional stages of Scrub, making intermediate stages difficult to classify. Scrub occurs almost exclusively in Florida, although coastal scrubs extend into adjacent Alabama and Georgia.

Because Scrub occurs on high dry ground and is not an aesthetically pleasing habitat, at least to the uninitiated, this ecosystem and its many endangered and threatened species are rapidly being lost to development. Scrub is also readily damaged by off-road vehicle traffic or even foot traffic, which destroys the delicate ground cover and allows the loose sand to erode. Ground lichens may require 50 years or more to recover.

Xeric Hammock - (synonyms: xeric forest, sand hammock, live oak forest, oak woodland, oak hammock). Xeric Hammock is characterized as either a scrubby, dense, low canopy forest with little understory other than palmetto, or a multi-storied forest of tall trees with an open or closed canopy. Several gradations between these extremes exist. Typical plants include live oak, sand live oak, laurel oak, turkey oak, blackjack oak, red oak, sand post oak,

staggerbush, saw palmetto, sparkleberry, pignut hickory, southern magnolia, redbay, American holly, wild olive, black cherry, fox grape, beautyberry, bluejack oak, Chapman's oak, persimmon, and yaupon. Typical animals include barking treefrog, spadefoot toad, gopher tortoise, worm lizard, fence lizard, black racer, red rat snake, hognose snake, crowned snake, screech-owl, turkey, blue jay, eastern mole, gray squirrel, and eastern flying squirrel.

Xeric Hammock is an advanced successional stage of Scrub or Sandhill. The variation in vegetation structure is predominantly due to the original community from which it developed. In all cases, however, the soils consist primarily of deep, excessively-drained sands that were derived from old dune systems. The sparsity of herbs and the relatively incombustible oak litter preclude most fires from invading Xeric Hammock. When fire does occur, it is nearly always catastrophic and may revert Xeric Hammock into another community type. Xeric Hammock only develops on sites that have been protected from fire for 30 or more years.

Xeric Hammocks are often associated with and grade into Scrub, Sandhill, Upland Mixed Forest or Slope Forest. The species composition of Xeric Hammock is also often similar to Prairie Hammock and Maritime Hammock. Xeric Hammock is often considered the climax community on sandy uplands.

Xeric Hammock occurs generally as isolated patches that rarely cover extensive areas. Mature examples are rare, and scrub derived types have always been scarce. Because of its general location on high ground with big trees, Xeric Hammock is prime residential property, especially when near the coast. Remaining tracts of Xeric Hammock require protection from fire and development.

**COASTAL UPLANDS** - substrate and vegetation influenced primarily by such coastal (maritime) processes as erosion, deposition, salt spray, and storms.

Beach Dune - (synonyms: sand dunes, pioneer zone, upper beach, sea oats zone, coastal strand). Beach Dune is characterized as a wind-deposited, foredune and wave-deposited upper beach that are sparsely to densely vegetated with pioneer species, especially sea oats. Other typical pioneer species include beach cordgrass, sand spur, dune or bitter panic grass, railroad vine, beach morning glory, seashore paspalum, beach elder, dune sunflower, sea purslane, and sea rocket. Typical animals include ghost crab, six-lined racerunner, kestrel, red-winged blackbird, savannah sparrows, beach mouse, and raccoon. Beach dune, especially along its ecotone with the unvegetated beach, is also the primary nesting habitat for numerous shorebirds and marine turtles, including many rare and endangered species.

Beach Dune communities are found along shorelines subject to high energy waves which deposit sand-sized grains to form the open beach. Onshore winds move the sand grains inland until slowed by an obstacle, usually plant stems, causing the grains to drop. As the plants grow upward and burial continues, a foredune is built. Dune height is largely determined by the strength and the directional constancy of winds and by the growth habits of dune-forming plants. As a cape or barrier island grows seaward, new beaches are deposited seaward of the old ones and a characteristic ridge and swale topography develops.

Beach Dunes are very dynamic communities and mobile environments. The wind continually moves the sand inland from the beach until trapped by vegetation. Beach Dunes are subject to drastic topographic alterations during winter storms and hurricanes. Taking the brunt of storm surge, intact Beach Dunes are essential for protection of inland biological communities.

The soils of Beach Dunes are composed of sands that are similar to those washed onto the adjacent beach, except that the wind selectively lifts out the smaller sand particles, blows them inshore, and deposits them around plant stems. These deep siliceous or calcareous sands drain rapidly, creating decidedly xeric conditions.

Beach Dunes occur in an extremely harsh environment. The dune vegetation must be able to tolerate loose, dry, unstable, nutrient poor soils, as well as exposure to wind, salt spray, sand abrasion, intense sunlight, and storms. Thus, dune species have evolved several morphological adaptations to survive in this harsh environment. Many of them root easily from fragments washed ashore in storm debris, or they produce large floating seeds that can be transported by ocean currents. Some have thickened cuticles and succulent foliage to better retain water and to reduce the effects of salt spray and sand abrasion. Some spread by subterranean or surface runners that creep across the barren sands. Many readily rereoot from higher up their stems when buried by blowing sand and consequently develop a matted or wiry root system. Some have become so dependent on the dune habitat that they lose vigor without shifting sands constantly stimulating them to send out new shoots and rereoot. These characteristics are the primary reasons for their unique ability to stabilize aeolian sand into nearly static beach dunes.

In spite of their ability to withstand the harsh maritime environment, plants of the Beach Dunes are extremely vulnerable to human impacts. A footpath or off-road vehicle trail over the beach dunes can damage the vegetation, giving wind and water the leverage needed to begin erosional processes. A gap, or blowout, forms and continually widens until it is slowly revegetated and stabilized. The sand from the gap moves inland, and rapidly buries vegetation, destabilizing the beach dunes and often disturbing adjacent communities. When a storm ensues, the unvegetated gap allows storm surges easy access to these communities for further disruption. Because of their vulnerability, Beach Dunes require protection from trampling (i.e., boardwalks for beach access) and off-road vehicles. Coastal developments which affect the sand sources that are necessary for Beach Dune replenishment should be strongly discouraged.

Coastal Berm - (synonyms: shell ridge, coastal levee, coastal forest, buttonwood embankment, mangrove hammock). Coastal Berm applies to a variety of plant associations that develop on ridges of storm deposited sand, shells, and debris. These associations include dense thickets of large shrubs and small trees, hammocks, or sparse shrubby vegetation with spiny xerophytic plants. Typical plants include cabbage palm, cocoplum, sea grape, marsh elder, beach orach, greenbrier, prickly pear cactus, evening primrose, dropseed, poison ivy, marshhay, Spanish bayonet, bay cedar, wax myrtle, live oak, muhly grass, sea purslane, tall wiregrass, salt myrtle, sea oats, beach morning glory, sea oxeye, stinging nettle, love vine, prickly apple, snowberry, varnish leaf, stoppers, coral bean, privet, strangler fig, and wild coffee. Many animals typical of Beach Dune likewise inhabit Coastal Berm.

Coastal Berm is generally a ridge of storm-deposited marine debris that is parallel to the shore, occasionally occurring in a series with alternating swales. Such storm ridges are usually found along low-energy coastlines, and are often surrounded by mangrove or salt marsh communities. Coastal Berm may be difficult to differentiate from Indian-constructed Shell Mound or wind-deposited Coastal Strand or Maritime Hammock. It is often associated with and may grade into Tidal Swamp (mangroves) or Overwash Plain. It may also be confused with dredge spoil. Its coastal location subjects Coastal Berm to maritime influences similar to that experienced by Coastal Strand.

Coastal Grassland - (synonyms: overwash plain, deflation plain, salt flat, coastal savannah). Coastal Grassland is characterized as a treeless flat land or gently undulating land with barren sand or a sparse to dense ground cover of grasses, prostrate vines, and other herbaceous or suffrutescent species that are adapted to harsh maritime conditions. Older, more established sites may include scattered or small clumps of trees or shrubs. Typical plants include muhly grass, bluestem grasses, sea oats, beach cordgrass, dune panic grass, beach morning glory, sea oxeye, beach elder, sea purslane, glasswort, sand spurs, evening primrose, pennywort, ground cherry, sedges, crowfoot grass, dropseed, prickly pear cactus, rushes, love grass, wax myrtle, and groundsel bush. Typical animals include ghost crab, blackbirds, and savannah sparrows. Some shorebirds also nest in this community.

Coastal Grassland is a low flat area behind the foredunes that is found on broader barrier

islands, capes, spits, and is best developed along the Gulf Coast. It may be periodically flooded by saltwater and covered with sand and debris during major storms. The frequency of overwash processes is largely related to the height and continuity of the seaward beach dunes; low, dissected dunes allowing more frequent overwash than high continuous dunes.

Coastal Grassland species will colonize expanses of newly deposited sands. With time, these areas become vegetated with pioneer species, eventually taking on characteristics similar to prairie. If no major storms occur to renew the process, Coastal Grasslands will often be colonized by shrubs and trees and eventually may succeed to Coastal Strand or Flatwoods.

Coastal Rock Barren - (synonyms: littoral rock pavement, algal barren, cactus barren, rocky flat). Coastal Rock Barren is an ecotonal community occurring along rocky coastlines in the Florida Keys. They are generally characterized as flat rocklands with much exposed and eroded limestone and are sparsely vegetated with stunted, xeric and halophytic shrubs, cacti, algae, and herbs. Typical plants include white mangrove, black mangrove, red mangrove, buttonwood, caper tree, sea grape, bay cedar, cat's claw, lantana, forestiera, stoppers, nickerbean, glasswort, sea purslane, shore grass, seashore dropseed, railroad vine, sea oxeye, prickly apple, milkpeas, prickly pear cactus, Spanish bayonet, and saltwort.

Soils, if they can be called that, generally consist of calcareous marls and organic debris within solution depressions and crevices in the coralline limestone pavement. The proximity of Coastal Rock Barren to coastal waters makes them subject to inundations by saltwater during storms and perhaps during extreme high tides. Rainfall generally forms pools and puddles on the surface, percolating slowly, if at all, through crevices in the highly consolidated substrate. Most freshwater is probably absorbed rapidly by the scattered plants, or is lost to evaporation or runoff.

Plants of Coastal Rock Barren are adapted to high insolation levels, salt spray, occasional inundations by saltwater, and other tropical marine influences. Because of their insular location, their frequent association with wetlands, and their general sparsely distributed vegetation, fire is highly unlikely in Coastal Rock Barren.

Coastal Rock Barren often occurs in a continuum between Marine Consolidated Substrate and Rockland Hammock or Pine Rockland. It may also be associated with and grade into Marl Prairie. Coastal Rock Barren often has species compositions that are similar to those of some Coastal Berm and Shell Mound communities. It often exhibits zonation patterns, typically grading seaward into rocky shore or buttonwood and mangrove association, and inland into thorn scrub, then cactus hammock, then Maritime Hammock. Where the slope rises noticeably, the entire sequence of transition zones may be condensed into a few yards. Where the slope is imperceptible, these zones may become intermingled over several acres.

Coastal Rock Barren is a very rare community, occurring as tiny patches scattered along some shorelines in the Florida Keys. Because it occurs on sites near water in a region undergoing intensive resort development, Coastal Rock Barren is rapidly disappearing. Existing

sites should be diligently protected from development, cactus poaching, and visitor overuse. They may also be affected by offshore dredging and beach nourishment activities which would increase sediment loads and possibly convert them to coralline Beach Dune.

Coastal Strand - (synonyms: shrub zone, maritime thicket, coastal scrub). Coastal Strand is characterized as stabilized, wind-deposited coastal dunes that are vegetated with a dense thicket of salt-tolerant shrubs, especially saw palmetto. Other typical plants include sand live oak, cabbage palm, myrtle oak, yaupon, sea grape, cat's claw, nakedwood, lantana, greenbrier, buckthorn, cocoplum, nickerbean, coin vine, beach jacquemontia, pinweed, bay cedar, necklace pod, sea lavender, Spanish bayonet, woody goldenrod and Florida rosemary. Typical animals include gopher tortoise, six-lined racerunner, southern hognose snake, coachwhip snake, diamondback rattlesnake, and beach mouse.

Coastal Strand occurs on deep, wind-deposited sands which have been wind- sorted and wave-washed. There is usually some shell admixed with quartz grains on the beach, but this is rapidly leached out in the course of only a few hundred years. Coastal Strand dunes are generally quite stable but are susceptible to severe damage if the vegetation is disturbed. Shrubs in the Coastal Strand are frequently dwarfed and pruned as a result of the salt spray-laden winds that kill twigs on the seaward side, producing a smooth, dense upward-slanting canopy resembling a sheared hedge.

Coastal Strand is actually an ecotonal community that generally lies between Beach Dune and Maritime hammock. It may also grade into Scrub, and it often shares many of the same species that occur in Coastal Berm. Fire may reduce succession towards Maritime Hammock. However, maritime influences alone will often suffice to inhibit succession to forest.

Coastal Strand is probably the most rapidly disappearing community in Florida. It is most extensive along the Atlantic Coast where, being elevated and next to the coast, it is prime resort or residential property. Coastal Strand originally occurred as a nearly continuous band along the Atlantic shorelines. Now it occurs largely as broken and isolated small stretches. In south Florida, it has also been disturbed by invasions of exotic species, principally Brazilian pepper and Australian pine. Along with other coastal communities, Coastal Strand protects inland communities from the severe effects of storms.

Maritime Hammock - (synonyms: coastal hammock, maritime forest, tropical hammock). Maritime Hammock is characterized as a narrow band of hardwood forest lying just inland of the Coastal Strand community. Live oak, cabbage palm, and redbay generally combine to form a dense, wind-pruned canopy whose streamlined profile deflects winds and generally prevents hurricanes from uprooting the trees. Other typical plants include American holly, southern magnolia, red cedar, sea grape, false mastic, paradise tree, lancewood, gumbo- limbo, strangler fig, poisonwood, wild olive, saw palmetto, beautyberry, poison ivy, coral bean, coontie, prickly ash, wild coffee, snowberry, myrsine, caper tree, marlberry, rouge-plant, and ferns. Typical animals include squirrel treefrogs, ring-necked snake, rat snakes, and gray squirrel. Migrating birds rely on these forests for food and shelter following trans-oceanic or trans-gulf

migrations.

Maritime Hammock occurs on old coastal dunes that have been stabilized long enough for the growth of a forest. Tree growth often begins in swales between old dune ridges where a higher moisture gradient exists. The isolated strips of tree growth gradually coalesce into a continuous forest. Humus buildup contributes to moisture retention, while the dense canopy minimizes temperature fluctuations by reducing soil warming during the day and heat loss at night. Soils of Maritime Hammock are generally well-drained because of the underlying deep sands.

The generally mesic conditions and insular locations of well-developed Maritime Hammock communities inhibit natural fires, which occur no more frequently than once every 26 to 100 years. In mature Maritime Hammock, fire may alter the original appearance, obscuring former beach ridge vegetation patterns and creating a diversity of plant sub-associations. Nutrient recycling is generally accomplished by detrital organisms instead of by fire.

Maritime Hammock is closely associated with and often grades into Coastal Strand, Scrub, Hydric Hammock, or Prairie Hammock. Because of species overlap, Maritime Hammock may also be confused with Shell Mound, Coastal Berm, Xeric Hammock, and Rockland Hammock. Maritime Hammock is the terminal stage of succession in coastal areas.

Maritime Hammock is prime resort and residential property because of its relatively protected location along the coast. Although it originally occurred in virtually continuous bands with Coastal Strand, Maritime Hammock is now dissected into short strips by development and is rapidly disappearing. Maritime Hammock is reasonably resilient so long as the canopy remains intact and the landform stable. Removal of large exotic species should be conducted in phases to minimize canopy disruptions.

Shell Mound - (synonyms: midden, Indian mound, tropical hammock, maritime hammock, coastal hammock). Shell Mound is unusual among the biological communities in that it is largely a result of the activities of Indians, instead of natural physical factors. Shell Mound is generally characterized as an elevated mound of mollusk shells and aboriginal garbage on which a hardwood, closed-canopy forest develops. In some cases, a sparse shrubby community, sometimes with cactus, may develop in lieu of hammock vegetation. Typical plants include gumbo-limbo, cabbage palm, mastic, red cedar, hackberry, live oak, forestiera, coral bean, marlberry, saffron plum, sagaretia, coontie, and others.

Shell Mound soils are composed of shells and shell fragments with an organic component derived from forest litter. The soil generally is circumneutral to slightly alkaline (pH = 7-8) and contains 1-20% organic materials. The loose collection of shells allows water to drain extremely rapidly. The calcareous substrate, in combination with their coastal location, often permits tropical or subtropical species of plants to grow much further north on Shell Mounds than their normal ranges on other substrates. Their coastal, usually insular, location generally protects Shell Mounds from fire, but subjects them to marine influences, including high winds, salt spray,

high insolation, and storm surge.

Shell Mound is often associated with and grades into Rockland Hammock, Coastal Berm, or Maritime Hammock. It is often so similar in species composition to these communities that it may be difficult to differentiate. Some Shell Mounds may also be very similar to Coastal Rock Barren communities.

Because they are constructed of archaeological remains, Shell Mounds are vulnerable to damage by artifact-seekers and archaeological excavations. Sites where visitor use is not monitored should not be publicized. Archaeological investigations should be conducted with care to protect important botanical features.

**MESIC UPLANDS** - dry to moist hills of sand with varying amounts of clay, silt or organic material; diverse mixture of broad leaved and needle leaved temperate woody species.

Slope Forest - (synonyms: ravine forest, bluff forest, mesic hammock, hardwood hammock, steepheads, mixed hardwood and pine, climax hardwoods, southern mixed hardwoods, mixed mesophytic forest). Slope Forests are characterized as well-developed, closed canopy forests of upland hardwoods on steep slopes, bluffs, and ravines. The combination of densely shaded slopes and cool, moist microclimate produces conditions that are conducive for the growth of many species which are more typical of the Piedmont and Southern Appalachian Mountains, including black walnut, basswood, wild hydrangea, sweet shrub, strawberry bush, wild ginger, bluebell, maidenhair fern, Solomon's seal, liverleaf, doll's eyes, bellwort, bloodroot, snakeroot, false hellebore, lousewort, wild comfrey, rattlesnake plantain, bladder nut, and leatherwood. Other typical plants include southern magnolia, American beech, spruce pine, white oak, laurel oak, mockernut hickory, American holly, southern red cedar, pignut hickory, sand hickory, sweetgum, sourwood, partridgeberry, saw greenbrier, sarsaparilla vine, trilliums, silverbell, Christmas fern, witchhazel, redbud, mountain laurel, Carolina laurelcherry, Sebastianbush, fringe tree, bigleaf snowbell, tulip poplar, white ash, live oak, flowering dogwood, horse sugar, silky camellia, Florida yew, Ashe magnolia, pyramid magnolia, and torreyia tree. Typical animals include southern dusky salamander, three-lined salamander, slimy salamander, mud salamander, red salamander, spring peeper, box turtle, five-lined skink, broadhead skink, ground skink, gray rat snake, eastern king snake, rough green snake, eastern garter snake, coral snake, southern copperhead, red-tailed hawk, turkey, woodcock, mourning dove, yellow-billed cuckoo, screech-owl, great horned owl, common night hawk, ruby-throated hummingbird, red-bellied woodpecker, yellow-bellied sapsucker, downy woodpecker, pileated woodpecker, crested flycatcher, eastern phoebe, eastern kingbird, blue jay, tufted titmouse, Carolina chickadee, nuthatches, Carolina wren, hermit thrush, robin, brown thrasher, cedar waxwing, white-eyed vireo, red-eyed vireo, yellow-throated warbler, palm warbler, ovenbird, summer tanager, cardinal, rufous-sided towhee, white-throated sparrow, orchard oriole, opossum, gray squirrel, eastern woodrat, golden mouse, raccoon, gray fox, bobcat, and white-tailed deer.

Slope Forests occur on areas with substantial topographic relief. Soils are generally composed of sands, sandy-clays, or clayey-sands with substantial organics and occasionally calcareous components near the bottom of the slope. Sandy soils are generally well drained, but clayey soils may shed much of the rainfall and exhibit significant surface water runoff. Thus, soil erosion is often a combination of seepage erosion, which occurs largely from the valley floors up, and surface erosion, which occurs largely from the hilltops down.

Slope Forests are mesic communities with relatively moist and cool microclimates that vary, however, with topographic location. Although the preponderance of deciduous trees creates a thick mulch of leaf litter which helps retain soil moisture, the higher elevations with deep sandy soils and thinner leaf mantles may exhibit nearly xeric soil conditions. Lower elevations on the slopes near cool streams or where seepage is prevalent tend to be cooler, and moister soils may be nearly hydric. In addition slight changes in soil moisture are often reflected

by different plant species. For example, star anise tends to be associated with the lower seepage slopes and other wet sites, while mockernut hickory tends to be associated with well-drained, drier upper sites. Furthermore, north-facing slopes receive less sunlight in winter, which tends to lower surface temperatures and allows many northern species that require a substantial winter chill to survive in southern slope forest refugia.

Slope Forests exhibit one of the highest species diversities in the state, largely because of their admixture of northern temperate and subtropical elements. Several endemic species also occur in Slope Forests. Tree density is relatively high, inducing much competition for space, water, sunlight and nutrients. Succession is generally restricted to areas where trees have fallen and created openings in the canopy.

Slope Forests are climax communities that may be very difficult to distinguish from Upland Hardwood Forest or Upland Mixed Forest because they share many species. Slope Forests generally have steeper slopes than other upland communities, and they frequently have plants that appear to be specifically adapted to slopes, such as oak-leaf hydrangea and torreyia tree. Slope Forests are often associated with and grade into Upland Pine Forests or Sandhills at their upper elevations, and Bottomland Forest, Seepage Slope, or floodplain communities at their lower elevations. Seepage Streams commonly occur along the valley floors of Slope Forests, while bluff communities may occur where the slope is unstable or precipitous.

Slope Forests are very sensitive communities whose delicate microclimate can be easily disturbed by timber harvests which open the canopy, or by hydrological manipulations which affect seepage and surface water sources. Their steep slopes quickly erode when unvegetated or scarred by facilities development or by foot or vehicular traffic. Unsanitary dumps are frequently located in slope forest ravines or steepheads. Dumped refuse not only disturbs or buries the delicate vegetation, but also could impact water quality. Impoundments of slope forest ravines are also common. They destroy the unique microhabitats and lotic environments which occur on the lower slopes. Additionally, the unique assemblage of plants and animals attracts many hobbyists and professional collectors whose uncontrolled activities could significantly impact some species. Because of their biological and geological characteristics, slope forests should be protected diligently from human-related disturbances.

Upland Glade - (synonyms: chalky limestone glades, north Florida chalk glades, calcareous glades, chalky barrens). Upland Glades are characterized as forest openings dominated by clumps of grasses and sedges along with sparse herbaceous species occurring on thin calcareous soils with areas of exposed limestone. The vegetation is dominated by black sedge, diamond flower, innocence, beakrush, panicums, beardgrass, white-top sedge, wiregrass, and weak-leaf yucca. "Islands" of woody species are located within the openings and consist of often stunted or twisted trees and shrubs, including redbud, red cedar, wax myrtle, ash, black cherry, winged sumac, beautyberry, common persimmon, and sweetgum. Other typical species include larkspur, poppy mallow, marsh pink, milkweed, milkwort, rattlesnake master, side-oats grama, coneflower, ratibida, purple coneflower, and bluestem palm. Typical animals include black racer, Eastern hognose snake, green anole, turkey, mourning dove, white-tailed deer.

Upland Glades typically occur on limestone outcrops on the sides or crests of hills and are usually less than 5 acres in size. They may occur as a scattered group of openings on hillsides and hilltops. The soils are often nonexistent on pavement-like stretches of nearly unbroken limestone but when present are thin, less than 20 inches deep, and alkaline or calcareous.

The hydroperiod is variable and ranges seasonally from very dry to saturated. Hillside sites may be wet much of the time from seepage, whereas hilltop sites are usually dry. During wet seasons, water may flow across the relatively impermeable substrate. Fire patterns are unknown but burning may be infrequent due to sparse vegetation and seepage.

Florida Upland Glades have not been systematically compared with the glades that occur in most other southeastern states, where they are also usually rare. Bovine bones and old barbed wire in and around some of the glades suggest that they may have been used for pasture and that they may be decades or even centuries old. The surrounding forest may be classified as Upland Mixed or Hardwood Forest and, in most cases, is secondary growth. Development pressures in the area where the Upland Glades are located is usually low, but the glades are threatened by access road construction and by timber removal from the surrounding forest, especially because they are used as areas to park heavy machinery. Although the origin of the Upland Glades is uncertain, they appear to be persistent and provide habitat for plant species that occur nowhere else in Florida. Currently none of the Florida Upland Glades are protected.

Upland Hardwood Forest and Upland Mixed Forest - (synonyms: mesic hammock, climax hardwoods, upland hardwoods, beech-magnolia climax, oak-magnolia climax, pine-oak-hickory association, southern mixed hardwoods, clay hills hammocks, Piedmont forest). Upland Hardwood Forests and Upland Mixed Forests are characterized as well-developed, closed-canopy forests of upland hardwoods on rolling hills. These communities have quite similar physical environments and share many species, including southern magnolia, pignut hickory, sweetgum, Florida maple, devil's walking stick, American hornbeam, redbud, flowering dogwood, Carolina holly, American holly, eastern hophornbeam, spruce pine, loblolly pine, live oak, and swamp chestnut oak, among others. The primary difference between these communities is that Upland Mixed Forests generally lack shortleaf pine, American beech and other more northern species that typically occur in Upland Hardwood Forests. This is predominantly a result of minor climatic differences, Upland Hardwood Forests being most common in northern panhandle Florida, and Upland Mixed Forests being most common in northern and central peninsula Florida. Other typical plants include gum bumelia, hackberry, persimmon, red cedar, red mulberry, wild olive, redbay, laurel cherry, black cherry, bluff oak, water oak, cabbage palm, basswood, winged elm, Florida elm, sparkleberry, Hercules' club, slippery elm, beautyberry, partridgeberry, sarsaparilla vine, greenbrier, trilliums, beech drops, passion flower, bedstraw, strawberry bush, silverbell, caric sedges, fringe tree, horse sugar, white oak, and blackgum. Typical animals include slimy salamander, Cope's gray treefrog, bronze frog, box turtle, eastern glass lizard, green anole, broadhead skink, ground skink, red-bellied snake, gray rat snake, rough green snake, coral snake, woodcock, barred owl, pileated woodpecker, shrews, eastern mole,

gray squirrel, wood rat, cotton mouse, gray fox, and white-tailed deer.

Upland Hardwood and Mixed Forests occur on rolling hills that often have limestone or phosphatic rock near the surface and occasionally as outcrops. Soils are generally sandy-clays or clayey sands with substantial organic and often calcareous components. The topography and clayey soils increase surface water runoff, although this is counterbalanced by the moisture retention properties of clays and by the often thick layer of leaf mulch which helps conserve soil moisture and create decidedly mesic conditions. Furthermore, the canopy is densely closed, except during winter in areas where deciduous trees predominate. Thus, air movement and light penetration are generally low, making the humidity high and relatively constant. Because of these conditions Upland Hardwood and Mixed Forests rarely burn.

Upland Hardwood Forests and Upland Mixed Forests are climax communities for their respective geographic locations. They are often associated with and grade into Upland Pine Forest, Slope Forest or Xeric Hammock. Occasionally, Upland Mixed Forests may also grade into Maritime Hammock or Prairie Hammock. During early stages of succession, Upland Hardwood and Mixed Forest may be difficult to distinguish from Upland Pine Forests that have not been burned for several years. Disturbed sites may require hundreds of years to reach full development with species compositions representative of climax conditions.

Silvicultural, agricultural, industrial, and residential developments have already eliminated the vast bulk of these communities. These activities are continuing at an accelerated pace in many areas, such that the few remnant mature examples are in urgent need of protection and proper management.

Upland Pine Forest - (synonyms: longleaf pine upland forest, loblolly-shortleaf upland forest, clay hills, high pineland). Upland Pine Forest is characterized as a rolling forest of widely spaced pines with few understory shrubs and a dense ground cover of grasses and herbs. Pristine areas are dominated by longleaf pine and wiregrass, while areas that suffered agricultural disturbances are dominated generally by shortleaf and loblolly pines and old field grasses and herbs. Other typical plants include southern red oak, runner oak, bluejack oak, blackjack oak, post oak, sassafras, black cherry, gallberry, persimmon, mockernut hickory, twinflower, huckleberry, dangleberry, goldenrod, Indian grass, partridge pea, goats rue, winged sumac, blueberry, dog fennel, snakeroot, golden-aster, yellow jessamine, broomsedge, asters, pencil flower, bracken fern, greenbrier, fox grape, flowering dogwood, sweetgum, and blackgum. Typical animals include gopher tortoise, eastern fence lizard, eastern diamondback rattlesnake, bobwhite, red-bellied woodpecker, fox squirrel, cotton rat, cotton mouse, gray fox, bobcat, and white-tailed deer.

Upland Pine Forest occurs on the rolling hills of extreme northern Florida. The soils are composed of sand with variable, sometimes substantial, amounts of Miocene clays. The resultant prevalence of clays helps retain soil moisture, creating more mesic conditions than originally would have occurred. Thus, many plants which previously were restricted to valleys and other low areas may now inhabit the Upland Pine Forests.

Fire is a dominant factor in the ecology of this community because it reduces hardwood encroachment and facilitates pine and wiregrass reproduction. Without relatively frequent fires, Upland Pine Forest succeeds to Upland Mixed Forest and eventually to Upland Hardwood Forest. The natural fire frequency appears to be every 3 to 5 years. More frequent fires would likely eliminate pine recruitment, especially when loblolly and shortleaf pines are dominant species.

Upland Pine Forest is a fire climax community that is associated with and often grades into Upland Mixed Forest or Upland Hardwood Forest. Gradations between these communities are frequently so subtle that distinctions are usually arbitrary. Upland Pine Forest is often confused with Sandhill. The primary differences between them reside in their soil characteristics and some species of plants and animals.

Upland Pine Forests have been substantially degraded throughout their range. The sandy clay soils were prime agricultural lands for plantations as well as for American Indians. Thus, the longleaf pines were logged, the soil was turned, and the wiregrass disappeared. Only isolated tracts of the original longleaf pine-wiregrass association remain, the bulk being replaced by loblolly-shortleaf pine associations. Much of the latter has further succeeded to Upland Mixed or Hardwood Forest because of fire exclusion. The restoration of Upland Pine Forest to its original condition is impeded by the current inability to propagate wiregrass where it has been extirpated.

**ROCKLANDS** - low, generally flat limestone outcrops with tropical vegetation or limestone exposed through karst activities with tropical or temperate vegetation.

Pine Rockland - (synonyms: Miami rock ridge pinelands, Everglades flatwoods, Dade rockland pine). Pine Rockland is characterized as an open canopy forest of slash pines with a patchy understory of tropical and temperate shrubs and palms and a variable ground cover of grasses and herbs. Scattered outcrops of weathered oolitic limestone, known locally as pinnacle rock, are also common. Typical plants include south Florida slash pine, saw palmetto, cabbage palm, silver palm, gallberry, velvet seed, bolly, locustberry, myrsine, tetrazygia, varnish leaf, marlberry, indigo berry, poisonwood, bastic, live oak, stoppers, shining sumac, satin leaf, wild tamarind, rubber vine, snowberry, broomsedge, wiregrass, muhly grass, rattlebox, partridge pea, coontie, and pinefern. Typical animals include southeastern five-lined skink, ringneck snake, pygmy rattlesnake, red-shouldered hawk, Carolina wren, eastern bluebird, pine warbler, opossum, marsh rabbit, cotton rat, cotton mouse, raccoon, and bobcat.

Pine Rockland occurs on relatively flat, moderately to well drained terrain. Because limestone bedrock is at or very near the surface, soils are generally small accumulations of sand, marl, and organic material in depressions and crevices in the rock surface. Drainage varies according to the porosity of the limestone substrate, but it is generally rapid. Consequently, most sites are wet for only short periods following heavy rains. During the rainy season, however, some sites may be shallowly inundated by very slow flowing surface water for up to 60 days each year.

Fire is an important physical factor and must be periodically introduced into Pine Rocklands to keep them from succeeding to Rockland Hammock. Natural fires probably occurred every 3 to 10 years during pre-Columbian times. The degree of understory development is directly related to the length of time since the last fire. If understory development progresses for more than 8 to 10 years, fire will probably not penetrate, or it will be catastrophic.

Temperature also plays an important role in Pine Rocklands. Because the large constituent of tropical and subtropical plants are more exposed to below-freezing temperatures in the relatively open understory, they are more likely to succumb to freeze damage than conspecifics in the sheltered Rockland Hammocks. Thus, below-freezing temperatures help reduce tropical hardwood encroachment in Pine Rocklands.

Pine Rocklands are extremely limited in distribution, occurring along the southern extreme of the Atlantic Coastal Ridge, or the Miami Rock Ridge, and in scattered locations in the lower Florida Keys and other disjunct areas of south Florida. The tremendous development pressures in these rapidly urbanizing areas have greatly reduced the extent of this community; much of the remaining Pine Rockland is in poor condition because of improper management, or it is so isolated and confined by surrounding developments that proper management is not possible. Additionally, Brazilian pepper and other exotic plants have profusely invaded many Pine Rocklands.

Pine Rocklands harbor a diverse array of tropical and subtropical plants and animals that are endemic to South Florida. Several of these are considered to be endangered, threatened, or rare. Additionally, several species that are widespread in the West Indies are found in the United States almost exclusively in Pine Rocklands.

Rockland Hammock - (synonyms: tropical hammock, hardwood hammock). Rockland Hammock is characterized as a hardwood forest on upland sites in regions where limestone is very near the surface and is often exposed. These forests have high species diversity and are often dominated by trees 60 feet or taller. Typical plants include live oak, gumbo-limbo, wild tamarind, stoppers, pigeon plum, false mastic, poisonwood, mahogany, inkwood, marlberry, lancewood, strangler fig, wild coffee, bistic, black ironwood, paradise tree, satin leaf, redbay, cabbage palm, laurel oak, tallowwood, prickly ash, hackberry, guiana-plum, shortleaf fig, cat's claw, soapberry, sea grape, coffee colubrina, soldierwood, geiger tree, wild pine, Spanish moss, ferns, coonties, poison ivy, greenbrier, and fox grape. Typical animals include tree snail, Schaus swallowtail, white-crowned pigeon, woodrat, and cottonmouse.

Rockland Hammocks occur on high ground that does not normally flood, but they are often dependent upon high water tables to maintain reservoirs in solution features of the limestone and to keep humidity levels high. The dense canopy minimizes temperature fluctuations by reducing soil warming during the day and heat loss at night. Mesic conditions are further developed by the hammock's rounded profile, which deflects winds, thus limiting desiccation during dry periods and reducing interior storm damage.

Rockland Hammocks are frequently located within wetlands that serve as essential firebreaks. They are susceptible to fire when the water table drops more than two feet below ground surface or the soil moisture content is less than 35%. Although Rockland Hammock can reestablish within 25 years after a fire, maximum development of structure and diversity probably requires more than 100 fire-free years.

Rockland Hammock is the advanced successional stage of Pine Rockland. It grades into Coastal Rock Barren and Marl Prairies. It may also intergrade with Shell Mounds or Sinkholes and be difficult to separate from them.

Rockland Hammock is a rare community that requires protection from fire, canopy disruption, and ground water reduction. Many plants and animals of Rockland Hammocks must also be protected from collectors. Rockland Hammock is prime development property and is disappearing rapidly.

Sinkhole - (synonyms: lime sink, sink, solution pit, cenote, grotto, doline, chimney hole, banana hole). Sinkholes are generally characterized as cylindrical or conical depressions with steep limestone walls. Those which drain readily and only contain standing water during or for short periods following heavy rains are considered to be Sinkholes, while those which contain water throughout most of the year and dry down only during extreme droughts are considered to

be Sinkhole Lakes. The differences between these two communities are often subtle. They may occur together if the upper portions of the limestone are typically above water level, while the lower portions are typically below water level.

The vegetative structure of Sinkholes may be that of a well-developed forest where sands cover the rock and/or the sides of the Sinkholes are moderately sloped. These conditions are typically confined to the upper portions and around the rim of the Sinkhole. Steeper rock walls are generally more or less covered by mosses, liverworts, and ferns with occasional herbs and shrubs in crevices. Typical plants include southern magnolia, sweetgum, wax myrtle, wild grape, Virginia creeper, poison ivy, partridgeberry, greenbrier, water oak, flowering dogwood, horse sugar, sparkleberry, diamond-leaf oak, live oak, hophornbeam, tupelo, white ash, Florida maple, pignut hickory, beautyberry, and gum bumelia. Steep rock walls are more or less covered by a variety of mosses, liverworts, ferns and sometimes herbs, including such rare and threatened species as Venus'-hair fern and halberd fern. Sinkholes provide habitat for relictual populations of many species of salamanders and invertebrates that would be unable to survive in otherwise drier areas.

Sinkholes are most common in karst areas where the underlying limestone has been riddled with solution cavities by the chemical and physical actions of underground waters. As these cavities enlarge and become interconnected, large underwater caverns develop. When water tables drop, the cavern roof is no longer supported by the hydrostatic pressure and portions of it may collapse, leaving a deep cylindrical or conical surface depression known as a Sinkhole. The organic and mineral debris that collapsed into the cavity may partially occlude, but generally does not completely block, the Sinkhole's connections with the underground water table. Thus, Sinkholes frequently function as aquifer recharge areas. Some Sinkholes are the relics of ancient springs or swallowholes, flow having ceased because of lower water tables. The relic stream bed may still be discernible, but has been obliterated in most cases.

Steep limestone walls generally restrict soils to organic accumulations in cracks and crevices. Where the sides of a sinkhole have collapsed, sands may have slumped over the limestone, creating conditions similar to a Slope Forest.

Sinkholes generally have a very moist microclimate. The depression itself helps protect the Sinkhole from drying winds, while the fringe of trees surrounding the Sinkhole often form a nearly complete canopy which shelters the Sinkhole from intensive insolation. Additionally, seepage from the surrounding uplands may slowly moisten the walls, while the frequent presence of standing water contributes to the high humidity. These conditions may also buffer temperature extremes, allowing a unique mixture of tropical and temperate flora to exist in many Florida Sinkholes.

Sinkholes and Sinkhole Lakes are often the antecedents of other Lacustrine and Palustrine communities, including Dome Swamp; Depression Marsh; and Sandhill Upland, Flatwoods and Prairie Lakes. When several Sinkholes coalesce, Basin Marsh or Swamp and

Clastic Upland, Marsh or Swamp Lakes may eventually develop. Thus, the distinctions between Sinkhole communities and other related communities are frequently subtle, as one very gradually succeeds to another. The limestone dissolution processes that initiated their development continue, and subsequent droughts which lower ground water tables could renew the Sinkhole development process.

Sinkholes are extremely fragile communities. Their popularity as recreational areas subjects their flora to trampling and their steep walls to severe erosion from foot traffic and, in some cases, from dirt bikes. Sinkhole Lakes attract swimmers and divers whose activities may disturb the aquatic community as well. The unique flora of many Sinkholes has made them additionally vulnerable to overcollection.

Sinkholes are frequently used as dump sites. These activities will degrade water quality in the Sinkhole and eventually the underground aquifer. Thus, litter and refuse should be removed promptly when they occur. Similarly, pollution of the water supplies (aquifer and seepage sources) should be avoided. Chemical applications, waste treatments, and spills on the surrounding upland should be closely monitored to determine their potential impacts and mitigation requirements.

The delicate microclimate of Sinkholes may also be easily disturbed by activities in the surrounding areas. Logging of the surrounding canopy will increase both insolation and sedimentation levels, while major soil disturbances in the surrounding uplands could disrupt seepage water sources. Large withdrawals of groundwater nearby could substantially lower water tables and reduce the hydroperiods of Sinkhole Lakes. Any of these activities could significantly alter the microclimate and induce deleterious vegetational responses. Likewise, the invasion of exotic plant species is also a concern in these important communities.

**MESIC FLATLANDS** - flat, moderately well-drained sandy substrates with admixture of organic material, often with a hard pan.

Dry Prairie - (synonyms: palm savannah, palmetto prairie, pineland-threawn range). Dry Prairie is characterized as a nearly treeless plain with a dense ground cover of wiregrass, saw palmetto, and other grasses, herbs, and low shrubs. Other typical plants include broomsedge, carpet grass, runner oak, Indian grass, love grass, blazing star, rabbit tobacco, pine lily, marsh pink, milkwort, goldenrod, musky mint, pawpaw, dwarf wax myrtle, gallberry, stagger bush, fetterbush, and dwarf blueberry. Typical animals include box turtle, six-lined racerunner, black racer, coachwhip, turkey vulture, crested caracara, bobwhite, sandhill crane, burrowing owl, loggerhead shrike, meadowlark, grasshopper sparrow, least shrew, cotton rat, harvest mouse, spotted skunk, and bobcat.

Dry Prairie occurs on relatively flat, moderately to poorly drained terrain. The soils typically consist of 1 to 3 feet of acidic sands generally overlying an organic hardpan or clayey subsoil. The hardpan substantially reduces the movement of water below and above its surface, such that Dry Prairies may become flooded for short periods during rainy seasons. The normal water table, however, is several inches to several feet below the surface. Dry Prairie is very similar to Mesic Flatwoods in most respects, except that pines and palms are absent or at a density below one tree per acre.

The natural fire frequency in Dry Prairies appears to be every 1 to 4 years, which averages slightly more frequent than generally occurs in Mesic Flatwoods. The higher frequency of fire is probably the primary factor that limits pine recruitment in this community. Some authorities suggest that fire every 1 to 4 years is unnaturally high and an artifact of human intervention; i.e., they suggest that Dry Prairie is not a natural biological community. Other authorities disagree and suggest that Dry Prairies were at one time more widespread. Further research is necessary to solve this controversy.

Dry Prairie is closely associated with and often grades into Wet Prairie or Mesic Flatwoods. Some Mesic Flatwoods differ only in having a pine overstory, and when timbered are often difficult to distinguish from Dry Prairies. Many of the plants and animals occurring in Dry Prairies also occur in Scrubby Flatwoods, Mesic Flatwoods, Sandhill, and Coastal Grassland.

Dry Prairies are apparently endemic to Florida and largely confined to a few regions of the state. Most representatives of this community have been converted to farm fields or citrus groves. The few remnants of Dry Prairie are disappearing rapidly. Because Dry Prairie is an important habitat for several animals that occur nowhere else in the eastern United States (e.g., caracara and burrowing owl), the preservation of existing tracts through appropriate management is paramount.

Mesic Flatwoods - (synonyms: pine flatwoods, pine savannahs, pine barrens). Mesic Flatwoods are characterized as an open canopy forest of widely spaced pine trees with little or no

understory but a dense ground cover of herbs and shrubs. Several variations of Mesic Flatwoods are recognized, the most common associations being longleaf pine - wiregrass - runner oak and slash pine - gallberry - saw palmetto. Other typical plants include: St. Johns-wort, dwarf huckleberry, fetterbush, dwarf wax myrtle, stagger bush, blueberry, gopher apple, tar flower, bog buttons, blackroot, false foxglove, white-topped aster, yellow-eyed grass, and cutthroat grass. Typical animals of Mesic Flatwoods include: oak toad, little grass frog, narrowmouth toad, black racer, red rat snake, southeastern kestrel, brown-headed nuthatch, pine warbler, Bachman's sparrow, cotton rat, cotton mouse, black bear, raccoon, gray fox, bobcat, and white-tailed deer.

Mesic Flatwoods occur on relatively flat, moderately to poorly drained terrain. The soils typically consist of 1-3 feet of acidic sands generally overlying an organic hardpan or clayey subsoil. The hardpan substantially reduces the percolation of water below and above its surface. During the rainy seasons, water frequently stands on the hardpan's surface and briefly inundates much of the flatwoods; while during the drier seasons, ground water is unobtainable for many plants whose roots fail to penetrate the hardpan. Thus, many plants are under the stress of water saturation during the wet seasons and under the stress of dehydration during the dry seasons.

Another important physical factor in Mesic Flatwoods is fire, which probably occurred every 1 to 8 years during pre-Columbian times. Nearly all plants and animals inhabiting this community are adapted to periodic fires; several species depend on fire for their continued existence. Without relatively frequent fires, Mesic Flatwoods succeed into hardwood-dominated forests whose closed canopy can essentially eliminate the ground cover herbs and shrubs. Additionally, the dense layer of litter that accumulates on unburned sites can eliminate the reproduction of pines which require a mineral soil substrate for proper germination. Thus, the integrity of the Mesic Flatwoods community is dependent on periodic fires. However, fires that are too frequent or too hot would eliminate pine recruitment and eventually transform Mesic Flatwoods into Dry Prairie.

Mesic Flatwoods are closely associated with and often grade into Wet Flatwoods, Dry Prairie, or Scrubby Flatwoods. The differences between these communities are generally related to minor topographic changes. Wet Flatwoods occupy the lower wetter areas, while Scrubby Flatwoods occupy the higher drier areas.

Mesic Flatwoods are the most widespread biological community in Florida, occupying an estimated 30 to 50% of the state's uplands. However, very few undisturbed areas of Mesic Flatwoods exist because of habitat mismanagement and silvicultural, agricultural, or residential development. Mesic Flatwoods are often fairly resilient, and with proper management they can generally be restored.

Mesic Hammock - (new community added 4/4/05 – modified 4/14/05 - Ann F. Johnson) is a hardwood forest community of open or closed canopy dominated by live oak (*Quercus virginiana*), with cabbage palm (*Sabal palmetto*) often present in the canopy and subcanopy. Epiphytes (ferns orchids and bromeliads) are often found and may become abundant in undisturbed stands. Shrubby understory may be dense or open, tall or short and is composed of

saw palmetto (*Serenoa repens*), beautyberry (*Callicarpa americana*), and wax myrtle (*Myrica cerifera*), with the addition of tropical shrubs, such as nakedwood (*Myrcianthes fragrans*) and wild coffee (*Psychotria nervosa*), in the south. The herb layer is often sparse or patchy and consists of various grasses, including low panic grasses (*Dichanthelium* spp.) and basket grass (*Oplismenus hirtellus*), and sedges. Mesic hammock usually occurs as fringes or small patches on the borders of, or in higher parts of, rivers, swamps, marshes, and large lakes, and ranges from central and south Florida (Polk to Dade and Collier counties) northward along the Atlantic and Gulf coasts to North Carolina and Texas. Soils are sand mixed with organic matter and are normally dry underfoot. It is distinguished from prairie hammock by its situation bordering wetlands in an upland landscape, rather than on rises in a marshy, wetland landscape; it differs from hydric hammock in the absence of wetland trees such as sweetbay (*Magnolia virginiana*) and black gum (*Nyssa biflora*), and from xeric hammock in the absence of sand live oak (*Quercus geminata*), myrtle oak (*Quercus myrtifolia*) and other scrub species. It is distinguished from maritime hammock by its inland occurrence on non-dune substrates and from upland hardwood and upland mixed forests to the north by its low species diversity and lack of many characteristic deciduous broad-leaved trees in the canopy and subcanopy, such as *Quercus michauxii*, *Carpinus caroliniana*, and *Cornus florida*, as well as by its occurrence on sandy soils in contrast to the loamy or clay-based soils on which upland forests occur. It is found primarily in Florida where its area may be between 100,00 and 500,000 acres, although this is difficult to estimate since it occurs as scattered small stands or fringing borders in a matrix of dry prairie, mesic flatwoods, floodplain marshes, or hydric hammock. Examples may be found around large lakes in Osceola and Polk counties, and along the St Johns River marshes.

Prairie Hammock - (synonyms: palm/oak hammock, hydric hammock). Prairie Hammock is characterized as a clump of tall cabbage palms and live oaks in the midst of prairie or marsh communities. These hammocks generally have a very open understory although saw palmetto typically rings the perimeter of these rounded clumps. Other typical plants include wax myrtle, water oak, stoppers, marlberry, pigeon plum, poison ivy, poisonwood, orchids, and lidflowers. Typical animals include box turtle, southeastern five-lined skink, black racer, and several species of shrews and rodents.

Prairie Hammocks occur on slight rises in relatively flat terrain. Soils generally consist of sands overlying calcareous marls but may be a more complex association of marl, peat, and sand over limestone. Prairie Hammocks may flood during extreme high water, but they are seldom inundated for more than 10 to 40 days each year. Oak and palm dominated Prairie Hammocks on drier sites tolerate occasional light ground fires, but more diverse hammocks rarely burn. Sites with heavy shrub layers are liable to be severely damaged by a canopy fire.

Prairie Hammock may be associated with or grades into Hydric Hammock, Rockland Hammock, or Shell Mound. It is an advanced successional stage of Mesic Flatwoods, Dry Prairie, or Marl Prairie. Prairie Hammock also shares many species with Xeric Hammock and Maritime Hammock.

Prairie Hammock is largely restricted to peninsular Florida. Although Prairie Hammocks are widespread and fairly common, their generally small size increases their vulnerability to disturbances.

Scrubby Flatwoods - (synonyms: xeric flatwoods, dry flatwoods). Scrubby Flatwoods are characterized as an open canopy forest of widely scattered pine trees with a sparse shrubby understory and numerous areas of barren white sand. The vegetation is a combination of Scrub and Mesic Flatwoods species; Scrubby Flatwoods often occupy broad transitions or ecotones between these communities. Typical plants include longleaf pine, slash pine, sand live oak, Chapman's oak, myrtle oak, scrub oak, saw palmetto, staggerbush, wiregrass, dwarf blueberry, gopher apple, rusty lyonia, tarflower, golden-aster, lichens, silkbay, garberia, huckleberry, goldenrod, runner oak, pinweeds, and frostweed.

Scrubby Flatwoods generally occur intermingled with Mesic Flatwoods along slightly elevated relictual sandbars and dunes. The white sandy soil is several feet deep and drains rapidly. However, the water table is unlikely to be very deep. Scrubby Flatwoods normally do not flood even under extremely wet conditions. Temperatures and humidities of air and soil in Scrubby Flatwoods fluctuate substantially more than in most other communities because the scattered overstory, sparse understory, and barren sands of Scrubby Flatwoods do not ameliorate daily and seasonal changes very well.

Although the elevated, deeper sandy soils of scrubby flatwoods engender a drier environment than the surrounding mesic flatwoods, the general sparsity of ground vegetation and the greater proportion of relatively incombustible scrub-oak leaf litter reduces the frequency of naturally occurring fires. Only after a long absence of fire and during periods of drought does the leaf litter become sufficiently combustible and concentrated enough to support an ecological burn. Several species of plants in Scrubby Flatwoods are typical scrub plants which endure only when long intervals between fires occur. Thus, a periodicity of approximately 8 to 25 years between fires appears to be natural for this community.

Scrubby Flatwoods are associated with and often grade into Mesic Flatwoods, Scrub, Dry Prairie or Sandhills. This community is essentially a Mesic Flatwoods with a Scrub understory.

**WET FLATLANDS** - flat, poorly drained sand, marl or limestone substrates.

Hydric Hammock - (synonyms: wetland hardwood hammock, wet hammock). Hydric Hammock is characterized as a well developed hardwood and cabbage palm forest with a variable understory often dominated by palms and ferns. Typical plants include cabbage palm, diamond-leaf oak, red cedar, red maple, swamp bay, sweetbay, water oak, southern magnolia, wax myrtle, saw palmetto, bluestem palmetto, needle palm, poison ivy, dahoon holly, myrsine, hackberry, sweetgum, loblolly pine, Florida elm, swamp chestnut oak, American hornbeam, Walter viburnum, royal fern, peppervine, rattanvine, yellow jessamine, and Virginia creeper. Typical animals include green anole, flycatchers, warblers, and gray squirrel.

Hydric Hammock occurs on low, flat, wet sites where limestone may be near the surface and frequently outcrops. Soils are sands with considerable organic material that, although generally saturated, are inundated only for short periods following heavy rains. The normal hydroperiod is seldom over 60 days per year. Because of their generally saturated soils and the sparsity of herbaceous ground cover, Hydric Hammocks rarely burn.

Hydric Hammock occurs as patches in a variety of lowland situations, often in association with springs or karst seepage, and in extensive forests covering lowlands just inland of coastal communities. Hydric Hammock generally grades into Floodplain Swamp, Strand Swamp, Basin Swamp, Baygall, Wet Flatwoods, Coastal Berm, Maritime Hammock, Slope Forest, Upland Mixed Forest, or Upland Hardwood Forest. Hydric Hammock is often difficult to differentiate from Bottomland Forest, Prairie Hammock, and Floodplain Forest.

The normal hydrological regime must be maintained in Hydric Hammock. If the water table is lowered, Hydric Hammock will gradually change to mesic conditions. If the hammock is flooded, many trees will die and eventually be replaced by more hydrophytic species.

Marl Prairie - (synonyms: scrub cypress, marl flat, dwarf cypress savanna, sedge flat, spikerush marsh). Marl Prairies are sparsely vegetated seasonal marshes on flatlands along the interface between deeper wetlands and coastal or upland communities where limestone is near the surface. The freshwater marl substrate is derived from periphyton, masses of algae and other minute organisms, that grow floating or loosely attached to the vegetation and exposed limestone. These organisms precipitate calcium carbonate when surface water is present. Dominant plants include muhly grass, sawgrass, spikerush, bluestem, beakrush, shoregrass, and pond cypress. Although generally a system of sedges, grasses, and grass-like plants of varying heights and densities, widely scattered, stunted cypress or mangrove trees are often present. These cypress trees, sometimes called dwarf, toy or hat rack cypress, have huge buttresses, gnarled bonsai-like crowns, and may be hundreds of years old. Other typical plants include fragrant waterlily, pickerelweed, wiregrass, asters, love grass, wild pine, cutgrass, panicums, black sedge, sand cordgrass, swamp lily, stargrass, musky mint, milkwort, white-top sedge, cowhorn orchid, fire flag, dogfennel, and many others.

The highly alkaline marl soils are from 2 inches to 3.5 feet thick and are fine gray or white muds. The most extensive types are freshwater Perrine marl, which is largely calcite and marine aragonite deposits, which are found mostly on coastal sites. The substrate may be concrete-like in the winter and spring dry seasons but soft and, slippery when wet. The soils are seasonally flooded but the hydroperiod is highly variable.

Marl Prairies may grade into Wet Prairies or Wet Flatwoods and often occur in a continuum with Pine Rockland, Strand Swamp, and Basin Wetlands. In the absence of fire, succession is generally toward Prairie Hammock. Marl Prairies generally occur where fire has burned off surface peat and sawgrass rhizomes. The vegetation is frequently so sparse that it will not carry a fire.

Within the U.S., Marl Prairies are limited to south Florida and have several species endemic to the state. Several very large examples of this NC occur in the Everglades National Park and in Big Cypress National Preserve.

This NC is extremely vulnerable to hydrological modifications and disruption of the natural fire regime. The soft substrate surface is easily disturbed and damaged by offroad vehicles.

Wet Flatwoods - (synonyms: low flatwoods, moist pine barren, hydric flatwoods, pond-pine flatwoods, pocosin, cabbage palm/pine savannah or flatwoods). Wet Flatwoods are characterized as relatively open-canopy forests of scattered pine trees or cabbage palms with either thick shrubby understory and very sparse ground cover, or a sparse understory and a dense ground cover of hydrophytic herbs and shrubs. Several variations exist between these extremes. Typical plants include pond pine, slash pine, sweetbay, spikerush, beakrush, sedges, dwarf wax myrtle, gallberry, titi, saw palmetto, creeping beggarweed, deer tongue, gay feather, greenbrier, bluestem, and pitcher plants. Typical animals include oak toad, cricket frog, chorus frog, black racer, yellow rat snake, diamondback rattlesnake, pygmy rattlesnake, red-shouldered hawk, bobwhite, opossum, cottontail rabbit, cotton rat, cotton mouse, raccoon, striped skunk, bobcat, and white-tailed deer.

Wet Flatwoods occur on relatively flat, poorly drained terrain. The soils typically consist of 1 to 3 feet of acidic sands generally overlying an organic hardpan or clay layer. Cabbage palm flatwoods tend to occur on more circumneutral sands (pH 6.0 - 7.5) underlain by marl or shell beds. The hardpan substantially reduces the percolation of water below and above its surface. During the rainy season, water frequently stands on the surface, inundating the flatwoods for 1 or more months per year. During the drier seasons, ground water is less accessible for many plants whose roots fail to penetrate the hardpan. Thus, many plants are under the stress of water saturation during the wet seasons, and under the stress of dehydration during the dry seasons.

Another important physical factor in Wet Flatwoods is fire. Natural fires probably

occurred every 3 to 10 years during pre-Columbian times. Nearly all plants and animals inhabiting this community are adapted to periodic fires, and several species depend on fires for their continued existence. Without relatively frequent fires, Wet Flatwoods succeed into hardwood dominated forests whose closed canopy would essentially eliminate the ground cover herbs and shrubs. In fact, much of the variation in community structure is probably associated with fire frequency. Thus, the longer the period of time since the last fire, the more developed will be the understory shrubs. If the understory is allowed to grow for too long, the accumulation of needle drape and the height of flammable understory shrubs will increase the probability of a catastrophic canopy fire.

Wet Flatwoods are closely associated with and often grade into Hydric Hammock, Mesic Flatwoods, Wet Prairie, or Basin Swamp. Wet Flatwoods may also grade into Dome Swamp or Strand Swamp, but the absence of a Wet Prairie ecotone suggests that the hydrology has been disturbed.

Although Wet Flatwoods may have been an abundant biological community of the Coastal Plain at one time, examples with an intact overstory and understory, without exotics, and with the potential for future maintenance by fire are rare. They are relatively resilient to overstory damage but recover poorly when the ground cover or hydrology has been disturbed. Wet Flatwoods are vulnerable to disruptions of fire and hydrological regimes. Exotic plants readily invade Wet Flatwoods in south Florida and must be controlled promptly.

Wet Prairie - (synonyms: sand marsh, savannah, coastal savannah, coastal prairie, pitcher plant prairie). Wet Prairie is characterized as a treeless plain with a sparse to dense ground cover of grasses and herbs, including wiregrass, toothache grass, maidencane, spikerush, and beakrush. Other typical plants include hatpins, marsh pinks, crownbeard, sundews, black-eyed susan, stargrass, white-top sedge, meadowbeauty, yellow-eyed grass, sneezeweed, sunflower, wax myrtle, pitcher plants, tickseed, St. John's wort, and panicums. Typical animals include cricket frog, chorus frog, little grass frog, black racer, yellow rat snake, cottonmouth, pygmy rattlesnake, northern harrier, caracara, southeastern kestrel, killdeer, long-billed marsh wren, red-winged blackbird, marsh rabbit, cotton rat, and cotton mouse.

Wet Prairie occurs on low, relatively flat, poorly drained terrain of the coastal plain. Soils typically consist of sands often with a substantial clay or organic component. The most important physical factors are hydrology and fire. Wet Prairie is seasonally inundated or saturated for 50 to 100 days each year and burns every 2 to 4 years. Wax myrtle quickly invades and will dominate Wet Prairies with longer fire intervals. In south Florida, melaleuca invasions can seriously impact Wet Prairies. Generally, Wet Prairies have a much shorter hydroperiod than other herbaceous wetlands and are subject to regular and prolonged desiccation during the dry season due to their flat topography.

Wet Prairie is closely associated with and often grades into Wet Flatwoods, Depression Marsh, Seepage Slope, Mesic Flatwoods, or Dry Prairie. Several other biological communities have somewhat similar species compositions or overlap in characteristics, including Swale,

Seepage Slope, Basin Marsh, Floodplain Marsh, and Marl Prairie.

Wet Prairies were probably common throughout the Coastal Plain at one time. Few good quality, intact examples remain and some types, e.g. pitcher plant prairies, are becoming increasingly rarer. Wet Prairie is vulnerable to hydrological and fire regime alterations, overgrazing, and soil disturbances by off-road vehicles. Recovery from disturbances is often poor and slow.

**SEEPAGE WETLANDS** - sloped or flat sands or peat with high moisture levels maintained by downslope seepage.

Baygall - (synonyms: seepage swamp, bayhead, bay swamp). Baygalls are generally characterized as densely forested, peat-filled seepage depressions often at the base of sandy slopes. The canopy is composed of tall, densely packed, generally straight-boled evergreen hardwoods dominated by sweetbay, swamp red bay, and loblolly bay. A more or less open understory of shrubs and ferns commonly occurs, while sphagnum mats are often interlaced with the convoluted tree roots. Other typical plants include dahoon holly, Atlantic white cedar, fetterbush, male-berry, myrtle-leaved holly, large gallberry, wax myrtle, odorless wax myrtle, hurrah-bush, dog-hobble, white alder, possumhaw, red chokeberry, Virginia willow, laurel greenbrier, poison ivy, cinnamon fern, chain fern, wild grape, netted chain fern, sweetgum, cypress, lizard's tail, and needle palm. Typical animals include mole salamander, southern dusky salamander, southern mud salamander, opossum, southeastern shrew, short-tailed shrew, marsh rabbit, black bear, raccoon, southern mink, and bobcat.

Baygalls typically develop at the base of a slope where seepage usually maintains a saturated peat substrate. They may also be located at the edges of floodplains or in other flat areas where high lowland water tables help maintain soil moisture. Baygall soils are generally composed of peat with an acidic pH (3.5 - 4.5).

Since Baygalls rarely dry out enough to burn, the normal fire interval in these communities is probably 50-100 years or more. After a fire, bay trees usually resprout from the roots and replace themselves, but severe fires may change a Baygall into a different community. If only a small amount of surface peat is removed, a Baygall may be replaced by a Wet Flatwoods community. If the ground surface is lowered considerably, willows may invade, followed by a cypress-gum community. With recurrent fire, the site will become a shrub bog. If the subsurface peat does not burn and fire and hydrological regimes are undisturbed, a burned out bay forest may be replaced by a stand of white cedar.

Baygall is often associated with and may grade into Seepage Slope, Floodplain Forest or Floodplain Swamp. The species composition of Baygalls frequently overlaps with Bog, Dome Swamp, Basin Swamp, Strand Swamp, Bottomland Forest, Wet Flatwoods, and Hydric Hammock.

Baygalls are dependent upon seepage flow and a high water table. Alterations in the local or regional hydrology could impact Baygall communities. They may also need fire protection during droughts, especially if water tables are lowered. Baygalls are vulnerable to logging, peat mining, and conversion to agricultural land. When drained, the peat soils are valued for farming, although they then begin to oxidize and disappear. The renewed interest in mining peat as fuel may place greater pressure on these wetlands.

Seepage Slope - (synonyms: herb bog, pitcher plant bog, grass-sedge bog, shrub bog,

seep). Seepage Slopes are wetlands characterized as shrub thickets or boggy meadows on or at the base of a slope where moisture is maintained by downslope seepage such that the ground is usually saturated but rarely inundated. They generally occur where water percolating down through the sand hits an impermeable layer, such as clay or rock. Typical plants include pond pine, slash pine, longleaf pine, titi, fetterbush, myrtle-leaved holly, black titi, male-berry, large gallberry, dahoon holly, gallberry, white cedar, tulip poplar, wax myrtle, odorless wax myrtle, blueberry, dog-hobble, racemed fetterbush, sweet pepperbush, possumhaw, Virginia willow, laurel greenbrier, wiregrass, pitcher plants, beakrush, cutthroatgrass, orchids, cinnamon fern, chain fern, bluestem, yellow-eyed grass, and an array of insectivorous plants. A large number of orchids, insectivorous plants, showy wildflowers and other plant species associated with this NC are rare or endemic and considered endangered or threatened. Typical animals include the pine barrens treefrog, squirrel treefrog, ribbon snake, and cottonmouth.

Seepage Slope soils are acidic, loamy sands with low nutrient availability that are constantly saturated by seepage except during droughts. They are rarely inundated, although small pools and rivulets are common. Fire with a frequency of about 5 years or less limits shrub and tree invasion and recycles nutrients in herb bogs. Shrub bogs typically burn no more often than once every 20 to 50 years. In the absence of fire, larger woody plants establish, the increased transpiration of which lowers soil moisture levels. Over a period of years without fire, the Bog becomes drier and a Baygall may develop.

The pitcher plant and shrub types of this NC occur mostly in two regions of Florida, the western panhandle and northeast Florida, while cutthroat seeps occur along the lower central ridge. Seepage Slopes may be limited in the U.S. to the southern Gulf coastal plain. Recent estimates indicate that only about 1% of the original extent of this type of system remains.

Conversion to pine plantations may have destroyed more Seepage Slopes than all other factors combined. Their topographic position is convenient for farm pond construction and they are subjected to hydrologic effects from a variety of nearby development activities. Many Seepage Slopes are very small and can easily be destroyed by fire lanes, rights-of-way, or ditches that disturb the delicate hydrologic balance.

**FLOODPLAIN WETLANDS** - flat, alluvial sand or peat substrates associated with riverine Natural Communities and subjected to flooding but not permanent inundation.

Bottomland Forest - (synonyms: bottomland hardwoods, river bottom, stream bottom, lowland hardwood forest, mesic hammock). Bottomland Forest is characterized as a low-lying, closed-canopy forest of tall, straight trees with either a dense shrubby understory and little ground cover, or an open understory and ground cover of ferns, herbs, and grasses. Typical plants include water oak, live oak, red maple, sweetgum, loblolly pine, white cedar, cabbage palm, diamond-leaf oak, southern magnolia, loblolly bay, swamp tupelo, spruce pine, American beech, dahoon holly, wax myrtle, swamp dogwood, Florida elm, stiffcornel dogwood, and American hornbeam. Typical animals include marbled salamander, mole salamander, three-lined salamander, slimy salamander, five-lined skink, ringneck snake, gray rat snake, eastern king snake, cottonmouth, wood duck, red-tailed hawk, turkey, yellow-billed cuckoo, screech-owl, great-horned owl, ruby-throated hummingbird, acadian flycatcher, pileated woodpecker, hermit thrush, cedar waxwing, yellow-throated warbler, opossum, gray squirrel, flying squirrel, raccoon, mink, gray fox, bobcat, and white-tailed deer.

Bottomland Forest occurs on low-lying flatlands that usually border streams with distinct banks, such that water rarely overflows the stream channel to inundate the forest. They also occur in scattered low spots in basins and depressions that are rarely inundated, which allows typical upland species to survive. Soils are generally a mixture of clay and organic materials. The water table is high, but Bottomland Forests are inundated only during extreme floods or exceptionally heavy rains (i.e., not annually). Tree density and species diversity is relatively high. The canopy is dense and closed, except during winter in areas where deciduous trees predominate. Thus, air movement and light penetration are generally low, making the humidity high and relatively constant. Because of these characteristics, Bottomland Forests rarely burn.

Bottomland Forest is a very stable community that requires a hundred years or more to mature. In some cases, it is an advanced successional stage of a Bog community. Bottomland Forest may be extremely difficult to distinguish from Floodplain Forest or Hydric Hammock. They can generally be separated during periods of typical high water, when the latter two communities would be inundated, while Bottomland Forest would not. Bottomland Forest is often associated with and grades into Floodplain Forest, Hydric Hammock, Mesic Flatwoods, Upland Mixed Forest, Upland Hardwood Forest, Slope Forest, Maritime Hammock, Baygall, or Wet Flatwoods. There may be much species overlap among these communities.

Bottomland Forests are widespread throughout the Coastal Plain but are less extensive in Florida than elsewhere. Nearly all Bottomland Forests have suffered from timbering operations, which frequently leave long-lasting scars from soil disturbance. Their location on substrates that occasionally are inundated or saturated make Bottomland Forests generally unsuitable for development.

Floodplain Forest - (synonyms: bottomland hardwoods, seasonally flooded basins or

flats, oak-gum-cypress, elm-ash-cottonwood, second bottom, levee forest, river terrace, river ridge). Floodplain Forests are hardwood forests that occur on drier soils at slight elevations within floodplains, such as on levees, ridges and terraces, and are usually flooded for a portion of the growing season. Floodplain Forests are largely restricted to the alluvial rivers of the panhandle. The dominant trees are generally mixed mesophytic hardwoods, such as overcup oak, water hickory, diamond-leaf oak and swamp chestnut oak. The understory may be open and parklike or dense and nearly impenetrable. Other typical plants include bluestem palmetto, willow oak, green ash, Florida elm, sweetgum, hackberry, water oak, American hornbeam, tulip poplar, coastal plain willow, black willow, eastern cottonwood, swamp cottonwood, river birch, red maple, silver maple, box elder, American sycamore, catalpa, sweetbay magnolia, hawthorn, swamp azalea, pink azalea, gulf sebastiana, lanceleaf greenbrier, poison ivy, peppervine, rattanvine, indigo bush, white grass, plume grass, redtop panicum, caric sedges, silverbells, crossvine, American wisteria and wood grass.

Floodplain Forests harbor a diverse array of animals including both temporary residents and permanent residents. Typical animals include marbled salamander, mole salamander, two-toed amphiuma, Alabama waterdog, Southern dusky salamander, two-lined salamander, three-lined salamander, dwarf salamander, slimy salamander, rusty mud salamander, sirens, southern toad, cricket frog, bird-voiced treefrog, gray treefrog, bullfrog, river frog, Southern leopard frog, alligator, river cooter, stinkpot, Southeastern five-lined skink, broadhead skink, mud snake, rainbow snake, redbelly watersnake, brown water snake, glossy crayfish snake, black swamp snake, cottonmouth, yellow-crowned night-heron, wood duck, Mississippi kite, swallowtail kite, red-shouldered hawk, woodcock, barred owl, chimney swift, hairy woodpecker, pileated woodpecker, Acadian flycatcher, Carolina wren, veery, white-eyed vireo, red-eyed vireo, parula warbler, prothonotary warbler, Swainson's warbler, hooded warbler, cardinal, towhee, opossum, southeastern shrew, short-tailed shrew, beaver, wood rats, rice rats, cotton mouse, golden mouse, bear, and raccoon.

Soils of Floodplain Forests are variable mixtures of sand, organics, and alluvials, which are often distinctly layered. Hydroperiod is the primary physical feature of Floodplain Forests, which are inundated by flood waters nearly every year for 2 to 50% of the growing season. The organic material accumulating on the floodplain forest floor is picked up during floods and redistributed in the floodplain or is washed downriver to provide a critical source of minerals and nutrients for downstream ecosystems, in particular estuarine systems. These floods also replenish soil minerals through deposition on the floodplain. Floodplain Forests usually do not have standing water in the dry season.

Floodplain Forests are often associated with and grade into Floodplain Swamp, Bottomland Forest, Baygall, or Slope Forest. The species composition is frequently similar to that of Hydric Hammock and Bottomland Forest communities.

The maintenance of natural hydrologic regimes is critical to the health of Floodplain Forests and to the downstream systems with which they are connected. Species composition and the functional relationships throughout a river system are negatively impacted by hydrological

alterations such as artificial impoundments, river diversion projects, pesticide use, forest clearcutting, or intensive agriculture.

Floodplain Marsh - (synonyms: river marsh). Floodplain Marshes are wetlands of herbaceous vegetation and low shrubs that occur in river floodplains, mainly in Central Florida and along the St. Johns, Kissimmee and Myakka rivers, on sandy alluvial soils with considerable peat accumulation. Emergent grasses, herbs, and shrubs that dominate Floodplain Marshes include sawgrass, maidencane, and buttonbush. Other typical plants include sand cordgrass, dotted smartweed, arrowheads, pickerelweed, reimagrass, spikerush, bulrushes, bladderpod, common reed, coreopsis, glasswort, seashore dropseed, sea purslane, and water primrose. Typical animals include cricket frog, pig frog, leopard frog, American alligator, eastern mud snake, banded water snake, striped swamp snake, great blue heron, great egret, snowy egret, little blue heron, tricolored heron, black-crowned night-heron, yellow-crowned night-heron, northern harrier, sandhill crane, raccoon, and river otter.

Floodplain Marshes are maintained by regimes of fire and water. Fires apparently burn on a one- to five-year basis under natural conditions and maintain the open herbaceous community by restricting shrub invasion; however, severe fires during drought periods will often burn the mucky peat.

Floodplain Marshes are flooded with flowing water for about 250 days annually. Shortened hydroperiods will permit invasion by shrubs and subsequent loss of the marsh. Many of these marshes have been degraded by pollution or destroyed by drainage for agricultural uses.

Floodplain Marshes are associated with, and often grade into, Wet Prairie or Riverine communities. They eventually succeed to Bog, if succession is not reversed by a muck fire.

Floodplain Swamp - (synonyms: river swamp, bottomland hardwoods, seasonally flooded basins or flats, oak-gum-cypress, cypress-tupelo, slough, oxbow, back swamp). Floodplain Swamps occur on flooded soils along stream channels and in low spots and oxbows within river floodplains. Dominant trees are usually buttressed hydrophytic trees such as cypress and tupelo; the understory and ground cover are generally very sparse. Other typical plants include ogeechee tupelo, water tupelo, swamp titi, wax myrtle, dahoon holly, myrtle-leaved holly, large gallberry, possumhaw, hurrah-bush, white alder, lizard's tail, leather fern, royal fern, marsh fern, soft rush, laurel greenbrier, hazel alder, hawthorn, and swamp privet.

Floodplain Swamps harbor a diverse array of animals including both temporary and permanent residents. Typical animals include marbled salamander, mole salamander, amphiuma, Alabama waterdog, Southern dusky salamander, two-lined salamander, three-lined salamander, dwarf salamander, slimy salamander, rusty mud salamander, southern toad, cricket frog, bird-voiced treefrog, gray treefrog, bullfrog, river frog, Southern leopard frog, alligator, river cooter, stinkpot, Southeastern five-lined skink, broadhead skink, mud snake, rainbow snake, redbelly water snake, brown water snake, glossy crayfish snake, black swamp snake, cottonmouth, yellow-crowned night-heron, wood duck, swallowtail kite, Mississippi kite, red-shouldered

hawk, woodcock, barred owl, chimney swift, hairy woodpecker, pileated woodpecker, Acadian flycatcher, Carolina wren, veery, white-eyed vireo, red-eyed vireo, parula warbler, prothonotary warbler, hooded warbler, Swainson's warbler, cardinal, towhee, opossum, southeastern shrew, short-tailed shrew, beaver, wood rat, rice rat, cotton mouse, golden mouse, bear, raccoon, and bobcat.

Soils of Floodplain Swamps are highly variable mixtures of sand, organic, and alluvial materials, although some sites, especially within sloughs or on smaller streams, may have considerable peat accumulation. Floodplain Swamps are flooded for most of the year, with sites along channels inundated by aerobic flowing water while those of sloughs and backswamps are flooded with anaerobic water for extensive periods of time. Soils and hydroperiods determine species composition and community structure. Seasonal and often prolonged inundations restrict the growth of most shrubs and herbs, leaving most of the ground surface open or thinly mantled with leaf litter. Floods redistribute detrital accumulations to other portions of the floodplain or into the main river channel. This rich organic debris is essential to the functional integrity of downriver ecosystems such as estuaries. These swamps are usually too wet to support fire.

Floodplain Swamps are often associated with and grade into Floodplain Forest or Hydric hammock, and occasionally Baygall. The species composition of Floodplain Swamps is frequently similar to the Slough, Strand Swamp, Dome Swamp, and Basin Swamp communities.

Alteration of the hydroperiod by impoundments or river diversions and the disruption of floodplain communities by forestry or agriculture have devastating consequences to entire river and bay systems. Many plant and animal species, both onsite and down river, depend upon the presence and natural fluctuations of these swamps for survival and reproduction.

Freshwater Tidal Swamp - (synonyms: tidewater swamp, rivermouth swamp, sweetbay-swamp, tupelo-redbay). Freshwater Tidal Swamps occur on floodplains near the mouths of rivers just inland from mangroves or saltmarshes. They are swamp forests with well-developed trees inland and increasingly dwarfed trees towards the coast, often with an extensive mat of convoluted surface roots. The dominant trees are usually cabbage palm, black gum, bald cypress, southern magnolia, and red cedar. Other typical plants include water tupelo, pumpkin ash, swamp bay, white cedar, titi, wax myrtle, cocoplum, dahoon holly, myrtle-leaved holly, saltbush, asters, and leather fern. Typical animals include those with marine affinities such as olive nerites and fiddler crabs.

Freshwater Tidal Swamps occur near the mouths of rivers, often between anastomosing channels, on soils that are highly organic. These swamps are flooded by freshwater at least twice daily in response to tidal cycles. They are extremely vulnerable to hydrological modifications, saltwater intrusion, and clearcut logging.

Although this NC is widespread around the southeastern U.S., cabbage palm is a conspicuous element only in Florida. Because they are found only near river mouths, their distribution is inherently limited in Florida.

Slough - Sloughs are characterized as broad shallow channels, inundated with flowing water except during extreme droughts, that are the deepest drainageways within Strand Swamps and Swale systems. The vegetation structure of Sloughs is variable but characterized, in general, by pond apple, Carolina (pop) ash, fragrant waterlily, large emergent herbs, and floating aquatic plants. Typical plants include water elm, ogeechee tupelo, fire flag, water lettuce, golden canna, giant cutgrass, frog's bit, duckweed, buttonbush, coastal plain willow, pickerelweed, arrowheads, and lizard's tail. These canopied Sloughs, especially in south Florida, are ideal moist, warm habitats for rare and endangered tropical epiphytes. Many Caribbean species that occur in this NC are virtually never encountered in other Florida habitats. Pond apple branches are often heavily loaded with epiphytic orchids, bromeliads, ferns and peperomias. Typical animals are those of adjacent Strand Swamps and Swales.

Sloughs are often aligned with the lowest part of linear depressions in the underlying limestone bedrock. The soils are peat, unless they have been destroyed by catastrophic fires that often occur during droughts. The normal hydroperiod is at least 250 days per year.

Sloughs often grade into Strand Swamps and Swales and may also occur in Floodplain Swamps and Basin Swamps. Sloughs are generally abundant throughout Florida.

Sloughs are extremely vulnerable to hydrologic disturbance and must have a reliable, quality water source to persist. Peat mining and clearcutting are additional threats to this NC.

Strand Swamp - (synonyms: cypress strand, stringer). Strand Swamps are shallow, forested, usually elongated depressions or channels dominated by bald cypress. They are generally situated in troughs in a flat limestone plain. Typical plants include red maple, laurel oak, cabbage palm, strangler fig, red bay, sweet bay, coastal plain willow, wax myrtle, myrsine, buttonbush, royal palm, poison ivy, swamp lily, leather fern, royal fern, sawgrass, swamp primrose, water hyssop, floating heart, dotted smartweed, and arum. Canopy plants are mainly temperate, while understory and epiphytic plants are mainly tropical. Small young trees at the outer edge of Strand Swamps grade into large old ones in the interior, giving a strand a distinctly rounded cross-sectional profile. Typical animals include ribbon snake, cottonmouth, opossum, gray squirrel, black bear, raccoon, mink, otter, Florida panther, and white-tailed deer.

Strand Swamp soils are peat and sand over limestone. The best developed forests are on deep peat that acts as a wick to draw moisture from groundwater up into the root zone during droughts. The normal hydroperiod is 200-300 days with a maximum water depth of 18 to 30 inches. Water is deepest and remains longest near the center where the trees are biggest.

Fire occurs in Strand Swamps on a cycle of perhaps 30 to 200 years, with the largest trees on the deepest peat towards the center of the strand burning least frequently. Fire is essential for maintenance of this NC; without fire, hardwood invasion and peat accumulation would convert the strand to Bottomland Forest in a few hundred years. Cypress is very tolerant of light surface fires, but muck fires burning into the peat can kill the trees, lower the ground surface, and

transform a Strand into a Slough.

The classic examples of Strand Swamp, those with tropical species, occur mainly in Collier County, Florida, where the Fakahatchee Strand is perhaps the finest example. Strand Swamps also occur in other areas of the southeastern coastal plain. Strand Swamps are extremely vulnerable to local as well as regional hydrological modifications. Most Strands were heavily disturbed by logging but many have recovered well and there are a few small strands that are thought to be virgin.

Swale - (synonyms: slough, river of grass, glades). Swales are marshes situated in broad shallow channels with flowing water and characterized by emergent grasses, sedges, and herbs up to ten feet tall. The dominant species is sawgrass. Other typical plants include buttonbush, coastal plain willow, arrowheads, pickerelweed, fragrant water lily, cutthroatgrass, water hyssop, water primrose, bladderwort, and muhly grass. Typical animals include cricket frog, pig frog, alligator, Florida redbelly turtle, Florida banded water snake, great blue heron, great egret, green-backed heron, wing rail, purple gallinule, raccoon, and mink.

Swale soils are peat, unless removed by severe fire, or sands, and are generally located over linear depressions in the underlying limestone. The natural hydrology consists of sheet flow that may be maintained on the order of 250 days per year.

Natural, light ground fires every 1 to 5 years are typical and result from lightning in late spring when the ground surface is dry, although sawgrass will carry a fire over water. When the peat dries out in extreme droughts, devastating muck fires may consume the soil and lower the ground surface so that the Swale is replaced by a Slough. Where fire is relatively infrequent, thickets of buttonbush and coastal plain willow develop.

The major occurrences of this NC in the U.S. are in south Florida in the Everglades - Big Cypress region. These Swales may grade into Wet Prairie and Marl Prairie so that the distinction between Swale with definite flowing water and a prairie without perceptible flow may be arbitrary. The threats to this NC are disruption of natural hydrologic and fire cycles, conversion to agriculture, and invasion of exotics in disturbed areas.

**BASIN WETLANDS** - shallow, closed basin with outlet usually only in time of high water; peat or sand substrate, usually inundated; wetland woody and/or herbaceous vegetation.

Basin Marsh - (synonyms: prairie, freshwater marsh). Basin Marsh is characterized as an herbaceous or shrubby wetland situated in a relatively large and irregular shaped basin. Typical plants include common reed, panicum, cutgrass, southern watergrass, pennywort, Spanish needle, redroot, soft rush, American lotus, water primrose, arrowhead, coastal plain willow, saltbush, elderberry, spikerush, knotweed, buttonbush, and dog fennel. Typical animals include two-toed amphiuma, lesser siren, greater siren, cricket frog, green treefrog, bull frog, pig frog, leopard frog, alligator, eastern mud snake, green water snake, banded water snake, striped swamp snake, black swamp snake, great blue heron, great egret, snowy egret, little blue heron, tricolored heron, bald eagle, and northern harrier.

Basin Marshes usually develop in large solution depressions that were formerly shallow lakes. The lake bottom has slowly filled with sediments from the surrounding uplands and with peat derived from plants. Thus, the soils are usually acidic peats. The hydroperiod is generally around 200 days per year. Open areas of relatively permanent water within the marsh, with or without floating aquatic vegetation, are considered to be Marsh Lakes (See Lacustrine Natural Communities).

Fire maintains the open herbaceous community by restricting shrub invasion. The normal interval between fires is 1 to 10 years, with strictly herbaceous marshes burning about every 1 to 3 years, and those with substantial willow and buttonbush having gone 3 to 10 years without fire. Fires during drought periods will often burn the mucky peat and will convert the marsh into a Marsh Lake.

Basin Marshes are associated with and often grade into Wet Prairie or Lake communities. They may eventually succeed to Bog, if succession is not reversed by a muck fire. Many of the plants and animals occurring in Basin Marshes also occur in Floodplain Marsh, Slough, Swale and Depression Marsh. Large examples of the Depression Marsh, in fact, may be very difficult to distinguish from small examples of Basin Marsh.

Normal hydroperiods must be maintained, or Basin Marsh vegetation will change. Shortened hydroperiods will permit the invasion of mesophytic species, while longer hydroperiods will convert marsh into lake. Fire is also necessary to control hardwood encroachment. However, fires during droughts should be avoided to reduce the possibility of a muck fire. Many sites have been degraded by pollution or drained for agricultural uses.

Basin Swamp - (synonyms: gum swamp, bay, bayhead, swamp). Basin Swamp is generally characterized as a relatively large and irregularly shaped basin that is not associated with rivers, but is vegetated with hydrophytic trees and shrubs that can withstand an extended hydroperiod. Dominant plants include blackgum, cypress, and slash pine. Other typical plants include red maple, swamp redbay, sweetbay magnolia, loblolly bay, Virginia willow, fetterbush,

laurel greenbrier, Spanish moss, wax myrtle, titi, sphagnum moss, and buttonbush. Typical animals include southern dusky salamander, cricket frog, little grass frog, chicken turtle, striped mud turtle, ringneck snake, scarlet kingsnake, crayfish snake, cottonmouth, wood duck, hawks, turkey, great horned owl, barred owl, pileated woodpecker, songbirds, gray squirrel, black bear, raccoon, mink, river otter, bobcat, and white-tailed deer.

Soils in Basin Swamps are generally acidic, nutrient poor peats, often overlying a clay lens or other impervious layer. The resulting perched water table may act as a reservoir releasing groundwater as adjacent upland water tables drop during drought periods. The typical hydroperiod is approximately 200-300 days. Basin Swamps are thought to have developed in oxbows of former rivers or in ancient coastal swales and lagoons that existed during higher sea levels.

Infrequent fire is essential for the maintenance of cypress dominated Basin Swamps. Blackgum and hardwood dominated Basin Swamps burn less often, while pine dominated Basin Swamps burn more frequently. Without fire, hardwood invasion and peat accumulation will eventually create a Bottomland Forest or Bog. Typical fire intervals in Basin Swamps may be anywhere from 5 to 150 years. Cypress and pines are very tolerant of light surface fires, but muck fires burning into the peat can kill the trees, lower the ground surface, and transform a swamp into a pond or lake.

Small Basin Swamps may be difficult to distinguish from large Dome Swamps. Basin Swamps are often associated with and may grade into Wet Flatwoods, Hydric Hammock, or Bottomland Forest. The species composition of Basin Swamps frequently overlaps with Floodplain Swamp, Strand Swamp, and Baygall.

Like other wetland communities, normal hydroperiods must be maintained in Basin Swamps. If water levels must be artificially manipulated, somewhat deeper than normal water is not likely to do much harm, but extended hydroperiods will limit tree growth and prevent reproduction. Shortened hydroperiods will permit invasion of mesophytic species and change the character of the understory or will allow a devastating fire to enter which would drastically alter the community. Occasional fires are necessary to maintain the cypress and pine components.

Basin Swamps are unsuitable for construction because of their extended hydroperiods and peaty soils. Most have been degraded by timber harvests, and many have been drained or polluted. Thus, very few pristine examples of Basin Swamp communities exist. Those that remain should be adequately protected and properly managed.

Bog - (synonyms: Bog swamp, pocosins, evergreen shrub bogs, wet scrub/shrub, peat islands, teardrop islands). Bogs are characterized as wetlands on deep peat substrate with moisture maintained by capillary action and soils usually saturated or inundated. The vegetation is characterized by sphagnum moss and dense evergreen forests or shrub thickets of hydrophytic species or by marshy prairie with or without woody species. Typical plant species include titi,

sphagnum moss, fetterbush, large gallberry, loblolly bay, redbay, and sweetbay. There may be small sites fitting the description of this Natural Community in many Florida counties, but very few have been documented. Bogs are scattered around lakeshores and in Dome Swamps, ponds and Sinkholes. Other typical plants include black titi, pond pine, slash pine, white cedar, wax myrtle, odorless wax myrtle, dahoon holly, gallberry, Virginia willow, buttonbush, cocoplum, maleberry, blueberry, dog-hobble, racemed fetterbush, sweet pepperbush, possumhaw, red chokeberry, swamp tupelo, red maple, cypress, pitcher plants, sundews, arrowheads, golden club, arum, bog buttons, hatpins, yellow-eyed grass, bloodroot, orchids, coral greenbrier, cinnamon fern, and grass-of-parnassus. Typical animals include dwarf salamander, squirrel treefrog, little grass frog, banded water snake, and cottonmouth.

Bogs occur on acidic peat soils that have accumulated in a depression. The peat may fill the depression or be an island or isolated mass floated into position by high water. The hydrologic regime of the peat soils is dominated by capillary action that draws water up from below.

Fire frequency in Bogs is highly variable. In shrubby types they occur normally every 3-8 years while in woody types every 50-150 years.

Bogs may grade into Baygall, Wet Flatwoods, Seepage Slopes, Basin Swamp, and Bottomland Forest. Bogs may be distinguished from ecologically similar Seepage Slopes in that they are maintained by opposite hydrological processes. A Seepage Slope is dependent upon water seeping down from an upslope source, whereas a Bog is kept moist by moisture drawn up from below by capillary action.

In managing Bogs, the hydrologic regime and water quality must be maintained. Boardwalks may be necessary for access and interpretive purposes. Some Bogs may require fire management, but catastrophic peat fires should be avoided. Threats other than drainage, pollution, trampling and catastrophic fires include mining of peat for fuel, agricultural and horticultural uses.

Coastal Interdunal Swale – [ This description was written July 7, 1999 by Jon Blanchard and Ann Johnson in response to a request from the Division of Recreation and Parks. They will be using it to describe interdunal swales on Topsail Hill. This description was based mostly upon a Community Characterization Abstract written by Orzell in 1992, but modified to incorporate recent thinking, especially as it relates to the age and dynamics of the dune and swale system.]

Coastal Interdunal Swales are associated with the large barrier islands on the Florida coasts, most commonly in the panhandle. They appear as a mix of grasslands, small ponds, and depression marshes. A good example can be found on Santa Rosa Island, especially on the portion within Eglin Air Force Base, in Santa Rosa and Okaloosa Counties. Typically these occur where 1) dune and swale topography has developed within the past 5000 years, 2) a lens of groundwater intersects the bottom of the swales, and 3) extensive flooding by saltwater is infrequent. It appears that Coastal Interdunal Swales owe their existence to a subsurface

hydraulic connection with the barrier island's water table. The water levels in the interdunal wetlands are strongly tied to local rainfall events. Consequently, the community varies from flooded to completely dry depending on rainfall, as well as area and elevation of the surrounding dunes.

Dominant species are quite variable depending on local hydrology, substrate, and the age of the swales. Individual swales can be dominated by a number of species including umbrellagrass (*Fuirena scirpoidea*), St. John's Wort (*Hypericum reductum*), redroot (*Lacnathes caroliniana*), centella (*Centella asiatica*) yellow-eyed grass (*Xyris elliottii*), and broomsedge (*Andropogon virginicus*). They are particularly rich with species from the sedge family (Cyperaceae).

Coastal Interdunal Swales are distinguished from The Inventory's Coastal Grassland natural community by long periods of standing water following rains. They are distinguished from depression marshes by their location on barrier islands. They are distinguished from tidal fresh water marshes by the lack of tidal fluctuations in water levels.

Little in the way of active management is required other than to prevent disruption by vehicles or excessive foot traffic. Fires occasionally burn through the swales but the dominant factor in this community's development and maintenance is hydrology. Chinese tallow (*Sapium sebiferum*) is known to invade Coastal Interdunal Swales, its presence should be monitored closely.

Depression Marsh - (synonyms: isolated wetland, flatwoods pond, St. John's wort pond, pineland depression, ephemeral pond, seasonal marsh). Depression Marsh is characterized as a shallow, usually rounded depression in sand substrate with herbaceous vegetation often in concentric bands. Depression Marshes are similar in vegetation and physical features to, but are generally smaller than, Basin Marshes. Typical plants include St. John's wort, spikerush, yellow-eyed grass, chain fern, willows, maidencane, wax myrtle, swamp primrose, bloodroot, buttonbush, fire flag, pickerelweed, arrowheads, and bladderwort.

Larger and more permanent Depression Marshes may have many of the same plants and animals listed as typical of Basin Marshes. However, because of their isolation and small size, many Depression Marshes support a very different assemblage of species than that found in larger, more permanent wetlands. Depression Marshes are considered extremely important in providing breeding or foraging habitat for such species as the flatwoods salamander, mole salamander, tiger salamander, dwarf salamander, striped newt, oak toad, cricket frog, pinewoods treefrog, barking treefrog, squirrel treefrog, little grass frog, southern chorus frog, ornate chorus frog, narrowmouth toad, eastern spadefoot toad, gopher frog, white ibis, wood stork and sandhill crane. Depression Marshes occurring as isolated wetlands within larger upland ecosystems are of critical importance to many additional wetland and upland animals.

Depression Marshes are typical of karst regions where sand has slumped around or over a sinkhole and thereby created a conical depression subsequently filled by direct rain fall, runoff, or seepage from surrounding uplands. The substrate is usually acid sand with deepening peat toward the center. Some depressions may have developed or be maintained by a subsurface hardpan. Hydrological conditions vary, with most Depression Marshes drying in most years.

Hydroperiods range widely from as few as 50 days or less to more than 200 days per year.

Fire is important to maintaining this community type by restricting invasion of shrubs and trees and the formation of peat. Fire frequency is often greatest around the periphery of the marsh and least toward the center. A severe peat fire can lower the ground surface and create a pond at the center of the marsh.

Depression Marshes are often associated with and grade into Wet Prairie, Seepage Slope, Wet Flatwoods, Mesic Flatwoods, Dome Swamp or Bog. They also may occur in association with various types of lakes, such as Sandhill Lake or Flatwoods Lake.

Depression Marshes are threatened by drainage, agriculture, pollution, fire suppression, and invasion of exotic species. Depression Marshes may be filled and converted to other uses. A regional lowering of the water table as a result of overuse may eliminate many Depression Marshes. Depression Marshes on some public lands have been deepened by explosives to allow for stocking with game fish. By preying upon the eggs and larvae of frogs and salamanders, these fish may eliminate the amphibians that depend on such seasonal wetlands for successful reproduction. Likewise, many species of invertebrates not adapted to predation by fishes may be eliminated.

Dome Swamp - (synonyms: isolated wetland cypress dome, cypress pond, gum pond, bayhead, cypress gall, pine barrens pond). Dome Swamps are characterized as shallow, forested, usually circular depressions that generally present a domed profile because smaller trees grow in the shallower waters at the outer edge, while bigger trees grow in the deeper water in the interior. Pond cypress, swamp tupelo, and slash pine are common plants. Other typical plants include red maple, dahoon holly, swamp bay, sweetbay, loblolly bay, pond apple, Virginia willow, fetterbush, chain fern, netted chain fern, poison ivy, laurel greenbrier, Spanish moss, wild pine, royal fern, cinnamon fern, coastal plain willow, maidencane, orchids, wax myrtle, swamp titi, St. John's wort, sawgrass, lizard's tail, swamp primrose, water hyssop, redroot, sphagnum moss, floating heart, buttonbush, arum, and fire flag. Typical animals include flatwoods salamander, mole salamander, dwarf salamander, oak toad, southern cricket frog, pinewoods treefrog, little grass frog, narrowmouth toad, alligator, snapping turtle, striped mud turtle, mud turtle, eastern mud snake, cottonmouth, woodstork, wood duck, swallow-tailed kite, barred owl, pileated woodpecker, great-crested flycatcher, prothonotary warbler, and rusty blackbird.

Dome Swamps typically develop in sandy flatwoods and in karst areas where sand has slumped around or over a sinkhole, creating a conical depression. Soils are composed of peat, which becomes thickest toward the center of the dome, and are generally underlain with acidic sands and then limestone, although other subsoils may also occur. Some domes have a clay lens that helps retain water levels.

Dome Swamps often derive much of their water through runoff from surrounding uplands, but they may also be connected with underground channels, in which case subterranean flows would dominate the hydrological regime. Dome Swamps generally function as reservoirs

that recharge the aquifer when adjacent water tables drop during drought periods. The normal hydroperiod for Dome Swamps is 200 to 300 days per year with water being deepest and remaining longest near the center of the dome.

Fire is essential for the maintenance of a cypress dome community. Without periodic fires, hardwood invasion and peat accumulation would convert the dome to Bottomland Forest or Bog. Dome Swamps dominated by bays are close to this transition. Fire frequency is greatest at the periphery of the dome and least in the interior where long hydroperiods and deep peat maintain high moisture levels for most of the year. The normal fire cycle might be as short as 3 to 5 years along the outer edge and as long as 100 to 150 years towards the center. The profile of a Dome Swamp (i.e., smaller trees at the periphery and largest trees near the center) is largely attributable to this fire regime. The shorter hydroperiods along the periphery permit fires to burn into the edge more often, occasionally killing the outer trees. Cypress is very tolerant of light surface fires, but muck fires burning into the peat can kill them, lower the ground surface, and transform a dome into a pond.

Dome Swamps may have a Depression Marsh or pond in their center, creating a doughnut appearance when viewed from above. Dome Swamps typically grade into Wet Prairie or Marl Prairie around the periphery, but they may also be bordered by Bottomland Forest or Swale. The species composition of Dome Swamps frequently overlaps with Strand Swamp, Wet Flatwoods, Basin Swamp, Baygall, Floodplain Swamp, and Freshwater Tidal Swamp.

Normal hydroperiods must be maintained. Somewhat deeper than normal water levels are not likely to do much harm, but extended hydroperiods will limit tree growth and prevent reproduction. Shortened hydroperiods will permit the invasion of mesophytic species, which will change the character of the understory and eventually allow hardwoods to replace cypress. Dome Swamps may also be degraded by pollution and the invasion of exotic plants.

## LACUSTRINE

Clastic Upland Lake - (synonyms: clay-bottomed lake, silt-bottomed lake, fluctuating or disappearing lake, deep water lake, limesink). Clastic Upland Lakes are generally characterized as shallow to relatively deep, irregular- shaped depressions or basins occurring in uplands on clay substrates. They are lentic water bodies with surface inflows but often without significant outflows. Water is generally dissipated through evaporation and transpiration, but it may also disappear, especially during prolonged droughts, through sinks that connect with the aquifer.

Vegetation varies substantially in Clastic Upland Lakes. Some portions of the water's edge may be dominated by hydrophytic shrubs, such as buttonbush, Virginia willow, wax myrtle, St. John's wort, primrose willow, elderberry, white alder, black titi, swamp privet, Carolina ash, witchhazel, large gallberry, hurrah-bush, and possumhaw. Other shorelines may be vegetated with sedges, grasses, and rushes; or they may be dominated by hydrophytic trees, such as bald cypress, water hickory, water oak, laurel oak, water elm, sweetbay magnolia, redbay, sweetgum, waterlocust, red maple, loblolly bay, and black gum. Shallow water zones of Clastic Upland

Lakes are generally densely vegetated by concentric bands of emergents, floating, and submersed aquatics, including pickerelweed, arrowhead, banana-lily, American lotus, spatterdock, fragrant water lily, coontail, watermilfoil, bladderwort, fanwort, and pondweed.

Typical animals include Florida gar, bowfin, threadfin shad, chain pickerel, golden shiner, ironcolor shiner, redeye club, yellow bullhead, brown bullhead, pirate perch, golden topminnow, lined topminnow, pygmy killifish, mosquitofish, least killifish, brook silverside, flier, Okefenokee pygmy sunfish, bluespotted sunfish, warmouth, bluegill, redear sunfish, largemouth bass, black crappie, swamp darter, two-toed amphiuma, newts, sirens, cricket frog, bullfrog, pig frog, leopard frog, alligator, snapping turtle, Florida cooter, yellow-belly turtle, mud turtle, stinkpot, Florida softshell turtle, mud snake, green water snake, banded water snake, eastern garter snake, cottonmouth, great blue heron, great egret, snowy egret, little blue heron, green-backed heron, white ibis, wood stork, kingfisher, beaver, and river otter.

Clastic Upland Lakes generally have clay and organic substrates. Their water is characteristically clear to colored, circumneutral to slightly acidic, and soft with a low mineral content (particularly sodium, chloride, and sulfate). Clastic Upland lakes may be oligo-mesotrophic, with relatively low nutrient levels, to eutrophic, with very high nutrient levels, depending upon their geologic age and nutrient supplements from the surrounding uplands.

Clastic Upland Lakes are important breeding areas for many terrestrial and semi-aquatic amphibians. They are frequently very important feeding and nesting areas for many wading birds, ducks, reptiles, and fish. Clastic Upland Lakes are vulnerable to hydrological manipulations which permanently lower the water levels and hasten successional processes, and those which prevent periodic dry-downs and hasten eutrophication. They are also vulnerable to various activities in the surrounding uplands. Land clearing and timber harvests on the adjacent uplands generally increase sedimentation rates and, therefore, successional processes. Residential, agricultural, and industrial development within a lake's drainage basin generally increases pollution levels and accelerates eutrophication, which could be extremely detrimental to fish and other aquatic organisms. Human-related manipulations and activities within the drainage basin must be adequately controlled to avoid detrimental repercussions to these important communities.

Coastal Dune Lake - (synonyms: lagoon, sand-bottomed lake, silt-bottomed lake, oligotrophic lake, coastal lake). Coastal Dune Lakes are generally characterized as shallow irregularly shaped or elliptic depressions occurring in coastal communities. They are generally permanent water bodies, although water levels may fluctuate substantially. They are typically lentic water bodies without significant surface inflows or outflows. Instead, water is largely derived from lateral ground water seepage through the surrounding well-drained coastal sands. Storms occasionally provide large inputs of salt water and salinities vary dramatically over the long term.

Vegetation may be largely restricted to a narrow band along the shore, composed of hydrophytic grasses and herbs or a dense shrub thicket, depending on fire frequency and/or water

fluctuations. Shallow, gradually sloping shorelines may have much broader bands of emergent vegetation with submersed aquatic plants occasionally dominating much of the surface. Typical plants include rushes, sedges, marsh pennywort, cattail, sawgrass, water lilies, water shield, royal fern, marsh fleabane, marsh elder, salt myrtle, and black willow. Typical animals include mosquitofish, sailfin molly, alligator, mud turtle, saltmarsh snake, little blue heron, coot, and otter.

The substrate of Coastal Dune Lakes is primarily composed of sands with organic deposits increasing with water depth. Coastal Dune Lakes characteristically have slightly acidic, hard water with high mineral content, predominately sodium and chloride. Salinity levels often vary greatly, depending on local rainfall and storms. They are generally oligotrophic with low nutrient levels.

Coastal Dune Lakes develop from various coastal processes. They most commonly begin as a tidally influenced basin or lagoon that becomes closed by sand filling its inlet. Once isolated from the direct effects of tides, the water may become hypersaline, as salt water intrusion occurs readily through the sandy substrates, and the surface water evaporates rapidly. With further isolation from subsurface and overwash saltwater intrusion, the water gradually becomes less saline, but still varies considerably with local weather conditions.

Coastal Dune Lakes are very unusual coastal features, being relatively short-lived and likely to disappear rapidly. They are important breeding areas for many insects that form the base of numerous food chains. They may also be important watering holes for many mammals and birds inhabiting the surrounding xeric and coastal communities. Wading birds and ducks may also use these lakes as feeding and resting areas.

Coastal Dune Lakes are extremely vulnerable to hydrological manipulations. Excessive withdrawals of ground water could lower local water tables or increase salt water intrusion and, thus, induce successional responses in the lake basin. Groundwater pollution, especially from misapplications of chemicals on the surrounding coastal communities, could significantly alter the nutrient balance and produce devastating effects on the fauna and flora.

Coastal Rockland Lake - Coastal Rockland Lakes are characterized as "bare bottom" lacustrine systems of diminutive size with severely limited numbers and range (primarily confined to Monroe County). Lithophytic algae may occur sparsely on the limestone substrate that may be one of two types. In the Upper Keys from the northeast to approximately Big Pine Key, Miami limestone is prevalent, while west of this point a geologic shift to oolite occurs. The significance of this shift is not well known. Also characteristic of this community type are highly variable salinity ranges caused by saltwater intrusion and storm surges introducing saltwater into the system. The water is generally alkaline due to the limestone substrate and has a high mineral content.

Although this Natural Community is generally sparsely vegetated, it is critical in supporting an assortment of animals in the Keys. Typical animals associated with these

communities include Florida Keys sheepshead minnow and Florida Keys sailfin molly. The rare Key deer and other terrestrial fauna are thought to be dependent on Coastal Rockland Lakes for drinking water. Coastal Rockland Lakes are generally surrounded by Marine Tidal Swamp, Pine Rockland, or Rockland Hammock, depending on the proximity to the shoreline and the elevation of the surrounding ground.

Management of these systems requires protection of the essential fresh groundwater lens that floats above the denser saline groundwater. Protection of the surrounding vegetated communities is also desirable to maintain the association between the terrestrial and avian fauna dependent on Coastal Rockland Lakes.

The primary threat to Coastal Rockland Lakes is development. Even limited use of the groundwater in the vicinity of this Natural Community may lead to elimination of the freshwater lens. Although less common than residential and commercial development in the Keys, rock mining activities occur in close proximity to Coastal Rockland Lakes and can destroy an entire cluster in a very limited time. The estimated number of Coastal Rockland Lakes thought to occur in Florida is very deceptive in that they are often clustered and the range is extremely limited. Therefore, detrimental activities at one location could eliminate as much as 10 to 20 percent of the total number of Coastal Rockland Lakes.

Flatwoods/Prairie/Marsh Lake - (synonyms: Flatwoods pond, ephemeral pond, grass pond, St. John's wort pond, freshwater lake, pineland depression, swale, prairie pond). The distinctions between these communities, and from Depression Marsh, are often quite subtle, because of their successional interrelationships. Depression Marsh is characterized as a shallow, generally round or elliptical depression vegetated with concentric bands of hydrophytic herbaceous plants. Depending upon the depth and slope of the depression, an open water zone with or without floating plants may occur at the center. The open water zone is considered to be a Marsh Lake if it is small in comparison to the surrounding marsh. Otherwise, the system is considered to be a Flatwoods Lake or a Prairie Lake, depending upon the surrounding community.

Both Flatwoods Lake and Prairie Lake are surrounded by either a sparse, Wet Prairie-like zone or a dense ring of saw palmetto and other shrubs. Typical plants include spikerush, yellow-eyed grasses, St. John's wort, chain fern, coastal plain willow, maidencane, wax myrtle, water primrose, floating heart, buttonbush, fire flag, pickerelweed, arrowhead, bladderworts, bottlebrush threeawn, toothache grass, star rush, bulrushes, sawgrass, and nut sedge. Many animals utilize marshes primarily for feeding and breeding areas but spend most of their time in other habitats. Other animals are more dependent on marshes, spending most of their time within them. Typical animals include amphiuma, lesser siren, greater siren, cricket frog, green treefrog, bullfrog, pig frog, leopard frog, alligator, eastern mud snake, banded water snake, green water snake, striped crayfish snake, black swamp snake, American bittern, least bittern, great blue heron, great egret, snowy egret, little blue heron, tricolored heron, green-backed heron, black-crowned night-heron, white ibis, glossy ibis, bald eagle, northern harrier, king rail, Virginia rail, sora, limpkin, long-billed marsh wren, yellowthroat, red-winged blackbird, boat-

tailed grackle, and Florida water rat.

The depressions in which these communities develop are typically formed by one of two geological processes: (1) solution holes form in the underlying limestone, causing surface sands to slump into a circular depression; or (2) during higher sea levels, offshore currents, waves, and winds scoured depressions that became seasonally or permanently inundated after the seas regressed. Soils in these depressions generally consist of acidic sands with some peat and occasionally a clay lens.

Water is derived mostly from runoff from the immediately surrounding uplands. These NC's function as aquifer recharge areas by acting as reservoirs which release groundwater when adjacent water tables drop during drought periods. Water generally remains throughout the year in a Flatwoods/Prairie Lake or a Marsh Lake, although water levels may fluctuate substantially.

River Floodplain Lake and Swamp Lake - (synonyms: cypress pond, gum pond, oxbow lake, backwater, blackwater lake or pond). Swamp Lakes and River Floodplain Lakes are generally characterized as shallow open water zones, with or without floating and submerged aquatic plants, that are surrounded by Basin Swamp or Floodplain Swamp. They are generally permanent water bodies, although water levels often fluctuate substantially and they may become completely dry during extreme droughts. They are typically lentic water bodies occurring in confined basins or depressions. However, during floods or following heavy rains, they may exhibit decidedly lotic characteristics, flowing with the flood water or overflowing their banks into lower topographic areas. Some may even exhibit a slow perennial sheet flow, but water movement is generally so slow that lentic conditions prevail.

Except for the fringe of hydrophytic trees, shrubs and scattered emergents, plants may be absent altogether, or they may almost completely cover the water surface. When present, typical plants include fragrant water lily, banana lily, American lotus, spatterdock, duckweed, water meal, bog mat, water fern, dollar bonnet, frog's bit, water hyssop, water pennywort, coontail, milfoil, bladderwort, bog moss, and fanworts. Several exotic plants may also occur, including water lettuce, water hyacinth, salvinia, alligator weed, water spinach, parrot's feather, water chestnut, water sprite, hydrilla, and elodea. Scattered emergent plants such as lizard's tail, pickerelweed, slender spikerush and golden club may also occur, but the community will more appropriately be called Depression Marsh or Floodplain Marsh if emergents dominate the water body.

Typical animals include Florida gar, bowfin, redfin pickerel, golden shiner, taillight shiner, lake chubsucker, brown bullhead, tadpole madtom, pirate perch, golden topminnow, pygmy killifish, mosquito fish, flier, blue spotted sunfish, bluegill, largemouth bass, swamp darter, mole salamander, two-toed amphiuma, Alabama waterdog, sirens, cricket frog, bullfrog, pig frog, river frog, leopard frog, alligator, snapping turtle, Florida cooter, yellow-belly turtle, eastern mud turtle, stinkpot, Florida softshell turtle, mud snake, redbelly water snake, banded water snake, brown water snake, cottonmouth, great blue heron, great egret, snowy egret, little blue heron, green-backed heron, white ibis, wood stork, kingfisher, beaver, and river otter.

The substrates of Swamp Lakes and River Floodplain Lakes are variable and may be composed primarily of peats, sands, alluvial clays, or any combination of these. Swamp Lakes characteristically have highly colored, acidic, soft water with moderate mineral content, while River Floodplain Lakes characteristically have colored, alkaline or slightly acidic, hard or moderately hard water with high mineral content (sulfate, chloride, calcium, magnesium). Both types are generally mesotrophic to eutrophic (i.e., have moderate to high nutrient levels and primary productivity), although they sometimes exhibit partial oligotrophic characteristics, with low nutrient levels and primary productivity, because their darkly stained, acidic waters and surrounding tree canopy limit their productivity.

Swamp Lakes may have originated from one or more of the following geological processes: (1) solution of the underlying limestone and subsequent collapse of the surface to form a depression; (2) lowering of sea levels to isolate ancient coastal features, such as lagoons or dune swales; or (3) isolation of ancient river systems within relatively confined basins. River Floodplain Lakes generally originate along former stream channels as oxbows that have been isolated when new channels cut across a meander loop in the river, or along erosion scours formed by the tremendous forces of floodstage waters. They may also have been influenced by some of the processes that developed Swamp Lakes, or be the result of "nature's engineer", the beaver.

Swamp Lakes and River Floodplain Lakes are important breeding areas for many terrestrial and semi-aquatic amphibians. They are frequently very important feeding areas for many wading birds, ducks, and reptiles. They are also important nursery grounds and habitats for several species of fish. Swamp Lakes and Floodplain Lakes are extremely vulnerable to hydrological manipulations which lower the water levels and hasten successional processes. They are also vulnerable to land clearing and timber harvest operations within the surrounding swamps or adjacent uplands. Upland activities generally increase sedimentation, while activities within the swamp may increase insolation levels, alter nutrient levels and, in the case of Floodplain Lakes, increase the effects of flood scouring.

Sandhill Upland Lake - (synonyms: sand-bottomed lake, silt-bottomed lake, oligotrophic lake, sandhill lake). Sandhill Upland Lakes are generally characterized as shallow rounded solution depressions occurring in sandy upland communities. They are generally permanent water bodies, although water levels may fluctuate substantially, sometimes becoming completely dry during extreme droughts. They are typically lentic water bodies without significant surface inflows or outflows. Instead, water may be largely derived from lateral ground water seepage through the surrounding well-drained uplands and/or from artesian sources via connections with the underlying limestone aquifer.

Vegetation may be largely restricted to a narrow band along the shore, composed of hydrophytic grasses and herbs or a dense shrub thicket, depending on fire frequency and water fluctuations. Shallow, gradually sloping shorelines may have much broader bands of emergent vegetation with submerged aquatic plants occasionally dominating much of the water column;

floating plants sometimes cover much of the surface. Typical plants include panicums, rushes, bladderwort, water lilies, sawgrass, pickerelweed, fragrant waterlily, water shield, St. John's wort, arrowheads, beak rush, yellow-eyed grass, hatpins, meadow-beauty, sundews, and spikerush.

The substrate of Sandhill Upland Lakes is primarily composed of sands with organic deposits increasing with water depth. Sandhill Upland Lakes characteristically have clear, circumneutral to slightly acidic, moderately soft water with varying mineral content. They may be ultra-oligotrophic, with extremely low nutrient levels, seldom becoming eutrophic unless artificially fertilized by human-related activities.

Sandhill Upland Lakes are frequently extremely important breeding areas for terrestrial amphibians, including the threatened gopher frog, as well as many unusual or endemic insects. They are also important watering holes for many mammals and birds inhabiting the surrounding xeric communities. Wading birds and ducks may also use these lakes as feeding areas.

Sandhill Upland Lakes are extremely vulnerable to hydrological manipulations. Excessive municipal, industrial, or agricultural withdrawals of ground water could lower regional water tables and, thus, induce successional responses in the lake basin. Groundwater pollution, especially from misapplications of chemicals on the surrounding well-drained uplands, could significantly alter the nutrient balance and produce devastating effects on the fauna and flora. Furthermore, because they frequently have direct or indirect connections with the aquifer, Sandhill Upland Lakes often function as aquifer recharge areas and, thus, should be diligently protected from chemical pollution. Invasion by exotic species is also an important concern in Sandhill Upland Lake communities.

Sinkhole Lakes occur typically in deep, funnel-shaped depressions in a limestone base. Although the depression is relatively permanent, water levels may fluctuate dramatically. These lakes are characterized by clear, alkaline, hard water with high mineral content, including calcium, bicarbonate, and magnesium. Although they occur in most physiographic regions, the major occurrences of this NC in the U.S. are in Florida, where they are moderately widespread in the karst regions. They provide habitat for many species also found in accompanying subterranean NCs. The vegetation in some Sinkhole Lakes may be conspicuously absent or limited to a narrow fringe of emergents at the edge of the water. Other Sinkhole Lakes are completely covered by floating plants. When they occur, typical plants include American cupscale, bog moss, smartweed, rushes, cattails, bladderwort, duckweed, watermeal, azolla, and salvinia. Typical animals include crayfish, isopods, amphipods, pirate perch, redeye chub, yellow bullhead, and mud turtles.

Sinkhole Lakes are considered endangered in Florida. They are threatened by erosion which causes destruction of surrounding vegetation and to pollution and other threats to the aquifers with which they are connected.

## RIVERINE

Alluvial Stream - (synonyms: alluvial river, slow flowing river, deep river, muddy stream). Alluvial Streams are characterized as perennial or intermittent seasonal watercourses originating in high uplands that are primarily composed of sandy clays and clayey-silty sands. Because clay is a substantial component of these soils, surface runoff generally predominates over subsurface drainage. Thus, Alluvial Stream waters are typically turbid due to a high content of suspended particulates, including clays, silts, and sands, as well as detritus and other organic debris. Water temperatures may fluctuate substantially and are generally correlated with seasonal fluctuations in air temperature. Similarly, other water quality parameters vary substantially and generally fluctuate with seasonal rainfall patterns.

The most important characteristics of Alluvial Streams are the large range of flow rates and sediment loads encountered. Thus, water depth fluctuates substantially and is generally separated into two distinct stages, a normal or low flow stage and a flood or high flow stage. During the normal low flow stage the water is confined within the stream banks, while during flood stage the water overflows the banks and inundates the adjacent floodplain communities. Flood stages generally occur once or twice each year during winter or early spring and occasionally in summer.

Several important phenomena occur during floodstage. The flood waters transport detritus, minerals and nutrients from the surrounding uplands to the floodplain communities and beyond. This flushing action removes biological waste materials and simultaneously renourishes the floodplain communities. Most important, however, it provides a pulse of nutrient-rich water to the estuarine communities which occur where the stream empties into the sea. As the water spreads and moves more slowly over the broad floodplain communities, the heavy load of sediments, which was suspended by water currents, begins to settle. The heaviest sediments settle rapidly where the stream overflows its banks, causing a natural levee to develop. The flood waters are a controlling factor in the reproductive cycles of many Aquatic and semi-aquatic organisms. The onset of flooding, or its subsequent regressions, stimulates some animals to breed and lay eggs, or it may induce the hatching of eggs and the development of larvae. The flood stage waters expand the feeding grounds and habitat of fish and other aquatic organisms that normally inhabit the main stream. The flood waters function as a primary dispersal mechanism for many organisms, transporting seeds and small animals to distant locations where they otherwise would probably not reach.

Very few rooted plants occur within the main channel of Alluvial Streams, largely because the high natural turbidity reduces available light for photosynthesis. Water lilies, spatterdocks and other floating-leaved plants occasionally occur along quiet stretches, while pickerelweed, cattails, and other emergents may fringe the banks. Willows, cottonwood, river birch, silver maple, and other trees typically occur along the banks and natural levees. Typical animals include eel, gizzard shad, speckled chub, madtom, pirate perch, striped bass, redbreast sunfish, warmouth, bluegill, crappie, darter, Alabama waterdog, river frog, alligator, snapping

turtle, alligator snapping turtle, Florida cooter, river cooter, mud turtle, stinkpot, brown water snake, kingfisher, Louisiana waterthrush, beaver, and river otter.

Alluvial Streams are sparsely distributed in Florida, being primarily restricted to the northern panhandle. Nearly all have been degraded to some degree by disturbances within their watersheds. More serious damage can occur through physical alterations of their main channels, such as dredging, filling or damming. Damming poses the most serious threat, because it disrupts the natural flood cycle, traps upstream nutrients, and can lead to permanent loss of the floodplains due to longterm flooding of areas upstream of the dam. The adjacent floodplain communities are an essential and interrelated component of a viable Alluvial Stream community.

Blackwater Stream - (synonyms: blackwater river, blackwater creek). Blackwater Streams are characterized as perennial or intermittent seasonal watercourses originating deep in sandy lowlands where extensive wetlands with organic soils function as reservoirs, collecting rainfall and discharging it slowly to the stream. The tea-colored waters of Blackwater Streams are laden with tannins, particulates, and dissolved organic matter and iron derived from drainage through swamps and marshes. They generally are acidic (pH = 4.0 - 6.0), but may become circumneutral or slightly alkaline during low-flow stages when influenced by alkaline groundwater. Water temperatures may fluctuate substantially and are generally correlated with seasonal fluctuations in air temperature. The dark-colored water reduces light penetration and, thus, inhibits photosynthesis and the growth of submerged aquatic plants. Emergent and floating aquatic vegetation may occur along shallower and slower moving sections, but their presence is often reduced because of typically steep banks and considerable seasonal fluctuations in water level. Typical plants include golden club, smartweed, sedges, and grasses. Typical animals include river longnose gar, gizzard shad, threadfin shad, redbreast sunfish, chain pickerel, ironcolor shiner, Ohoopsee shiner, weed shiner, blacktail shiner, chubsucker, channel catfish, banded topminnow, pygmy killifish mosquitofish, mud sunfish, flier, everglades pygmy sunfish, banded sunfish, redbreast sunfish, dollar sunfish, stumpknocker, spotted bass, black crappie, darters, Alabama waterdog, river frog, alligator, snapping turtle, alligator snapping turtle, river cooter, Florida cooter, peninsula cooter, stinkpot, spiny softshell, red-belly watersnake, brown watersnake, beaver, and river otter.

Blackwater Streams have sandy bottoms overlain by organics and frequently underlain by limestone. Limestone outcrops may also occur. Blackwater Streams generally lack the continuous extensive floodplains and natural levees of Alluvial Streams. Instead, they typically have high, steep banks alternating with Floodplain Swamps. High banks confine water movement except during major floods. The absence of significant quantities of suspended sediments reduces their ability to construct natural levees.

Blackwater Streams are the most widely distributed and numerous Riverine systems in the southeast Coastal Plain. Very few, however, have escaped major disturbances and alteration. Clearcutting adjacent forested lands is one of the more devastating alterations for this community. Additionally, the limited buffering capacity of Blackwater Streams intensifies the detrimental impacts of agricultural and industrial effluents.

Seepage Stream - (Synonyms: steephead stream, clear brook, swift brook, hammock stream). Seepage Streams are characterized as perennial or intermittent seasonal water courses originating from shallow ground waters that have percolated through deep, sandy, upland soils. Seepage Streams typically have clear to lightly colored water maintained at fairly constant temperatures of around 70<sup>o</sup>F, and are relatively short, shallow, and narrow. Although a stream may be classified as a Seepage Stream along its entire length, they also form the headwaters of many Alluvial and Blackwater Streams. After large sediment loads are picked up or after drainage through extensive swamps, water clarity is diminished and the stream is then classified as Alluvial or Blackwater.

Because they are generally sheltered by a dense overstory of broad-leaved hardwoods which block out most sunlight, Seepage Streams most often have depauperate aquatic floras. Filamentous green algae occur sporadically within the stream, while mosses, ferns and liverworts may grow in clumps at the water's edge. In the lower, broader reaches where insolation levels are sometimes greater, narrow bands of spatterdocks, golden club, spikerush and pondweeds may occur along the shorelines, and tape grass and pondweed may grow in the streambed. Typical animals include sailfin shiner, creek chub, speckled madtom, brown darter, blackbanded darter, amphiuma, Alabama waterdog, southern dusky salamander, two-lined salamander, mud salamander, southern red salamander, bronze frog, snapping turtle, loggerhead musk turtle, rainbow snake, redbelly watersnake, and brown watersnake.

Percolation through deep soils slows the release of rainwater, filters the water, and buffers temperature extremes. Thus, Seepage Streams often exhibit perennial, slow flow rates of clear, cool, unpolluted water. Seepage Streams generally have sandy bottoms, although clays, gravel and limestone may be prevalent along stretches where formations composed of these sediments are exposed. Additionally, deep organic deposits may accumulate near stream bends and in other low areas where the leaf litter is not washed away by currents.

Seepage Streams are generally confined to portions of the state where topographic relief is pronounced, especially in northern Florida. They are often associated with Seepage Slope and Slope Forest near their head waters, and Bottomland Forest, Floodplain Forest and Swamp Forest near their mouths. Seepage Streams are readily distinguished from other Florida stream communities by their small magnitude, lack of a deep aquifer water source, and the absence of extensive swamp lowlands surrounding their head waters.

A unique type of Seepage Stream, the steephead stream, develops by a rather unusual geologic process. Rainfall percolates through the deep sandy soils capping the surrounding uplands until it encounters impermeable clays or other non-porous sediments. Water then travels laterally until reaching the surface and producing a seepage area along a slope or a spring. The seepage waters begin to erode the hill's base and cause the overburden to slump. Thus, the steephead stream valley is largely a product of seepage erosion which begins primarily at the bottoms of valleys instead of at their tops. Consequently, the gradient of steephead streams is

generally much lower than that of other upland streams in similar topography, because the head of a steephead stream is already near the bottom of a valley.

Seepage Streams may be threatened by various activities. Applications of fertilizers or biocides on the surrounding uplands, or dumping of hazardous wastes and other refuse within the drainage basin could pollute the shallow ground waters that feed the Seepage Streams. Deforestation of the surrounding slopes could increase surface erosion and cause excessive sedimentation of the stream valley, as well as increase insolation levels and cause the stream to become overgrown with shrubs or emergent herbaceous species. Impounding the stream would destroy much of the lotic habitat and restrict the upstream movements of aquatic animals. Because they are unique natural features of limited distribution within the state, Seepage Streams should be diligently protected from significant disturbances.

Spring-run Stream - (synonyms: calcareous stream, spring, or creek). Spring-run Streams are characterized as perennial water courses which derive most, if not all, of their water from artesian openings in the underground aquifer. Waters issuing from the aquifer are generally clear, circumneutral to slightly alkaline (pH = 7.0 - 8.2), and perennially cool (66 - 75<sup>o</sup>F). These conditions saturate the water with important minerals, allow light to penetrate deeply, and reduce the limiting effects of environmental fluctuations, all of which are conducive for plant growth. Thus, Spring-run Streams are among the most productive aquatic habitats. Typical plants include tape grass, wild rice, giant cutgrass, arrowheads, southern naiads, pondweeds, and chara. Typical animals include mollusks, stoneflies, mayflies, caddisflies, simuliids, chironomids, American alligator, alligator snapping turtle, Suwannee cooter, loggerhead musk turtle, rainbow snake, red-belly watersnake, brown watersnake, and many fishes.

Spring-run Streams generally have sand bottoms or exposed limestone along their central channel. Calcareous silts may form thick deposits in quiet shallow zones, while leaf drift and other debris collect around fallen trees and quiet basins. The latter, along with limestone outcrops and rock debris, form important aquatic habitats for many small aquatic organisms. When undisturbed, submerged aquatic vegetation clothes most of the spring-run stream bottom and provides shelter and an abundant food source for the extensive web of life.

The water emanating from the aquifer is generally clear because of the filtering and absorbing actions of the soils and aquifer limestones through which the water percolates and flows. When the water is deep, it may appear bluish because of light-refraction characteristics that are similar to those which cause the sky to be blue on clear days. If the water sources for the aquifer are substantially influenced by nearby swamps or flatwoods, the spring-run may temporarily become stained with tannins and other dissolved organics during or following periods of heavy rains. When extensive underground cavities connect the spring caverns with nearby sinks and swallow holes, the spring-run may become turbid with suspended particulates during and following heavy rains and floods. Conversely during periods of low rainfall, the aquifer can become supersaturated with calcium, carbonates, and other ions. These chemicals

readily precipitate when the water reaches the surface, causing the spring head or boil to appear milky.

Human activities affect flow rates by withdrawing water from the aquifer through deep wells. When withdrawal is substantial within the recharge area, spring flow is reduced or, in some cases, ceases entirely. Normal flow rates may return when excessive withdrawals are eliminated.

People can also substantially affect the quality of spring waters. Agricultural, residential, and industrial pollutants may readily leach through soils, especially when they are improperly applied or disposed. If polluted groundwater infiltrates the deep aquifer feeding a Spring-run Stream, recovery may not be possible. Applications of herbicides to control aquatic plant growth are also detrimental, because their use often induces eutrophication of the stream.

Other human-related impacts to Spring-run Streams include the destruction of aquatic vegetation by overuse or misuse, and the introduction and proliferation of exotic plants and animals. Both of these impacts may be very difficult to control. Overuse is likely to increase because of the limited number of publicly-owned springs and the desires of an increasing population to enjoy their clean, cool, aesthetic qualities and unique recreational opportunities. Exotic species are often severely detrimental to native species, and they may also disrupt recreational activities. A delicate balance between recreation and preservation must be sought.

## SUBTERRANEAN

Aquatic and Terrestrial Cave - (synonyms: cave, cavern grotto, chamber, chimney, sink, swallow hole, spring rise,). Aquatic and Terrestrial Caves are characterized as cavities below the surface of the ground in karst areas of the state. A cave system may contain portions classified as Terrestrial Caves and portions classified as Aquatic Caves. The latter vary from shallow pools highly susceptible to disturbance, to more stable, totally submerged systems. Because all caves initially develop under aquatic conditions, Terrestrial Caves can be considered essentially dry Aquatic Caves. The limestone aquifers that underlie the entire state of Florida could be considered vast Aquatic Cave communities. Troglobites (also called phreatobites) are organisms specially evolved to survive in deep cave habitats. The occasional observation of various species of troglobites in deep water wells from several regions in the state suggests that this community could be widespread. However, the dependence of troglobites on detrital inputs and other nutrients imported from the surface generally limits the distribution of well developed Aquatic Cave communities to karst areas with surface connections.

The area around cave entrances may be densely vegetated with species from the surrounding Natural Community. Within the cave, however, illumination levels and, thereby, vegetation densities drop rapidly with increased distance from the entrance. Within the limits of light penetration, called the twilight zone, species of algae, mosses, liverworts, and an occasional fern or herbaceous plant may grow. Beyond the twilight zone, plants are generally absent or limited to a few inconspicuous species of fungi that grow on guano or other organic debris. Thus, Subterranean Natural Communities differ from most other Natural Communities in that living plants are not dominant elements.

Animals inhabiting Subterranean Natural Communities are generally divided into three groups according to their cave adaptations: troglaxenes, troglaphiles, and troglobites. Troglaxenes spend much of their time in caves, but they must periodically return to the surface to feed or breed. Woodrats, harvestmen, cave crickets, some salamanders, and many species of bats are typical examples of troglaxenes. Troglaphiles may regularly live in caves, but their conspecifics also inhabit surface communities with moist microhabitats. Cave orb spiders, and some crickets, fish and salamanders are typical examples of troglaphiles. Troglobites are obligatory cave dwellers with special adaptations for living in complete darkness. Blind cave crayfish, blind cave salamander, cave amphipods, cave shrimp, cave snail, and cave isopods are typical troglobites in Florida's Aquatic Caves; cave mites, some cave spiders and springtails, and a cave earwig are typical troglobites in some Terrestrial Caves of north Florida. Even though they never leave their cave environments, troglobites and troglaphiles depend on outside energy sources, such as detritus that washes in through sinkholes and other cave entrances. Fecal materials derived from troglaxenes which feed outside the cave are also important nutrients for troglobites. Without these energy subsidies, the troglobitic elements could not exist.

Two geologic processes are predominantly responsible for the development of caves: phreatic and vadose. Phreatic processes occur below the aquifer's surface where ground water is

confined and subjected to hydrostatic pressure. Vadose processes occur at the top of or above the aquifer, where air enters the passageways and water flows freely under the influence of gravity. In both processes, the dissolution and corrosion of limestone play active roles in enlarging cave passageways. These forces differ primarily in the slopes of the passageways which result. Phreatic passageways are generally circular or elliptic, while vadose passageways are more triangular with the broad base of the triangle at the bottom. All limestone caves begin development under phreatic conditions in the aquifer. As water tables drop, vadose conditions eventually replace phreatic conditions. If the water table then rises, another reversal of processes occurs. Because water tables have fluctuated substantially with fluctuating sea levels during the Pleistocene and other geologic epochs, most caves in Florida exhibit both phreatic and vadose characteristics.

Since limestone caves initially develop in the aquifer, they are frequently associated with aquifer-related surface features. Thus, a Spring Run Stream issues from an Aquatic Cave, while Sinkhole Lakes and occasionally Blackwater Streams lead into Aquatic Caves. Similarly, Terrestrial Caves may occur at the bottoms of dry sinkholes or be associated with ancient springs, swallow holes or Aquatic Caves that have since been exposed by lower water tables. Typically, Terrestrial Caves may also exhibit aquatic conditions during periods of heavy rainfall, or vice versa during droughts. Additionally, Terrestrial Caves may harbor relatively permanent pools or lakes that are formed in natural depressions in the floor of the cave from the buildup of rimstone, or where the aquifer inundates the lower cavities. Thus, Terrestrial and Aquatic Caves often occur together.

Cave waters are generally clear, with deep water appearing bluish. The water may become stained brown from tannins leached from decaying plant matter nearby and carried in with rainwater. The water may also become milky white if fine limestone mud from the bottom of the Aquatic Cave is suspended in the water column following disturbance. A bottom substrate of organic silts can also muddy the water with suspended particles. Waters are generally circumneutral to alkaline with a high mineral content (particularly calcium bicarbonate and magnesium) and with constant temperature. Flowing water within Aquatic Caves generally has a lower pH, is often undersaturated with respect to carbonates, and has a relatively richer fauna. Contrastingly, pools that are fed by seepage or dripping water are generally characterized by a high pH, high concentration of dissolved carbonates, low content of organic matter suitable for food, and a sparse fauna. Cave water characteristics may also vary seasonally because of fluvial inputs from interconnected surface streams, or because of detrital pulses and other surface inputs during periods of substantial aquifer recharge. In general, however, Aquatic Caves are very stable environments with relatively constant physical and chemical characteristics.

Terrestrial Caves also are very stable environments, having relatively constant temperatures and humidities. Within the cave, however, these factors may vary with location. For example, the twilight zone (nearest to the light source) is generally warmer and experiences more temperature and humidity fluctuations than does the middle zone, a dark zone that is subject to air circulation due to "cave breathing" phenomena. The deep zone, when it occurs, is the most stable zone of a Terrestrial Cave, because the air in it is essentially static. Terrestrial

Cave faunas often partition their distributions according to these zones, with troglonexes being more common in the twilight and middle zones, and troglobites being more common in the deep zone.

Subterranean Natural Communities are extremely fragile. Their faunas are adapted to very stable environments and have a limited ability to survive even minor environmental perturbations. Terrestrial Caves are threatened by disturbances of spelunkers. The mere entry into a bat roosting, maternity, or hibernation cave is often sufficient to cause abandonment by bats, thereby causing a major reduction in an important energy source for the remainder of the cave ecosystem.

Alterations in or around cave entrances will often upset detrital input levels and may also induce significant changes in air circulation patterns and the cave microclimate. Aquatic Caves are threatened by pollution of ground and surface waters from agricultural, industrial, and residential sources, as well as by disturbances from divers. The unique troglobitic species generally have very low population levels and can be severely impacted by overcollection or by changes in nutrient input levels that result from surface manipulations or hydrological alterations. Thus, special precautions and management procedures must be invoked to protect these unique, fragile communities from deleterious activities.

## MARINE AND ESTUARINE

### General Information

Marine Natural Communities and Estuarine Natural Communities occur along coastlines and include subtidal, intertidal, and supratidal zones. The distinction between Marine and Estuarine Natural Communities is often subtle. Estuarine Communities may temporarily exhibit freshwater conditions during periods of heavy rainfall or upland runoff or marine conditions when rainfall and upland runoff are low. Generally, however, estuarine areas are those areas within which seawater is significantly diluted with freshwater inflow from the land, while marine areas are those areas without significant freshwater inflow. The primary criterion for separation is the salinity level of the water, which often varies with local and temporal climatic conditions. In general, freshwater communities have salinity levels below 0.5 parts per thousand (ppt), Estuarine Natural Communities have salinity levels between 0.5 and 30 ppt, and Marine Natural Communities have salinity levels between 30 and 37 ppt. Differences in species compositions may exist between otherwise similar Marine and Estuarine Natural Communities, because of differences in salinity tolerance or other physical or biological factors.

Both Marine Natural Communities and Estuarine Natural Communities of Florida may be separated into Mineral Based, Faunal Based and Floral Based Communities. Mineral Based Communities include Consolidated Substrate and Unconsolidated Substrate communities which occur in subtidal, intertidal and supratidal zones. Faunal-based Communities include Octocoral Bed, Sponge Bed, Coral Reef, Mollusk Reef and Worm Reef Communities which occur in subtidal zones (Worm Reefs also occur in intertidal zones). Floral-based Communities include Algal Bed, Seagrass Bed, Tidal Marsh and Tidal Swamp Communities which occur in intertidal and supratidal zones (Seagrass Beds are subtidal only). Composite Substrate Communities include components of various other Marine and Estuarine Natural Communities in quantities too sparse to be classified as those communities. Composite Substrate Natural Communities occur in subtidal, intertidal and supratidal zones.

Consolidated Substrate - (synonyms: hard bottom, rock bottom, limerock bottom, coquina bottom, relic reef). Marine and Estuarine Consolidated Substrates are Mineral Based Natural Communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Consolidated Substrates are solidified rock or shell conglomerates and include coquina, limerock or relic reef materials. These communities may be sparsely inhabited by sessile, planktonic, epifaunal, and pelagic plants and animals but house few infaunal organisms (i.e., animals living within the substrate).

The three kinds of Consolidated Substrate Communities occurring in Florida are of limited distribution. Coquina, which is a limestone composed of broken shells, corals and other organic debris, occurs primarily along the east coast, in marine areas in the vicinity of St. Johns and Flagler Counties.

Limerock substrates occur as outcrops of bedded sedimentary deposits consisting primarily of calcium carbonate. This Consolidated Substrate is more widespread than coquina substrate and can be found in a patchy distribution under both marine and estuarine conditions from north Florida to the lower-most keys in Monroe County. Relic reefs, the skeletal remains of formerly living reefs, are more limited in distribution than limerock outcrops but more common than coquina substrate.

Consolidated Substrates are important in that they form the foundation for the development of other Marine and Estuarine Natural communities when conditions become appropriate. Consolidated Substrate Communities are easily destroyed through siltation or placement of fill, and deliberate removal by actions such as blasting or nondeliberate destruction by forces such as vehicular traffic.

Another type of disturbance involves the accumulation of toxic levels of heavy metals, oils, and pesticides in Consolidated Substrates. Significant amounts of these components in the sediments will kill the infauna, thereby eliminating a food source for certain fishes, birds and other organisms. A film of pollutants engulfing Consolidated Substrates can render these areas unsuitable for colonization by marine and estuarine flora and fauna. Such problems occur in some of the major port cities, in areas where there is heavy industrial development, and along major shipping channels where oil spills are likely to occur.

Unconsolidated Substrate - (synonyms: beach, shore, sand bottom, shell bottom, sand bar, mud flat, tidal flat, soft bottom, coralgal substrate, marl, gravel, pebble, calcareous clay). Marine and Estuarine Unconsolidated Substrates are Mineral Based Natural Communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Unconsolidated Substrates are unconsolidated material and include coralgal, marl, mud, mud/sand, sand or shell. This community may support a large population of infaunal organisms as well as a variety of transient planktonic and pelagic organisms (e.g., tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs).

In general, Marine and Estuarine Unconsolidated Substrate Communities are the most widespread communities in the world. However, Unconsolidated Substrates vary greatly throughout Florida, based on surrounding parent material. Unconsolidated sediments can originate from organic sources, such as decaying plant tissues (e.g., mud) or from calcium carbonate depositions of plants or animals (e.g., coralgal, marl and shell substrates). Marl and coralgal substrates are primarily restricted to the southern portion of the state. The remaining four kinds of Unconsolidated Substrate, mud, mud/sand, sand, and shell, are found throughout the coastal areas of Florida. While these areas may seem relatively barren, the densities of infaunal organisms in subtidal zones can reach the tens of thousands per meter square, making these areas important feeding grounds for many bottom feeding fish, such as redfish, flounder, spot, and sheepshead. The intertidal and supratidal zones are extremely important feeding grounds for many shorebirds and invertebrates.

Unconsolidated Substrates are important in that they form the foundation for the development of other Marine and Estuarine Natural Communities when conditions become appropriate. Unconsolidated Substrate Communities are associated with and often grade into Beach Dunes, Tidal Marshes, Tidal Swamps, Grass Beds, Coral Reefs, Mollusk Reefs, Worm Reefs, Octocoral Beds, Sponge Beds, and Algal Beds.

Unconsolidated Substrate Communities which are composed chiefly of sand (e.g., sand beaches) are the most important recreational areas in Florida, attracting millions of residents and tourists annually. This community is resilient and may recover from recreational disturbances. However, this community is vulnerable to compaction associated with vehicular traffic on beaches and disturbances from dredging activities and low dissolved oxygen levels, all of which can cause infaunal organisms to be destroyed or to migrate out of the area. Generally these areas are easily recolonized either by the same organisms or a series of organisms which eventually results in the community returning to its original state once the disturbance has ceased. In extreme examples, such as significant alterations of elevation, there is potential for serious long-term impacts from this type of disturbance.

Another type of disturbance involves the accumulation of toxic levels of heavy metals, oils, and pesticides within Unconsolidated Substrates. Significant amounts of these compounds in the sediments will kill the infaunal organisms, thereby eliminating a food source for certain fishes, birds, and other organisms. Such problems occur in some of the major port cities, in areas where there is heavy industrial development, and along major shipping channels where oil spills are likely to occur.

Coral Reef - (synonyms: deep-water barrier reef, deep-water patch reef, shallow-water barrier reef, shallow-water patch reef, live bottom community, hard bottom community, transitional reef, Hawk Channel reef, bank reef). Marine and Estuarine Coral Reefs are Faunal Based Natural Communities generally characterized as expansive conglomerates of hard, sessile, limestone-building coral occurring in warm subtidal waters. Coral Reefs are formed from a diverse assemblage of carbonate precipitating organisms of the phylum Cnidaria (Coelenterata). Two classes of Cnidaria are the principal reef builders. Hydrozoa, the class which includes coral, are important fast growing, colonial reef builders that are capable of withstanding temperate water temperatures. Fire coral are distributed as far north in Florida as Tarpon Springs in the Gulf of Mexico and at least to Cape Kennedy in the Atlantic Ocean. The second class of reef building Cnidarians are the Anthozoa. This class is divided into two subclasses, the Octocorallia (e.g., soft coral, sea fans and sea feathers) and the Zoantharia (e.g., true stony coral, and colonial anemones). The Octocorallia represent the group of organisms comprising Octocoral Bed communities. The Scleractinians, or true stony coral, are the primary hermatypic or reef building coral that belong in this subclass. Examples of the reef building, true stony coral, are: elkhorn, staghorn, mountainous star coral, rough and smooth starlet coral, cavernous star coral, lobed star coral, sheet coral, ivory tree coral, giant brain coral, grooved brain coral, smooth coral, pillar coral, and fungus coral. As many as thirty four species of coral have been reported on individual Coral Reefs in the Florida Keys.

Coral Reefs can be classified into at least four kinds including: shallow and deep water barrier reefs and shallow and deep water patch reefs. Patch reef communities are roughly dome shaped with a topographic relief of 5 to 10 feet. Patch reefs vary considerably in dimension, depending on the size and number of coral colonies comprising the reef. A patch reef may be as small as a single giant brain coral head with its associated biota, or as large as several acres. Common builders of patch reefs include mountainous star coral, giant brain coral, smooth starlet coral, cavernous star coral, smooth brain coral, grooved brain coral and fire coral. Associated flora and fauna vary greatly between shallow water and deep water patch reefs.

A common feature associated with patch reefs is the "halo" effect. A zone of barren solid substrate, sand, or rubble is formed as a result of grazing by various species of fishes and invertebrates. The organisms exit at night from the refuge of the coral heads to forage on the attached algae and sea grasses, thus leaving a "halo" of barren, exposed substrate surrounding the patch reef. The halo is easy to spot from the surface, which aides in locating patch reef habitat. An important function of halos on solidified substrates is that reef-expansion is made possible because coral recruitment can take place only on hard (consolidated) substrates.

Major barrier reef communities form the expansive, living structures oriented parallel to the shoreline and serving as natural, protective breakwaters. Barrier reefs may form as shallow-water reefs or deep-water reefs at the edge of the shelf, providing light penetration is adequate. Barrier reefs are important in absorbing wave energy as a primary line of protection for the shoreline allowing formation of low energy communities such as Tidal Swamps in areas that would be inhospitable otherwise. Distinctive features of the barrier reef are the presence of staghorn and elkhorn corals, coral zonation by depth, and spur and groove formations oriented seaward. A generalized bank reef can be subdivided into various biological zones including fore reef, back reef/rubble zone and spur and groove zone. This zonation is determined by water depth, degree of light penetration, and wave energy.

A major barrier reef builder is elkhorn coral. This fast growing species forms the structural framework for the reef while supplying the necessary habitat for reef oriented organisms. Other major reef builders in this type of reef habitat are: knobby brain coral, mountainous star coral, smooth brain coral, giant brain coral, leaf coral, cactus coral, fungus coral and pillar coral. However, reef coral species and associated flora and fauna vary greatly between shallow-water and deep-water barrier reefs.

Factors affecting the distribution of Coral Reefs include temperature, light penetration (turbidity), salinity, water currents and availability of suitable substrates. Most corals are very sensitive to cold temperatures, being largely restricted to seas that average above 21<sup>o</sup>C (70<sup>o</sup>F). Additionally, the water must be quite clear, since the symbiotic algae living within the corals are generally restricted to water depths of less than 50 meters (164 feet). Most Coral Reefs occur in marine waters with salinities between 30 and 37 ppt. Exposure to freshwater kills most species of corals within 30 minutes. Water currents transport essential nutrients and remove biological waste materials, silts and sands which could smother the reef. A hard substrate is necessary for

completion of development of the planktonic larvae of coral.

Coral Reefs are among the most diverse and productive environments in the world. Coral Reefs provide shelter and food for a myriad of reef fishes and marine invertebrates. Gross production of calcium carbonate is between 100 and 500 tons per acre per year on actively growing reefs. Fragmented coral are often the primary source for creating and nourishing the beaches of nearby islands. These qualities, combined with their structural complexity, biological richness, and aesthetic appeal make Coral Reefs an extremely valuable resource wherever they occur.

Coral Reefs are biologically and structurally sensitive systems. They are slow growing, requiring decades to fully develop. Thus, structural damage caused by boat groundings, anchors, and other physical impacts may require decades to fully recover. Coral Reefs in Florida are at the northern extent of their range. As such, they are vulnerable to decreases in water temperature. High water temperatures also affect corals adversely. Sedimentation and turbid water restrict coral growth and, when significant, smother and kill Coral Reefs. Thus, dredge and fill operations or upland developments which increase the amount of suspended sediments in runoff water impact coral reefs. Pollutants may trigger planktonic algal blooms, reduce oxygen levels, or otherwise upset the delicate balance of the reef ecosystem, thereby damaging the Coral Reef community. Over-fishing, coral collecting, and other recreational activities may also create chronic problems in this community and should be periodically assessed.

Mollusk Reef - (synonyms: oyster bar, oyster reef, oyster bed, oyster rock, oyster grounds, mussel reef, worm shell reef, Vermetid reef). Marine and Estuarine Mollusk Reefs are Faunal Based Natural Communities typically characterized as expansive concentrations of sessile mollusks occurring in intertidal and subtidal zones to a depth of 40 feet. In Florida, the most developed Mollusk Reefs are generally restricted to estuarine areas and are dominated by the American oyster. Less common are Mollusk Reefs dominated by mussels and others dominated by Vermetid worm shells. Numerous other sessile and benthic invertebrates live among, attached to, or within the collage of mollusk shells. Most common are burrowing sponge, anemones, mussels, clams, boring clam, oyster drill, lightning whelk, polychaetes, mud worms, oyster leech, barnacles, bluecrab, mud crab, stone crab, pea crab, amphipods, and starfish. Several fish also frequently occur near or feed among Mollusk Reefs, including cow-nosed ray, menhaden, lizardfish, gafftopsail catfish, pinfish, sea trout, spot, black drum, and mullet. Mollusk Reefs that are exposed during low tides (e.g., coon oysters) are frequented by a multitude of shorebirds, wading birds, raccoons, and other vertebrates.

Reef-building mollusks require a hard (consolidated) substrate on which the planktonic larvae (i.e., spat) settle and complete development. The spat dies if it settles on soft (unconsolidated) substrates, such as mud, sand or grass. Hard substrates include rocks, limestone, wood and other mollusk shells. Hard substrates are often limited in Estuarine Natural Communities because of the large amounts of silt, sands and muds that are deposited around river mouths. Once established, however, Mollusk Reefs can generally persist and often expand by building upon themselves.

The most common kind of Mollusk Reef, oyster mollusk reefs, occur in water salinities from just above fresh water to just below full strength sea

water, but develop most frequently in estuarine water with salinities between 15 and 30 ppt. Their absence in marine water is largely attributed to the many predators, parasites, and diseases of oysters that occur in higher salinities. Prolonged exposure to low salinities (less than 2 ppt.) is also known to be responsible for massive mortality of oyster reefs. Thus, significant increases or decreases in salinity levels through natural or unnatural alterations of freshwater inflow can be detrimental to oyster Mollusk Reef communities.

Mollusk Reefs occupy a unique position among estuarine invertebrates and have been an important human food source since prehistoric times. They present a dynamic community of estuarine ecology, forming refugia, nursery grounds, and feeding areas for a myriad of other estuarine organisms.

The major threats to mollusk reefs continue to be pollution and substrate degradation due, in large part, to upland development. Mollusks are filter feeders, filtering up to 100 gallons of water a day. In addition to filtering food, they also filter and accumulate toxins from polluted waters. Sources of these pollutants can be from considerably distant areas, but are often more damaging when nearby. Substrate degradation occurs when silts, sludge and dredge spoils cover and bury the Mollusk Reefs. Declining oyster and other Mollusk Reef populations can be expected in coastal waters that are being dredged or are receiving chemicals mixed with rainwater flowing off the land, or from drainage of untreated residential or industrial sewage systems.

Octocoral Bed - (synonyms: gorgonians, sea fans, sea feathers, sea fingers, sea pansies, sea plumes, sea rods, sea whips, soft corals). Marine and Estuarine Octocoral Beds are soft Faunal Based Natural Communities characterized as large populations of sessile invertebrates of the Class Anthozoa, Subclass Octocorallia, Orders Gorgonacea and Pennatulacea. The dominant animal species are soft corals such as gorgonians, sea fans, sea feathers, sea fingers, sea pansies, sea plumes, sea rods, and sea whips. This community is confined to the subtidal zone since the sessile organisms are highly susceptible to desiccation. Other sessile animals typically occurring in association with these soft corals are sea anemones. An assortment of non-sessile benthic and pelagic invertebrates and vertebrates (e.g., sponges, mollusks, tube worms, burrowing shrimp, crabs, isopods, amphipods, sand dollars, and fishes) are associated with Octocoral Beds. Specific species of interest living on or among the soft corals include the flamingo tongue shell, the purple shrimp, and the basket starfish. Sessile and drift algae can also be found scattered throughout Octocoral Beds.

Octocoral Beds require hard bottom (consolidated) substrate (i.e., coquina, limerock, relic reefs) on which to anchor. Hard bottom substrate occurs sparsely throughout Florida in marine and estuarine areas; however, soft corals prefer the warmer waters of the southern portion of the state, severely limiting the distribution.

Octocoral Beds may grade into other marine and estuarine hard bottom subtidal, intertidal, and supratidal communities (i.e., Consolidated Substrate, Sponge Bed, Coral Reef, Mollusk Reef, Worm Reef, lithophytic Algal Bed) as well as soft bottom communities (i.e., Unconsolidated Substrate, sammophytic Algal Bed, Seagrass Bed, Tidal Marsh, Tidal Swamp).

Management considerations should include locating all true Octocoral Beds within the state, thought to be more prevalent off the Southeast coast, and providing protection for them from external degradation. Primary threats to Octocoral Beds include siltation from beach "renourishment" or "restoration" projects, anchor damage by nautical craft, trawling by commercial fishermen, collecting for tourist-oriented trade, and water pollution, particularly oil spills.

Sponge Bed - (synonyms: branching candle sponge, Florida loggerhead sponge, sheepswool sponge). Marine and Estuarine Sponge Beds are soft Faunal Based Natural Communities characterized as dense populations of sessile invertebrates of the phylum Porifera, Class Demospongiae. The dominant animal species are sponges such as branching candle sponge, Florida loggerhead sponge and sheepswool sponge. Although concentrations of living sponges can occur in marine and estuarine intertidal zones, Sponge Beds are confined primarily to subtidal zones. Other sessile animals typically occurring in association with these sponges are stony corals, sea anemones, mollusks, tube worms, isopods, amphipods, burrowing shrimp, crabs, sand dollars, and fishes. Sessile and drift algae can also be found scattered throughout Sponge Beds.

Sponge Beds require hard bottom (consolidated) substrate (i.e., coquina, limerock, relic reefs) on which to anchor. Hard bottom substrate occurs sparsely throughout Florida in marine and estuarine areas; however, sponges prefer the warmer waters of the southern portion of the state, significantly limiting the distribution severely.

Sponge Beds may grade into other marine and estuarine hard bottom subtidal, intertidal and supratidal communities (i.e., Consolidated Substrate, Sponge Bed, Coral Reef, Mollusk Reef, Worm Reef, lithophytic Algal Bed) as well as soft bottom communities (i.e., Unconsolidated Substrate, ammophytic Algal Bed, Seagrass Bed, Tidal Marsh, Tidal Swamp).

Management considerations should include locating all true Sponge Beds within the state, thought to be more prevalent off the SW coast, and providing protection for them from external degradation. Primary threats to Sponge Beds include siltation from beach "renourishment" or "restoration" projects, anchor damage by nautical craft, trawling by commercial fishermen, collecting for tourist-oriented trade, and water pollution, particularly oil spills.

Worm Reef - (synonym: Sabellariid Reef). Worm Reefs are Faunal Based Natural Communities characterized by large colonial conglomerates of rigid Sabellariid worm tubes of the species Phragmatopoma lapidosa. These shallow water "reefs" are generally found in the lower reaches of the intertidal zone or upper reaches of the subtidal zone. Sabellariid reefs provide shelter for a diverse assortment of small benthic vertebrate and invertebrate organisms,

particularly since the surrounding habitat is generally bare substrate (e.g., Consolidated Substrate or Unconsolidated Substrate). Therefore, the mere presence of Worm Reefs greatly increases the faunal diversity of a given area.

Of all the Marine and Estuarine Natural Communities, Worm Reefs are probably the least well known. Worm Reefs are known from several locations along the southern coast of the state.

A Worm Reef can be surrounded by and grade into virtually any of the remaining Marine and Estuarine Natural Communities but is more likely to grade into an expanse of Unconsolidated Substrate. Information regarding effective management of Worm Reefs is lacking. However, excessive turbidity and siltation are probably significant factors in the decline of Worm Reefs. A beach renourishment project in West Palm Beach threatens one of the few remaining productive Worm Reef sites, located in one to three meters of water near the shore.

Algal Bed - (synonyms: algal mats, periphyton mats). Marine and Estuarine Algal Beds are Floral Based Natural Communities characterized as large populations of nondrift macro or micro algae. The dominant plant species include star alga, Argardhiella, Avrainvellea, Batophora, Bryopsis, Calothrix, Caulerpa, Chondria, Cladophora, Dictyota, Digenia, Gracilaria, Halimeda, Laurencia, Oscillatoria, shaving brush, Rhipocephalus, and Sargassum. This community may occur in subtidal, intertidal, and supratidal zones on soft and hard bottom substrates. Vascular plants (e.g., seagrasses) may occur in Algal Beds associated with soft bottoms. Sessile animals associated with Algal Beds will vary based on bottom type. For Algal Beds associated with hard bottom substrate (lithophytic), faunal populations will be similar to populations associated with Octocoral Beds and Sponge Beds. Those associated with soft bottom substrate (psammophytic) may have similar benthic and pelagic species in addition to infauna species. Recent research has shown that Algal Beds provide critical habitat for juvenile spiny lobsters, a species of great commercial importance.

Lithophytic Algal Beds are thought to be less widespread within Florida than psammophytic Algal Beds. The precise distribution of both kinds is not known; however, the distribution is thought to be less than for Marine and Estuarine Seagrass Beds.

Marine and Estuarine Algal Beds may grade into Seagrass Beds, Tidal Marsh, Tidal Swamp, or many of the other Marine or Estuarine Natural Communities. Supratidal Algal Beds such as periphyton beds (e.g., blue-green algal mats) may grade into various coastal Palustrine and Terrestrial Natural Communities.

Distribution information for Algal Beds is lacking. The location of major beds must be determined before this Natural Community can be managed adequately. Existing state dredge and fill laws provide specific protection for Marine and Estuarine Seagrass Beds but not for Algal Beds. The correction of this deficiency could prove to be the most effective management tool available.

The primary threat to Marine and Estuarine Algal Beds are dredging and filling activities which physically remove or bury the beds. Other damage occurs from increased turbidity in the water column which reduces available light; pollution, particularly from oil spills; and damage from boats.

Seagrass Bed - (synonyms: seagrass meadows, grass beds, grass flats). Marine and Estuarine Seagrass Beds are Floral Based Natural Communities typically characterized as expansive stands of vascular plants. This community occurs in subtidal (rarely intertidal) zones, in clear, coastal waters where wave energy is moderate. Seagrasses are not true grasses. The three most common species of seagrasses in Florida are turtle grass, manatee grass, and shoal grass. Nearly pure stands of any one of these species can occur, but mixed stands are also common. Species of Halophila may be intermingled with the other seagrasses, but species of this genus are considerably less common than turtle grass, manatee grass and shoal grass. Widgeon grass can also be found occurring with the previously listed seagrasses although they occur primarily under high salinities while widgeon grass occurs in areas of lower salinity.

Attached to the seagrass leaf blades are numerous species of epiphytic algae and invertebrates. Together, seagrasses and their epiphytes serve as important food sources for manatees, marine turtles, and many fish, including spotted sea trout, spot, sheepshead, and redfish. The dense seagrasses also serve as shelter or nursery grounds for many invertebrates and fish, including marine snails, clams, scallops, polychaete worms, pink shrimp, blue crab, starfish, sea urchins, tarpon, bonefish, seahorses, pompano, jack, permit, snapper, grunt, mullet, barracuda, filefish, and cowfish.

Marine and Estuarine Seagrass Beds occur most frequently on Unconsolidated Substrates of marl, muck or sand, although they may also occur on other Unconsolidated Substrates. The dense blanket of leaf blades reduces the wave-energy on the bottom and promotes settling of suspended particulates. The settled particles become stabilized by the dense roots and rhizomes of the seagrasses. Thus, Marine and Estuarine Seagrass Beds are generally areas of soil accumulation.

Other factors affecting the establishment and growth of Seagrass Beds include water temperature, salinity, wave-energy, tidal activity, and available light. Generally, seagrasses are found in waters with temperatures ranging from between 20<sup>o</sup> and 30<sup>o</sup>C (68<sup>o</sup>-86<sup>o</sup>F). Seagrasses occur most frequently in areas with moderate current velocities, as opposed to either low or high velocities. Although Marine and Estuarine Seagrass Beds are most commonly submerged in shallow subtidal zones, they may be exposed for brief periods of time during extreme low tides.

One of the more important factors influencing seagrass communities is the amount of solar radiation reaching the leaf blades. In general, the water must be fairly clear because turbidity blocks essential light necessary for photosynthesis. The rapid growth rate of seagrass under optimum conditions rivals that of most intensive agricultural practices, without energy input from man.

Marine and Estuarine Seagrass Beds are often associated with and grade into Unconsolidated Substrate, Coral Reefs, Tidal Swamps, and Tidal Marshes, but may also be associated with any other Marine and Estuarine Natural Community.

Marine and Estuarine Seagrass Beds are extremely vulnerable to human impacts. Many have been destroyed through dredging and filling activities or have been damaged by sewage outfalls and industrial wastes. In these instances, the Seagrass Beds are either physically destroyed, or succumb as a result of decreased solar radiation resulting from increased water turbidity.

Seagrass Beds are also highly vulnerable to oil spills. Low concentrations of oil are known to greatly reduce the ability of seagrasses to photosynthesize. Extreme high temperatures also have adverse impacts on Seagrass Beds. The area surrounding power plant outfalls, where water temperatures may exceed 35<sup>o</sup>C (95<sup>o</sup>F), has been found to be lethal to seagrasses. Marine and Estuarine Seagrass Beds are susceptible to long term scarring cuts from boat propellers, anchors and trawls. Such gouges may require many years to become revegetated. When protected from disturbances, seagrasses have the ability to regenerate and recolonize areas. Additionally, some successful replantings of Seagrass Beds have been conducted. However, the best management is to preserve and protect Marine and Estuarine Seagrass Beds in their natural state.

Tidal Marsh - (synonyms: saltmarsh, brackish marsh, coastal wetlands, coastal marshes, tidal wetlands). Marine and Estuarine Tidal Marshes are Floral Based Natural Communities generally characterized as expanses of grasses, rushes and sedges along coastlines of low wave-energy and river mouths. They are most abundant and most extensive in Florida north of the normal freeze line, being largely displaced by and interspersed among Tidal Swamps below this line. Black needlerush and smooth cordgrass are indicator species which usually form dense, uniform stands. The stands may be arranged in well-defined zones according to tide levels or may grade subtly over a broad area, with elevation as the primary determining factor. In the upper reaches of river mouths, where Estuarine Tidal Marsh begins to blend with Freshwater Tidal Swamp and Marsh, sawgrass may occur in dense stands. Sawgrass is the least salt tolerant of these Tidal Marsh species. Other typical plants include saltgrass, saltmeadow cordgrass (marsh hay), gulf cordgrass, soft rush and other rushes, salt myrtle, marsh elder, saltwort, sea oxeye, cattail, big cordgrass, bulrushes, seashore dropseed, seashore paspalum, shoregrass, glassworts, seablight, seaside heliotrope, saltmarsh boltonia, and marsh fleabane. Typical animals include marsh snail, periwinkle, mud snail, spiders, fiddler crabs, marsh crab, green crab, isopods, amphipods, diamondback terrapin, saltmarsh snake, wading birds, waterfowl, osprey, rails, marsh wrens, seaside sparrows, muskrat and raccoon.

Fishes frequently found in this community include blacktip shark, lemon shark, bonnet-head shark, hammerhead shark, southern stingray, yellow spotted ray, tarpon, ladyfish, bonefish, menhaden, sardines, anchovy, catfish, needlefish, killifish, bluefish, blue runner, lookdown, permit, snapper, grunts, sheepshead, porgies, pinfish, seatrout, red drum, mullet, barracuda, blenny, goby, trigger fish, filefish, and puffers.

Tidal Marsh soils are generally very poorly drained muck or sandy clay loams with substantial organic components and often a high sulfur content. The elevation of Tidal Marshes range from just below sea level to slightly above sea level with vegetation occupying the intertidal and supratidal zones. The frequently high density of plant stems and roots effectively traps sediments derived from upland runoff or from littoral and storm currents. The decaying, dead marsh plants and the transported detritus which the living plants trap, accumulate to form peat deposits. Together, these accretion processes may build land.

Tidal Marsh plants live under conditions which would stress most plants. High salt content in the soil, poor soil aeration, frequent submersion and exposure, intense sunlight, and occasional fires make the Tidal Marsh community inhospitable to most plants and require a wide tolerance limit for its inhabitants. The landward extent of Tidal Marsh along the shoreline is directly related to the degree of bottom slope; the more gradual the slope the broader the community band. Typical zonation in this community includes smooth cordgrass in the deeper edges, grading to salt tolerant plants such as black needlerush that withstand less inundation.

Tidal fluctuation is the most important ecological factor in Tidal Marsh communities, cycling nutrients and allowing marine and estuarine fauna access to the marsh. This exchange helps to make Tidal Marsh one of the most biologically productive Natural Communities in the world. In fact, primary productivity in Tidal Marshes surpasses that of most intensive agricultural practices. The former operates at no cost because of free energy subsidies from tides, while the latter requires costly energy subsidies in the form of fuels, chemicals, and labor. A myriad of invertebrates and fish, including most of the commercially and recreationally important species such as shrimp, blue crab, oysters, sharks, grouper, snapper and mullet, also use Tidal Marshes throughout part or all of their life cycles.

Tidal Marshes are also extremely important because of their storm buffering capacity and their pollutant filtering actions. The dense roots and stems hold the unstabilized soils together, reducing the impact of storm wave surge. The plants, animals, and soils filter, absorb, and neutralize many pollutants before they can reach adjacent marine and estuarine communities. These factors make Tidal Marshes extremely valuable as a Natural Community.

Adverse impacts of urban development of Tidal Marshes include degradation of water quality, filling of marshes, increased erosion, and other alterations such as bulkheading and beach renourishment. The most attractive coastal areas for development activities frequently are the most ecologically fragile and are extremely vulnerable to development of any kind. Offshore pollution in the form of oil spills and various forms of litter jettisoned from shipping traffic also impact Tidal Marsh.

Tidal Swamps - (synonyms: mangrove forest, mangrove swamp, mangrove islands). Marine and Estuarine Tidal Swamps are Floral Based Natural Communities characterized as dense, low forests occurring along relatively flat, intertidal and supratidal shorelines of low wave energy along southern Florida. The dominant plants of Tidal Swamp Natural Communities are

red mangrove, black mangrove, white mangrove and buttonwood. These four species occasionally occur in zones which are defined by varying water levels, with red mangrove occupying the lowest zone, black mangrove the intermediate zone, and white mangrove and buttonbush the highest zone. Other vascular plants associated with Tidal Swamps include salt grass, black needlerush, spike rush, glasswort, Gulf cordgrass, sea purslane, saltwort and sea oxeye. Typical animals of the Tidal Swamp include mangrove water snake, brown pelican, white ibis, osprey, bald eagle, and a variety of shorebirds, herons, egrets, and raccoon. Also included are sponges, oysters, marine worms, barnacles, mangrove tree crabs, fiddler crabs, mosquitos, and numerous other invertebrates. Fishes are likewise diverse in this community. Those most frequently occurring include black-tipped shark, lemon shark, nurse shark, bonnet-head shark, rays, tarpon, ladyfish, bonefish, menhaden, sardines, lookdown, permit, snapper, sheephead, porgies, pinfish, and mullet.

Several variations of Tidal Swamps are generally recognized. These include (1) overwash swamps found on islands which are frequently inundated by the tides; (2) narrow fringe swamps located along waterways; (3) riverine swamps found in floodplains; (4) basin swamps growing in depressions slightly inland from the water; (5) hammock swamps, similar to basin swamps but growing at a slightly higher elevation; and (6) scrub swamps growing over hard substrates such as limestone marl.

Tidal Swamps occur in flat coastal areas. The soils are generally saturated with brackish water at all times, and at high tides these same soils are usually inundated with standing water. Mangroves grow on a wide variety of soils ranging from sands to muds. In older Tidal Swamps the sands and muds are usually covered by a layer of peat which has built up from detritus (decaying plant material).

The prop roots of red mangroves, the extensive pneumatophores (aerial roots) of black mangroves and the dense root mats of the white mangrove serve to entrap sediments and recycle nutrients from upland areas and from tidal import. This process serves in "island formation" and is a part of the successional process involved in land formation in south Florida. These root structures also provide substrate for the attachment of and shelter for numerous marine and estuarine organisms.

Temperature, salinity, tidal fluctuation, substrate and wave energy are five physical factors influencing the size and extent of Tidal Swamps. Mangroves require an annual average water temperature above 19°C (66°F) to survive. They do not tolerate temperatures below freezing or temperatures which fluctuate widely over the course of a year. Salt water is a key element in reducing competition from other plants and allowing mangroves to flourish. In addition, mangroves have adapted to the salt water environment by either excluding or excreting salt from plant tissues. Mangroves can survive in freshwater but are usually not found in large stands under such conditions in nature because they succumb to competition.

Tidal Swamps are closely associated with and often grade into Seagrass Beds,

Unconsolidated Substrates, Tidal Marshes, Shell Mounds, Coastal Berms, Maritime Hammocks, and other coastal communities. Seagrass Beds and Unconsolidated Substrates are usually found in the subtidal regions surrounding Tidal Swamps. Tidal Marshes are often found along the inland boundary of the Tidal Swamps. Tropical hardwood species occupy Coastal Berm and Shell Mound communities which are often surrounded by mangroves. In Florida, Tidal Swamps occur along both coasts, buffered by barrier island formations. Tidal Swamps are most extensive from Cedar Key southward along the Gulf coast and from Ponce de Leon Inlet southward along the east coast. The most luxuriant growth occurs in the Ten-Thousand Island areas of southwest Florida.

The Marine and Estuarine Tidal Swamp communities are significant because they function as nursery grounds for most of the state's commercially and recreationally important fish and shellfish. These Natural Communities are also the breeding grounds for substantial populations of wading birds, shorebirds, and other animals. The continuous shedding of mangrove leaves and other plant components produce as much as 80% of the total organic material available in the aquatic food web. Additionally, Tidal Swamps help protect other inland communities by absorbing the brunt of tropical storms and hurricanes.

Tidal Swamps have been and continue to be areas of environmental concern because many acres were destroyed through diking and flooding, ditching for mosquito control, and dredging and filling activities. Fortunately, specific legal protection for mangrove swamps was adopted by the state in 1985. Today, mangroves continue to face such problems as destruction from oil spills and changes in the quantity, quality and timing of the fresh water input as the adjacent uplands are developed or otherwise altered. Reducing estuarine salinity and flushing chemical pollutants from adjacent uplands have resulted in the destruction of some Tidal Swamp areas and the invasion of non-mangrove species.

The combination of these factors has resulted in a decrease in the number of acres of Tidal Swamps and a reduction in available nursery grounds and valuable habitat for native wildlife. Mangrove swamps can be replanted by man; however, long term monitoring has not been conducted to determine if restored sites function as the original community did. The best management practice is to prevent further destruction of existing Tidal Swamps and maintain a natural flow of fresh water into these areas.

Composite Substrate - Marine and Estuarine Composite Substrates consist of a combination of Natural Communities such as "beds" of algae and seagrasses or areas with small patches of consolidated and unconsolidated bottom with or without sessile floral and faunal populations.

Composite Substrates may be dominated by any combination of marine and estuarine sessile flora or fauna, or mineral substrate type. Typical combinations of plants, animals and substrates representing Composite Substrates include soft and stony corals with sponges on a hard bottom such as a limerock outcrop; psammophytic algae and seagrasses scattered over a sand bottom; and patch reefs throughout a coralgal bottom. Any of the remaining Marine and

Estuarine Natural Communities can grade into Composite Substrate communities.

Although Composite Substrates can occur in any marine or estuarine area in Florida, some combinations are common while others are extremely rare. Combinations of Consolidated and Unconsolidated Substrate components offer the greatest opportunity for diversity, and should be high priority areas for protection. Management requirements are negligible providing the composite community is adequately protected.

Protection efforts will vary slightly based on components of the Composite Substrate community. Generally, degradation of physical and chemical water quality parameters should be prevented, as well as mechanical disturbance from anchoring, dredging, trawling and similar activities.

## **APPENDICES**

APPENDIX 1. Index of Plant Common Names and their Scientific Names

alligator weed	<u>Alternanthera philoxeroides</u>
American beech	<u>Fagus grandifolia</u>
American cupscale	<u>Sacciolepis striata</u>
American holly	<u>Ilex opaca</u>
American hornbeam	<u>Carpinus caroliniana</u>
American lotus	<u>Nelumbo lutea</u>
American sycamore	<u>Plantanus occidentalis</u>
American wisteria	<u>Wisteria frutescens</u>
arum	<u>Peltandra</u> spp.
arrowheads	<u>Sagittaria</u> spp.
ash	<u>Fraxinus</u> spp.
ashe magnolia	<u>Magnolia ashei</u>
asters <u>Aster</u> spp.	
Atlantic white cedar	<u>Chamaecyparis thyoides</u>
bald cypress	<u>Taxodium distichum</u>
banana lily	<u>Nymphaea mexicana</u>
basswood	<u>Tilia</u> spp.
bay cedar	<u>Suriana maritima</u>
beach bean	<u>Canavalia rosea</u>
beach cordgrass	<u>Spartina</u> spp.
beach elder	<u>Iva imbricata</u>
beach jacquemontia	<u>Jacquemontia reclinata</u>
beach morning glory	<u>Ipomoea stolonifera</u>
beach orach	<u>Atriplex arenaria</u>
beakrush	<u>Rhynchospora</u> spp.
beakrush sedges	<u>Rhynchospora</u> spp.
beardgrass	<u>Andropogon</u> spp.
beautyberry	<u>Callicarpa americana</u>
bedstraw	<u>Galium</u> spp.
beech drops	<u>Epifagus virginiana</u>
bellwort	<u>Uvularia</u> spp.
big cordgrass	<u>Spartina cynosuroides</u>
bigleaf snowbell	<u>Styrax grandifolia</u>
black cherry	<u>Prunus serotina</u>
black-eyed susan	<u>Rudbeckia hirta</u>
blackgum	<u>Nyssa biflora</u>
black ironwood	<u>Krugiodendron ferreum</u>
black mangrove	<u>Avicennia germinans</u>
black needlerush	<u>Juncus roemerianus</u>
black sedge	<u>Schoenus nigricans</u>

black titi  
black walnut  
black willow  
blackjack oak  
blackroot  
bladder nut  
bladderpod  
bladderwort  
blazing star  
bloolly  
bloodroot  
  
blue phlox  
bluebell  
blueberry  
bluejack oak  
bluestem  
bluestem palmetto  
bluff oak  
bog buttons  
bog mat  
bog moss  
bottlebrush threeawn  
box elder  
bracken fern  
Brazilian pepper  
broomsedge  
buckthorn  
bulrushes  
bunch flower  
bustic  
butterwort  
buttonbush  
buttonwood  
cabbage palm  
caper tree  
caric sedges  
Carolina ash  
Carolina holly  
carpet grass  
cat's claw  
catalpa Catalpa spp.  
cattail  
chain fern

Cliftonia monophylla  
Juglans nigra  
Salix nigra  
Quercus marilandica  
Pterocaulon pycnostachyum  
Staphylea trifolia  
Sesbania vesicaria  
Utricularia spp.  
Liatis spp.  
Pisonia discolor  
Lachnanthes caroliniana, Sanguinaria  
canadensis  
Phlox divaricata  
Campanula spp.  
Vaccinium spp.  
Quercus incana  
Andropogon spp.  
Sabal minor  
Quercus austrina  
Lachnocaulon spp.  
Wolffiella spp.  
Mayaca fluviatilis  
Aristida spiciformis  
Acer negundo  
Pteridium aquilinum  
Schinus terebinthifolius  
Andropogon virginicus  
Rhamnus caroliniana  
Scirpus spp.  
Melanthium virginicum  
Dipholis salicifolia  
Pinguicula spp.  
Cephalanthus occidentalis  
Conocarpus erecta  
Sabal palmetto  
Capparis spp.  
Carex spp.  
Fraxinus caroliniana  
Ilex ambigua  
Axonopus spp.  
Pithecellobium unguis-cati  
  
Typha spp.  
Woodwardia spp.

Chapman's oak  
chara  
Christmas fern  
cinnamon fern  
clubmoss  
coastal plain willow  
cocoplum  
coffee colubrina  
coin vine  
common persimmon  
common reed  
coneflower  
coontail  
coontie Zamia integrifolia  
coral bean  
coral greenbrier  
cordgrass  
coreopsis  
cottonwood  
  cowhorn orchid  
creeping beggarweed  
crossvine  
crowfoot grass  
crownbeard  
cucumber sunflower  
cutgrass  
cutthroatgrass  
cypress Taxodium spp.  
dahoon holly  
dangleberry  
deer tongue  
devil's walking stick  
dewberry  
diamond-flower  
diamond-leaf oak  
dogfennel  
dog-hobble  
doll's eyes  
dollar bonnet  
dollar wort  
dollarweeds  
dotted smartweed  
dropseed  
duckweed

Quercus chapmanii  
Chara spp.  
Polystichum acrostichoides  
Osmunda cinnamomea  
Lycopodium spp.  
Salix caroliniana  
Chrysobalanus icaco  
Colubrina arborescens  
Dalbergia ecastophyllum  
Diospyros virginiana  
Phragmites communis  
Rudbeckia fulgida  
Ceratophyllum demersum  
  
Erythrina herbacea  
Smilax walteri  
Spartina spp.  
Coreopsis spp.  
Populus spp.  
Cyrtopodium punctatum  
Desmodium incanum  
Anisostichus capreolata  
Dactyloctenium aegyptium  
Verbesina chapmanii  
Helianthus debilis ssp. cucumerifolius  
Leersia spp.  
Panicum abscissum  
  
Ilex cassine  
Gaylussacia frondosa  
Carphephorus odoratissimus  
Aralia spinosa  
Rubus spp.  
Hedyotis nigricans  
Quercus laurifolia  
Eupatorium capillifolium  
Leucothoe axillaris  
Actea pachypoda  
Brasenia schreberi  
Hydrocotyle spp.  
Rhynchosia spp.  
Polygonum punctatum  
Sporobolus spp.  
Lemna spp.

dune panic grass  
dune sunflower  
dwarf blueberry  
dwarf huckleberry  
eastern cottonwood  
eastern hophornbeam  
eel grass  
elderberry  
elodea  
evening primrose  
false foxglove  
false hellebore  
false mastic  
fanwort  
fetterbush  
fire flag  
floating heart  
Florida elm  
Florida maple  
Florida yew  
flowering dogwood  
forestiera  
fox grape  
fragrant waterlily  
fringe tree  
frog's bit  
frostweed  
gallberry  
garberia  
gay feather  
geiger tree  
giant cutgrass  
glasswort  
goats rue  
golden aster  
golden canna  
golden club  
goldenrod  
gopher apple  
grass-of-parnassus  
grasses Poaceae  
green ash  
greenbrier  
ground cherry

Panicum amarulum  
Helianthus debilis  
Vaccinium sp.  
Gaylussacia dumosa  
Populus deltoides  
Ostrya virginiana  
Vallisneria americana  
Sambucus canadensis  
Elodea canadensis  
Oenothera spp.  
Agalinis spp.  
Veratrum woodii  
Mastichodendron foetidissimum  
Cabomba caroliniana  
Lyonia lucida  
Thalia geniculata  
Nymphoides aquatica  
Ulmus americana var. floridana  
Acer barbatum  
Taxus floridana  
Cornus florida  
Forestiera spp.  
Vitis labrusca  
Nymphaea odorata  
Chionanthus virginica  
Limnobiium spongia  
Verbesina virginica  
Ilex glabra  
Garberia heterophylla  
Liatris spp.  
Cordia sebestena  
Zizaniopsis miliacea  
Salicornia spp.  
Tephrosia virginiana  
Chrysopsis spp.  
Canna flaccida  
Orontium aquaticum  
Solidago spp.  
Licania michauxii  
Parnassia grandifolia  
  
Faxinus pensylvanica  
Smilax spp.  
Physalis spp.

ground lichens  
guiana-plum  
gulf cordgrass  
gulf sebastiana  
gum bumelia  
gumbo limbo  
hackberry  
halberd fern  
hatpins Eriocaulon spp.  
hawthorn  
hazel alder  
Hercules' club  
hog plum  
hophornbeam  
hornbeam  
horse sugar  
huckleberry  
hurrah-bush  
hydrilla  
Indian grass  
indigo berry  
indigo bush  
inkberry  
inkwood  
innocence  
knotweed  
lanceleaf greenbrier  
lancewood  
lantana Lantana spp.  
larkspur  
large gallberry  
laurel greenbrier  
laurel oak  
laurel cherry  
leather fern  
leatherwood  
licania  
lidflowers  
little blue maidencane  
live oak  
liverleaf  
lizard's tail  
loblolly bay  
loblolly pine

Cladonia spp.  
Drypetes lateriflora  
Spartina spartinae  
Sebastiana fruticosa  
Bumelia lanuginosa  
Bursera simaruba  
Celtis spp.  
Tectaria amesiana

Crataegus spp.  
Alnus serrulata  
Zanthoxylum clava-herculis  
Ximenia americana  
Ostrya virginiana  
Carpinus caroliniana  
Symplocos tinctoria  
Gaylussacia spp.  
Leucothoe racemosa  
Hydrilla verticillata  
Sorghastrum spp.  
Randia aculeata  
Indigofera suffruticosa  
Scaevola plumieri  
Exothea paniculata  
Hedyotis procumbens  
Polygonum spp.  
Smilax smallii  
Nectandra coriacea

Delphinium carolinianum  
Ilex coriacea  
Smilax laurifolia  
Quercus hemisphaerica  
Prunus caroliniana  
Acrostichum danaeifolium  
Dirca palustris  
Licania michauxii  
Calyptanthes spp.  
Amphicarpum muhlenbergianum  
Quercus virginiana  
Hepatica nobilis  
Saururus cernuus  
Gordonia lasianthus  
Pinus taeda

locustberry  
longleaf pine  
lousewort  
love grass  
love vine  
mahogany  
maiden cane  
maiden hair fern  
male-berry  
manatee grass  
marlberry  
marsh elder  
marsh fern  
marsh fleabane  
marsh pennywort  
marsh pink  
marsh samphire  
marshhay  
mastic Mastichodendron foetidissimum  
meadow-beauty  
melaleuca  
milfoil Achillea millefolium  
milk peas  
milkweed  
milkwort  
mockernut hickory  
mosquito fern  
mountain laurel  
muhly grass  
musky mint  
myrsine  
myrtle oak  
myrtle-leaved holly  
necklace pod  
needle palm  
netted chain fern  
nickerbean  
nut sedge  
oak-leaf hydrangea  
odorless wax myrtle  
Ogeechee tupelo  
orchid Orchidaceae  
overcup oak  
panicums

Bursonima lucida  
Pinus palustris  
Pedicularis spp.  
Eragrostis spp.  
Cuscuta spp.  
Swietenia mahagoni  
Panicum hemitomon  
Adiantum spp.  
Lyonia liqustrina  
Cymodocea filiformis  
Ardisia escallonioides  
Iva frutescens  
Thelypteris palustris  
Pluchea spp.  
Hydrocotyle umbellata  
Sabatia spp.  
Philoxerus vermicularis  
Spartina patens  
  
Rhexia spp.  
Melaleuca quinquenervia  
  
Galactia spp.  
Asclepias spp.  
Polygala spp.  
Carya tomentosa  
Azolla caroliniana  
Kalmia latifolia  
Muhlenbergia spp.  
Hyptis alata  
Myrsine guianensis  
Quercus myrtifolia  
Ilex myrtifolia  
Sophora tomentosa  
Rhapidophyllum hystrix  
Woodwardia areolata  
Caesalpinia spp.  
Cyperus esculentus  
Hydrangea quercifolia  
Myrica inodora  
Nyssa ogeche  
  
Quercus lyrata  
Panicum spp.

paradise tree  
parrot's feather  
partridgeberry  
partridge pea  
passion flower  
paw paw  
pencil flower  
pennywort  
pepper vine  
persimmon  
pickerelweed  
pigeon plum  
pignut hickory  
pine lily  
pinefern  
pinewoods dropseed  
pink azalea  
pinweed  
pitcher plants  
plume grass  
poison ivy  
poisonwood  
pond apple  
pond cypress  
pond pine  
pondweed  
poppy mallow  
possumhaw  
post oak  
prickly apple  
prickly ash  
prickly pear cactus  
primrose willow  
privet  
pumpkin ash  
purple coneflower  
pyramid magnolia  
queens delight  
rabbit tobacco  
racemed fetterbush  
ragweed  
railroad vine  
ratibida  
rattanvine

Simarouba glauca  
Myriophyllum brasiliense  
Mitchella repens  
Cassia fasciculata  
Passiflora spp.  
Asimina spp.  
Stylosanthes biflora  
Hydrocotyle spp.  
Ampelopsis arborea  
Diospyros virginiana  
Pontederia cordata  
Coccoloba diversifolia  
Carya glabra  
Lilium catesbaei  
Anemia adiantifolia  
Sporobolus junceus  
Rhododendron vaseyi  
Lechea spp.  
Sarracenia spp.  
Erianthus spp.  
Toxicodendron radicans  
Metopium toxiferum  
Annona glabra  
Taxodium ascendens  
Pinus serotina  
Potamogeton spp.  
Callirhoe papaver  
Ilex decidua, Viburnum nudum  
Quercus stellata  
Cereus spp.  
Zanthoxylum clava-herculis  
Opuntia spp.  
Ludwigia peruviana  
Ligustrum spp.  
Fraxinus profunda  
Echinacea purpurea  
Magnolia pyramidata  
Stillingia sylvatica  
Pterocaulon pycnostachyum  
Leucothoe racemosa  
Ambrosia spp.  
Ipomoea pes-caprae  
Ratibida pinnata  
Berchemia scandens

rattlebox  
rattlesnake master  
rattlesnake plantain  
red bay Persea borbonia  
red buckeye  
red cedar  
red chokeberry  
red mangrove  
red maple  
red mulberry  
red oak Quercus falcata  
redbud  
redroot Lachnanthes caroliniana  
redtop panicum  
reimargrass  
river birch  
rosemary  
rouge-plant  
royal fern  
royal palm  
rubber vine  
runner oak  
rushes  
rusty lyonia  
sagaretia  
salt grass  
salt myrtle  
saltbush  
saltmarsh boltonia  
saltmeadow grass  
saltwort  
salvinia  
sand cordgrass  
sand hickory  
sand live oak  
sand pine  
sand post oak  
sand spur  
sarsaparilla vine  
sassafras  
satin leaf  
saw greenbrier  
saw palmetto  
sawgrass

Crotalaria spp.  
Polianthes virginica  
Goodyera pubescens

Aesculus pavia  
Juniperus virginiana  
Aronia arbutifolia  
Rhizophora mangle  
Acer rubrum  
Morus rubra

Cercis canadensis

Panicum rigidulum  
Reimarochloa oligostachya  
Betula nigra  
Ceratiola ericoides  
Rivina humilis  
Osmunda regalis  
Roystonea elata  
Echites umbellata  
Quercus pumila  
Juncaceae  
Lyonia ferruginea  
Sageretia minutiflora  
Distichlis spicata  
Baccharis halimifolia  
Baccharis spp.  
Boltonia diffusa  
Leptochloa fascicularis  
Batis maritima  
Salvinia rotundifolia  
Spartina bakeri  
Carya pallida  
Quercus geminata  
Pinus clausa  
Quercus margaretta  
Cenchrus spp.  
Smilax pumila  
Sassafras albidum  
Chrysophyllum oliviforme  
Smilax bona-nox  
Serenoa repens  
Cladium jamaicense

scrub hickory  
scrub oak  
scrub palmetto  
sea blites  
sea daisy  
sea grape  
sea lavender  
sea oats  
sea oxeye  
sea purslane  
sea rocket  
seashore dropseed  
seashore paspalum  
seaside heliotrope  
Sebastianbush  
sedges  
shaving brush  
shining sumac  
shoal grass  
shoregrass  
  shortleaf fig  
shortleaf pine  
side-oats grama  
silk bay  
silky camellia  
silver maple  
silverbells  
slash pine  
slippery elm  
smartweed  
smooth cordgrass  
snakeroot  
sneezeweed  
snowberry  
soapberry  
soft rush  
soldierwood  
Solomon's seal  
sourwood  
south Florida slash pine  
southern blue flag  
southern magnolia  
southern naiads  
southern red cedar

Carya floridana  
Quercus inopina  
Sabal etonia  
Suaeda spp.  
Borrchia arborescens  
Coccoloba uvifera  
Limonium spp.  
Uniola paniculata  
Borrchia frutescens  
Sesuvium spp.  
Cakile spp.  
Sporobolus virginicus  
Paspalum distichum  
Heliotropium curassavicum  
Sebastiana fruticosa  
Cyperaceae  
Penicillus capitatus  
Rhus copallina  
Halodule wrightii  
Monanthochloe littoralis  
Ficus citrifolia  
Pinus echinata  
Bouteloua curtipendula  
Persea humilis  
Stewartia malacodendron  
Acer saccharinum  
Halesia spp.  
Pinus elliotii  
Ulmus rubra  
Polygonum spp.  
Spartina alterniflora  
Sanicula spp.  
Helenium spp.  
Symphoricarpos albus  
Sapindus spp.  
Juncus effusus  
Colubrina elliptica  
Polygonatum biflorum  
Oxydendrum arboreum  
Pinus elliotii var. densa  
Iris virginica  
Magnolia grandiflora  
Najas quadalupensis  
Juniperus virginiana

southern red oak  
southern watergrass  
Spanish bayonet  
Spanish moss  
Spanish needle  
sparkleberry  
spatterdock  
sphagnum moss  
spikerush  
spleenworts  
spruce pine  
St. John's wort  
stagger bush  
star alga  
stargrass  
star rush  
stiffcornel dogwood  
stinging nettle  
stoppers  
strangler fig  
strawberry bush  
sugarberry  
sundews  
sunflower  
swamp azalea  
swamp bay  
swamp chestnut oak  
swamp cottonwood  
swamp dogwood  
  swamp lily  
swamp primrose  
swamp privet  
swamp red bay  
swamp titi  
swamp tupelo  
sweet pepperbush  
sweet-shrub  
sweetbay  
sweetgum  
sycamore  
tall wiregrass  
tallowtree  
tape grass  
tar flower

Quercus falcata  
Hydrochloa caroliniensis  
Yucca aloifolia  
Tillandsia usneoides  
Bidens bipinnata  
Vaccinium arboreum  
Nyphar spp.  
Sphagnum spp.  
Eleocharis spp.  
Asplenium spp.  
Pinus glabra  
Hypericum spp.  
Lyonia spp.  
Anadyomene stellata  
Alettris spp.  
Dichromena latifolia  
Cornus foemina  
Cnidocolus stimulosus  
Eugenia spp.  
Ficus aurea  
Euonymus americanus  
Celtis laevigata  
Drosera spp.  
Helianthus spp.  
Rhododendron viscosum  
Persea palustris  
Quercus michauxii  
Populus heterophylla  
Cornus spp.  
Crinum americanum  
Ludwigia palustris  
Forestiera acuminata  
Persea palustris  
Cyrilla racemiflora  
Nyssa sylvatica  
Clethra alnifolia  
Calycanthus floridus  
Magnolia virginiana  
Liquidambar styraciflua  
Platanus occidentalis  
Aristida patula  
Sapium sebiferum  
Vallisneria americana  
Befaria racemosa

tetrazygia  
tickseed  
titi  
toothache grass  
torreya tree  
tough bumelia  
tread softly  
trilliums  
tulip poplar  
tupelo  
turkey oak  
turtle grass  
twinflower  
varnish leaf  
velvet seed  
Venus'-hair fern  
Virginia creeper  
Virginia willow  
Walter viburnum  
water chestnut  
water elm  
water fern  
water hickory  
water hyacinth  
water hyssop  
water lettuce  
water lilies  
water meal  
water oak  
water pennywort  
water primrose  
water shield  
water spinach  
water sprite  
water tupelo  
waterlocust  
water milfoil  
wax myrtle  
weak-leaf yucca  
white alder  
white ash  
white cedar  
white grass  
white mangrove

Tetrazygia bicolor  
Coreopsis spp.  
Cyrilla racemiflora  
Ctenium aromaticum  
Torreya taxifolia  
Bumelia tenax  
Cnidoscolus stimulosus  
Trillium spp.  
Liriodendron tulipifera  
Nyssa spp.  
Quercus laevis  
Thalassia testudinum  
Dyschoriste oblongifolia  
Dodonaea viscosa  
Guettarda scabra  
Adiantum capillus-veneris  
Parthenocissus quinquefolia  
Itea virginica  
Viburnum obovatum  
Nelumbo lutea  
Planera aquatica  
Salvinia rotundifolia  
Carya aquatica  
Eichhornia crassipes  
Bacopa spp.  
Pistia stratiotes  
Nymphaea spp.  
Wolffia spp.  
Quercus nigra  
Hydrocotyle spp.  
Ludwigia repens  
Brasenia schreberi  
Ipomoea aquatica  
Ceratopteris thalictroides  
Nyssa aquatica  
Gleditsia aquatica  
Myriophyllum spp.  
Myrica cerifera  
Yucca flaccida  
Clethra spp.  
Fraxinus americana  
Chamaecyparis thyoides  
Leersia virginica  
Laguncularia racemosa

white oak  
white-top sedge  
white-topped aster  
widgeon grass  
wild buckwheat  
wild coffee  
wild comfrey  
wild ginger  
wild grape  
wild hydrangea  
wild indigos  
wild olive  
wild pine  
wild rice  
wild tamarind  
willow oak  
willows  
winged elm  
winged sumac  
wiregrass  
witchhazel  
wood grass  
wood-sorrel  
yaupon Ilex vomitoria  
yellow-eyed grass  
yellow jessamine  
yellow foxglove

Quercus alba  
Dichromena spp.  
Aster paternus  
Ruppia maritima  
Eriogonum tomentosum  
Psychotria spp.  
Cynoglossum virginianum  
Hexastylis arifolia  
Vitis spp.  
Hydrangea spp.  
Indigofera spp.  
Osmanthus americana  
Tillandsia spp.  
Zizania aquatica  
Lysiloma bahamense  
Quercus phellos  
Salix spp.  
Ulmus alata  
Rhus copallina  
Aristida spp.  
Hamamelis virginiana  
Oplismenus setarius  
Oxalis spp.  
  
Xyris spp.  
Gelsemium spp.  
Aureolaria flava

**APPENDIX 2.** Index of Animal Common Names and Their Scientific Names

Acadian flycatcher	<u>Empidonax virescens</u>
Alabama waterdog	<u>Necturus alabamensis</u>
alligator	<u>Alligator mississippiensis</u>
alligator snapping turtle	<u>Macrolemys temminckii</u>
American bittern	<u>Botaurus lentiginosus</u>
American coot	<u>Fulica americana</u>
American robin	<u>Turdus migratorius</u>
American woodcock	<u>Scolopax minor</u>
amphiuma	see two-toed amphiuma
anchovy	<u>Anchoa</u> sp.
anemone	see sea anemone
Bachman's sparrow	<u>Aimophila aestivalis</u>
bald eagle	<u>Haliaeetus leucocephalus</u>
banded sunfish	<u>Enneacanthus obesus</u>
banded topminnow	<u>Fundulus cingulatus</u>
banded water snake	<u>Nerodia fasciata</u>
bank swallow	<u>Riparia riparia</u>
barking treefrog	<u>Hyla gratiosa</u>
barracuda	<u>Sphyaena</u> sp.
barred owl	<u>Strix varia</u>
basket starfish	<u>Astrophyton muricatum</u>
bass	<u>Micropterus</u> sp.
beach mouse	<u>Peromyscus polionotus</u>
bear	see black bear
beaver <u>Castor canadensis</u>	
belted kingfisher	<u>Ceryle alcyon</u>
bird-voiced treefrog	<u>Hyla avivoca</u>
blackbanded darter	<u>Percina nigrofasciata</u>
black crappie	<u>Pomoxis nigromaculatus</u>
black-crowned night heron	<u>Nycticorax nycticorax</u>
black drum	<u>Pogonias cromis</u>
black-necked stilt	<u>Himantopus mexicanus</u>
black swamp snake	<u>Seminatrix pygaea</u>
blacktail shiner	<u>Notropis venustus</u>
blacktip shark	<u>Carcharhinus limbatus</u>
blenny <u>Bleniidae, Clinidae</u>	
blind cave crayfish	<u>Cambarus</u> sp., <u>Procambarus</u> sp., <u>Troglocambarus</u> sp.
blind cave salamander	<u>Haideotriton</u> sp.
blue crab	<u>Callinectes sapidus</u>
blue jay	<u>Cyanocitta cristata</u>

blue runner  
bluebird  
bluefish  
bluegill  
bluespotted sunfish  
blue-tailed mole skink  
boat-tailed grackle  
bobcat  
bobwhite  
bonefish  
bonnet-head shark  
boring clam  
bowfin Amia calva  
box turtle  
branching candle sponge  
broadhead skink  
bronze frog  
brook silverside  
brown bullhead  
brown darter  
brown pelican  
brown thrasher  
brown water snake  
brown-headed nuthatch  
bullfrog  
burrowing owl  
burrowing shrimp  
burrowing sponge  
cactus coral  
caracara  
cardinal  
Carolina chickadee  
Carolina wren  
cave amphipod  
cave cricket  
cave earwig  
cave isopod  
cave mite  
cave orb spider  
cave shrimp  
cave snail  
cave spider  
cave springtail  
cavernous star coral

Caranx crysos  
see eastern bluebird  
Pomatomus saltatrix  
Lepomis macrochirus  
Enneacanthus gloriosus  
Eumeces egregius lividus  
Quiscalus major  
Lynx rufus  
see northern bobwhite  
Albula vulpes  
Rhinobatos productus  
Bivalvia  
  
Terrapene carolina  
Verongia longissima  
Eumeces laticeps  
Rana clamitans  
Labidesthes sicculus  
Ictalurus nebulosus  
Etheostoma edwini  
Pelecanus occidentalis  
Toxostoma rufum  
Nerodia taxispilota  
Sitta pusilla  
Rana catesbeiana  
Athene cunicularia  
Thalassinoidea  
Demospongiae  
Madacis decactis  
Polyborus plancus  
see northern cardinal  
Parus carolinensis  
Thryothorus ludovicianus  
Crangonyx sp.  
Gryllidae  
Dermaptera  
Caecidotea sp.  
Acarina  
Araneidae  
Palaemonetes sp.  
Gastropoda  
Araneae  
Collembola  
Montastraea cavernosa

cedar waxwing  
chain pickerel  
channel catfish  
chickadee  
chicken turtle  
chimney swift  
chorus frog  
chub  
chubsucker  
club finger coral  
coachwhip  
common ground dove  
common nighthawk  
common yellowthroat  
coon oyster  
coot  
Cope's gray treefrog  
coral snake  
cotton mouse  
cotton rat  
cottontail rabbit  
cowfish  
cow-nosed ray  
crappie Pomoxis sp.  
crayfish snake  
creek chub  
crested flycatcher  
cricket frog  
crowned snake  
deer  
diamondback rattlesnake  
diamondback terrapin  
dollar sunfish  
downy woodpecker  
dwarf salamander  
earth snake  
eastern bluebird  
eastern diamondback rattlesnake  
eastern fence lizard  
eastern garter snake  
eastern glass lizard  
eastern harvestmouse  
eastern king snake  
eastern kingbird

Bombycilla cedrorum  
Esox niger  
Ictalurus punctatus  
see Carolina chickadee  
Deirochelys reticularia  
Chaetura pelagica  
Pseudacris sp.  
Cyprinidae  
Erimyzon sp.  
Porites porites  
Masticophis flagellum  
Columbina passerina  
Chordeiles minor  
Geothlypis trichas  
Ostrea frons  
see American coot  
Hyla chrysoscelis  
Micrurus fulvius  
Peromyscus gossypinus  
Sigmodon hispidus  
Sylvilagus floridanus  
Lactophrys sp.  
Rhinoptera bonasus  
  
Regina sp.  
Semotilus atromaculatus  
see great crested flycatcher  
see southern cricket frog  
Tantilla sp.  
see white-tailed deer  
see eastern diamondback rattlesnake  
Malaclemys terrapin  
Lepomis marginatus  
Picoides pubescens  
Eurycea quadridigitata  
Virginia sp.  
Sialia sialis  
Crotalus adamanteus  
Sceloporus undulatus  
Thamnophis sirtalis  
Ophisaurus ventralis  
Reithrodontomys humulis  
Lampropeltis getulus  
Tyrannus tyrannus

eastern meadowlark  
eastern mole  
eastern mud snake  
eastern phoebe  
eastern screech-owl  
eastern spadefoot  
eastern spotted skunk  
eastern woodrat  
eel  
elkhorn coral  
elliptical star coral  
encrusting fire coral  
Everglades pygmy sunfish  
fiddler crab  
filefish Balistidae  
fire coral  
five-lined skink  
flamingo tongue shell  
flat bullhead  
flatwoods salamander  
flier  
Florida cooter  
Florida Keys sailfin molly  
Florida Keys sheepshead minnow  
Florida gar  
Florida loggerhead sponge  
Florida mouse  
Florida scrub jay  
Florida softshell turtle  
Florida water rat  
Florida worm lizard  
flounder  
fox squirrel  
fungus coral  
gafftopsail catfish  
ghost crab  
giant brain coral  
gizzard shad  
glossy crayfish snake  
glossy ibis  
goby  
golden mouse  
golden shiner  
golden topminnow

Sturnella magna  
Scalopus aquaticus  
see mud snake  
Sayornis phoebe  
Otus asio  
Scaphiopus holbrookii holbrookii  
Spilogale putorius  
Neotoma floridana  
Anguilliformes  
Acropora palmata  
Dichocoenia sp.  
Milleporidae  
Elassoma evergladei  
Uca sp.

Millepora alicornis  
Eumeces fasciatus  
Cyphoma sp.  
Ictalurus platycephalus  
Ambystoma cingulatum  
Centrarchus macropterus  
Pseudemys floridana  
Poecilia cf. latipinna  
Cyprinodon cf. variegatus  
Lepisosteus platyrhynchus  
Sphaciospongia vesparia  
Podomys floridanus  
Aphelocoma coerulescens  
Apalone sp.  
Neofiber alleni  
Rhineura floridana  
Pleuronectiformes  
Sciurus niger  
Mycetophyllia sp.  
Bagre marinus  
Ocypode quadrata  
Colpophyllia natans  
Dorosoma cepedianum  
Regina rigida  
Plegadis falcinellus  
Gobiidae  
Peromyscus nuttali  
Notemigonus crysoleucas  
Fundulus chrysotus

coer

gopher frog  
gopher tortoise  
grasshopper sparrow  
gray fox  
gray rat snake  
gray squirrel  
gray treefrog  
great blue heron  
great-crested flycatcher  
great egret  
great horned owl  
greater siren  
green anole  
green-backed heron  
green crab  
green tree frog  
green water snake  
grooved brain coral  
ground dove  
ground skink  
grouper  
grunt  
gulf hammock rat snake  
hairy woodpecker  
hammerhead shark  
harvest mouse  
harvestman  
hermit crab  
hermit thrush  
hognose snake  
hooded warbler  
indigo snake  
ironcolor shiner  
ivory tree coral  
jack  
kestrel  
key deer  
killdeer  
killifish  
king rail  
kingfisher  
knobby brain coral  
ladyfish  
lake chubsucker

Rana areolata  
Gopherus polyphemus  
Ammodramus savannarum  
Urocyon cinereoargenteus  
Elaphe obsoleta spiloides  
Sciurus carolinensis  
Hyla chrysoscelis  
Ardea herodias  
Myiarchus crinitus  
Casmerodius albus  
Bubo virginianus  
Siren lacertina  
Anolis carolinensis  
Butorides striatus  
Decapoda sp.  
Hyla cinerea  
Nerodia cyclopion  
Diploria labyrinthiformes  
see common ground dove  
Scincella lateralis  
Serranidae  
Hermulidae  
Elaphe obsoleta williamsi  
Picoides villosus  
Sphyrna sp.  
see eastern harvest mouse  
Phalangida  
Paguroidea  
Catharus guttatus  
Heterodon sp.  
Wilsonia citrina  
Drymarchon corais  
Notropis chalybaeus  
Oculina valenciennesi  
Carangidae  
Falco sparverius  
Odocoileus virginianus clavium  
Charadrius vociferus  
Cyprinodontidae  
Rallus elegans  
see belted kingfisher  
Diploria clivosa  
Elops saurus  
Erimyzon sucetta

largemouth bass  
leaf coral  
least bittern  
least killifish  
least shrew  
lemon shark  
leopard frog  
lesser siren  
lightning whelk  
limpkin  
lined topminnow  
little blue heron  
little grass frog  
lizardfish  
lobed star coral  
loggerhead musk turtle  
loggerhead shrike  
long-billed marsh wren  
longnose gar  
lookdown  
Louisiana heron  
Louisiana waterthrush  
manatee  
mangrove crab  
  
mangrove fox squirrel  
mangrove water snake  
map turtle  
marbled salamander  
marsh crab  
marsh hawk  
marsh rabbit  
marsh snail  
meadowlark  
menhaden  
mink  
Mississippi kite  
mole salamander  
mole skink  
mosquito fish  
mountainous star coral  
mourning dove  
mud crab  
mud salamander

Micropterus salmoides  
Agaricia agaricites  
Ixobrychus exilis  
Heterandria formosa  
Cryptotis parva  
Negaprion brevirostris  
see southern leopard frog  
Siren intermedia  
Busycon contrarium  
Aramus guarauna  
Fundulus lineolatus  
Egretta caerulea  
Limnaeodes ocularis  
Synodontidae  
Solenastrea hyades  
Sternotherus minor  
Lanius ludovicianus  
Cistothorus palustris  
Lepisosteus osseus  
Selene vomer  
see tricolored heron  
Seirus motacilla  
Trichechus manatus  
Goniopsis cruentata, Aratus pisonii,  
Sesarma curacaoense  
Sciurus niger avicennia  
Nerodia clarkii compressicauda  
Graptemys sp.  
Ambystoma opacum  
Decapoda  
see northern harrier  
Sylvilagus palustris  
Littorinidae, Ellobiidae  
see eastern meadowlark  
Brevoortia sp.  
Mustela vison  
Ictinia mississippiensis  
Ambystoma talpoideum  
Eumeces egregius  
Gambusia affinis  
Monastraea annularis  
Zenaida macroura  
Zanthidae  
Pseudotriton montanus

mud shrimp  
mud snail  
mud snake  
mud sunfish  
mud turtle  
mud worms  
mullet  
muskrat  
needlefish  
newt  
night hawk  
northern bobwhite  
northern cardinal  
northern dusky salamander  
northern harrier  
northern parula  
northern rough-winged swallow  
nurse shark  
nuthatch  
oak toad  
Ohooppee shiner  
Okaloosa darter  
Okefenokee pygmy sunfish  
opossum  
orchard oriole  
osprey  
otter  
ovenbird  
oyster drill  
oyster leech  
palm warbler  
parula warbler  
pea crab  
peninsular cooter  
periwinkle  
permit  
pig frog  
pileated woodpecker  
pillar coral  
pine snake  
pine warbler  
pinewoods treefrog  
pinfish Lagodon rhomboides  
pink shrimp

Thalassinoidea  
Nassariidae  
Farancia abacura  
Acantharchus pomotis  
Kinosternon sp.  
Polychaeta  
see striped mullet  
Ondatra zibethicus  
Belonidae  
Notophthalmus sp.  
see common nighthawk  
Colinus virginianus  
Cardinalis cardinalis  
Desmognathus fuscus  
Circus cyaneus  
Parula americana  
Stelgidopteryx serripennis  
Ginglymostoma cirratum  
Sitta sp.  
Bufo guercicus  
Notropis leedsii  
Etheostoma okaloosae  
Elassoma okefenokee  
Didelphis virginiana  
Icterus spurius  
Pandion haliaetus  
see river otter  
Seiurus aurocapillus  
Urosalpinx sp.  
Hirudinea  
Dendroica palmarum  
see northern parula  
Pinnotheridae sp.  
Pseudemys floridana peninsularis  
Littorinidae  
Trachinotus falcatus  
Rana gylio  
Dryocopus pileatus  
Dendrogyra cylindrus  
Pituophis melanoleucas  
Dendroica pinus  
Hyla femoraus  
  
Penaeus duorarum

pirate perch  
pocket gopher  
polychaete  
polychaete worm  
pompano  
porgy  
porous coral  
prothonotary warbler  
puffers Tetraodontidae  
purple shrimp  
pygmy killifish  
pygmy rattlesnake  
quillback  
raccoon  
rainbow snake  
rat snake  
ray  
red drum  
red ratsnake  
red salamander  
red widow spider  
red-bellied snake  
red-bellied watersnake  
red-bellied woodpecker  
redbreast sunfish  
redeer sunfish  
redeye chub  
red-eyed vireo  
redfin pickerel  
redfish Sebastes sp.  
red-shouldered hawk  
red-tailed hawk  
red-winged blackbird  
rice rat Oryzomys palustris  
ringneck  
ring-necked duck  
ring-necked snake  
river frog  
river otter  
river cooter  
robin  
rose coral  
rough green snake  
rough starlet

Aphredoderus sayanus  
Geomys pinetis  
Polychaeta  
see polychaete  
Trachinotus sp.  
Sparidae  
Porites astreoides  
Protonotaria citrea  
  
Tozeuma sp.  
Leptolucania ommata  
Sistrurus miliarius  
Carpionodes cyprinus  
Procyon lotor  
Farancia erythrogramma  
Elaphe sp.  
Rajiformes  
Sciaenops ocellata  
Elaphe guttata  
Pseudotriton ruber  
Latrodectus bishopi  
Storeria occipitomaculata  
Nerodia erythrogaster  
Melanerpes carolinus  
Lepomis auritus  
Lepomis microlophus  
Notropis harperi  
Vireo olivaceus  
Esox americanus americanus  
  
Buteo lineatus  
Buteo jamaicensis  
Agelaius phoeniceus  
  
see ring-necked duck  
Aythya collaris  
Diadophis punctatus  
Rana heckscheri  
Lutra canadensis  
Pseudemys concinna  
see American robin  
Mancina areolata  
Opheodrys aestivus  
Siderastrea radians

rough-winged swallow  
ruby-throated hummingbird  
rufous-sided towhee  
rusty blackbird  
rusty mud salamander  
sailfin molly  
sailfin shiner  
saltmarsh snake  
sand dollar  
sand skink  
sandhill crane  
sardine Clupeidae  
scallop Pectinidae  
scarlet kingsnake  
screech owl  
scrub jay  
scrub lizard  
scrub wolf spider  
sea anemone  
  sea fan  
sea feather  
sea fingers  
sea pansy  
sea plume  
sea rod Plexaura sp.  
sea urchin  
sea whip  
seahorses  
seaside sparrow  
seatrout  
sheepshead  
sheepswood sponge  
sheet coral  
shore crab  
short-tailed shrew  
short-tailed snake  
six-lined racerunner  
slimy salamander  
smooth brain coral  
smooth star coral  
smooth starlet coral  
snapper  
snapping turtle  
snowy egret

see northern rough-winged swallow  
Archilochus colubris  
Pipilo erythrophthalmus  
Euphagus carolinus  
Pseudotriton montanus floridanus  
Poecilia latipinna  
Notropis hypselopterus  
Nerodia clarkii ssp.  
Scutellidae  
Neoseps reynoldsi  
Grus canadensis

Lampropeltis triangulum elapsoides  
see eastern screech-owl  
see Florida scrub jay  
see Florida scrub lizard  
Lycosidae  
Actiniaria  
Gorgonia sp.  
Pseudopterogorgia sp.  
Briareum asbetinum  
Renilla sp.  
Pseudopterogorgia sp.

Echinoidea  
Leptogorgia sp.  
Hippocampus sp.  
Ammodramus maritimus  
Cynoscion sp.  
Archosargus probatocephalus  
Hippiospongia lachne  
Agaricia lamarcki, A. grahamae  
Decapoda sp.  
Blarina carolinensis  
Stilosoma extenuatum  
Cnemidophorus sexlineatus  
Plethodon glutinosus  
Diploria strigosa  
Solenastrea bournoni  
Siderastrea siderea  
Lutjanidae  
Shelydra serpentina  
Egretta thula

sora  
southeastern five-lined skink  
southeastern shrew  
southern chorus frog  
southern copperhead  
southern cricket frog  
southern dusky salamander  
southern flying squirrel  
southern hognose snake  
southern leopard frog  
southern mink  
southern red salamander  
southern stingray  
southern toad  
spadefoot toad  
speckled madtom  
spiny lobster  
spiny softshell  
spot  
spotted bass  
spotted seatrout  
spotted skunk  
spring peeper  
squirrel tree frog  
staghorn coral

starfish Asteroidea  
starhead topminnow  
starlet coral  
stinkpot  
stone crab  
stony coral  
striped mud turtle  
striped mullet  
striped newt  
striped skunk  
striped swamp snake  
stumpknocker  
summer tanager  
Suwannee cooter  
Swainson's warbler  
swallowtail kite  
swamp darter  
tadpole madtom

Porzana carolina  
Eumeces inexpectatus  
Sorex longirostris  
Pseudacris ornata  
Agkistrodon contortrix contortrix  
Acris gryllus  
Desmognathus auriculatus  
Glaucomys volans  
Heterodon simus  
Rana utricularia  
Mustela vison mink  
Pseudotriton ruber vioscai  
Dasyatis americana  
Bufo terrestris  
see eastern spadefoot  
Noturus leptacanthus  
Panulirus argus  
Apalone spiniferus  
Leiostomus xanthurus  
Micropterus punctulatus  
Cynoscion nebulosus  
see eastern spotted skunk  
Pseudacris crucifer  
Hyla squirella  
Acropora prolifera, Acropora  
cervicornis  
  
Fundulus notti  
Siderastrea siderea, S. radians  
Sternotherus odoratus  
Menippe mercenaria  
Scleractinia  
Kinosternon baurii  
Mugil cephalus  
Notophthalmus perstriatus  
Mephitis mephitis  
Regina alleni  
Lepomis punctatus  
Piranga rubra  
Pseudemys concinna suwanniensis  
Limnothlypis swainsonii  
Elanoides forficatus  
Etheostoma fusiforme  
Noturus gyrinus

taillight shiner  
tarpon  
tiger salamander  
threadfin shad  
three-lined salamander  
towhee see rufous-sided towhee  
tree snail  
tricolor heron  
trigger fish  
tube worm  
tufted titmouse  
turkey  
turkey vulture  
two-lined salamander  
two-toed amphiuma  
veery  
Virginia rail  
warmouth  
weed shiner  
white ibis  
white-crowned pigeon  
white-eyed vireo  
white-tailed deer  
white-throated sparrow  
wild turkey  
woodcock  
wood duck  
wood rat  
wood stork  
worm lizard  
yellow bullhead  
yellow rat snake  
yellow-spotted ray  
yellow-bellied turtle  
yellow-bellied sapsucker  
yellow-belly slider  
yellow-billed cuckoo  
yellow-crowned night heron  
yellow-rumped warbler  
yellowthroat  
yellow-throated warbler

Notropis maculatus  
Megalops atlanticus  
Ambystoma tigrinum  
Dorosoma petenense  
Eurycea longicauda guttolineata

Gastropoda  
Egretta tricolor  
Balistidae  
Polychaeta  
Parus bicolor  
see wild turkey  
Cathartes aura  
Eurycea cirrigera  
Amphiuma means  
Catharus fuscescens  
Rallus limicola  
Lepomis gulosus  
Notropis texanus  
Eudocimus albus  
Columba leucocephala  
Vireo griseus  
Odocoileus virginianus  
Zonotrichia albicollis  
Meleagris gallopavo  
see American woodcock  
Aix sponsa  
Neotoma floridana  
Mycteria americana  
see Florida worm lizard  
Ictalurus natalis  
Elaphe obsoleta quadrivittata  
Rajiformes  
Trachemys scripta scripta  
Sphyrapticus varius  
see yellow-bellied turtle  
Coccyzus americanus  
Nyctanassa violacea  
Dedroica coronata  
see common yellowthroat  
Dendroica dominica

### APPENDIX 3

The Florida Natural Areas Inventory hierarchical classification of Terrestrial and Palustrine Natural Communities, including brief descriptions of and comparison with other Florida vegetation classification systems. Listed under each Florida Natural Areas Inventory natural community type are types in other vegetation classification systems into which the Florida Natural Areas Inventory type would fit.

The levels of the hierarchy are:

NATURAL COMMUNITY CATEGORIES - defined by hydrology and vegetation

NATURAL COMMUNITY GROUPS - defined by landform, substrate, and vegetation

Natural Community Type - defined by landform and substrate; soil moisture condition; climate; fire; and characteristic vegetation.

The vegetation classifications used in the comparison are:

Kuchler =A.W. Kuchler. 1964. Potential Natural Vegetation of the Conterminous United States. American Geographical Society Special Publication No. 36. (Map and accompanying manual)

Davis =J.H. Davis. 1967. General Map of Natural Vegetation of Florida. Institute of Food and Agricultural Sciences, University of Florida.

SCS =Soil Conservation Service. No date. 26 Ecological Communities of Florida. (Map and accompanying manual)

Myers =R.L. Myers. 1988. Florida's Physical Setting and Florida's Vegetation. Unpublished manuscript.

SAF =F.H. Eyre, Editor. 1980. Forest Cover Types of the United States and Canada. Society of American Foresters, Washington, D.C.

FLCFC =Florida Department of Transportation. 1985. Florida Land Use, Cover and Forms Classification System. (Used only the most specific level and class described in the document.)

TERRESTRIAL - Upland habitats dominated by plants which are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10% of the growing season.

XERIC UPLANDS - very dry, deep, well-drained hills of sand with xeric-adapted vegetation.

Sandhill - upland with deep sand substrate; xeric; temperate; frequent fire (2-5 years); longleaf pine and/or turkey oak with wiregrass understory.

Kuchler 112/Southern Mixed Forest  
Davis 6/Forests of Longleaf Pine and Xerophytic Oaks  
SCS 4/Longleaf Pine-Turkey Oak Hills  
Myers High pinelands - sandhill and southern ridge sandhill  
SAF 70/Longleaf Pine  
71/Longleaf Pine - Scrub Oak  
72/Southern Scrub Oaks  
FLCFC 412/Longleaf Pine - Xeric Oak  
421/Xeric Oak

other synonyms - High Pine

Scrub - old dune with deep fine sand substrate; xeric; temperate or subtropical; occasional or rare fire (20 - 80 years); sand pine and/or scrub oaks and/or rosemary and cladonia.

Kuchler 115/Sand Pine Scrub  
Davis 5/Sand Pine Scrub  
SCS 3/Sand Pine Scrub  
Myers Scrub - sand pine, oak, and rosemary scrub; slash pine scrub  
SAF 69/Sand Pine  
FLCFC 413/Sand Pine

other synonyms - Florida scrub, sand scrub

Xeric Hammock - upland with deep sand substrate; xeric-mesic; temperate or subtropical; rare or no fire; live oak and/or sand live oak and/or laurel oak and/or other oaks, sparkleberry, saw palmetto.

Kuchler 112/Southern Mixed Forest  
Davis 12/Hardwood Forests  
SCS 3/Sand Pine Scrub  
15/Oak Hammocks  
Myers Temperate Hammocks - xeric hammock  
SAF 72/Southern Scrub Oak  
89/Live Oak  
FLCFC 421/Xeric Oak  
423/Oak - Pine - Hickory

425/Temperate Hardwood  
427/Live Oak  
432/Sand Live Oak

other synonyms - dry woods, pine-oak-hickory woods

COASTAL UPLANDS - substrate and vegetation influenced primarily by such coastal (maritime) processes as erosion, deposition, salt spray, and storms.

Beach Dune - active coastal dune with sand substrate; xeric; temperate or subtropical; occasional or rare fire; marine influence; sea oats and/or mixed salt-spray tolerant grasses and herbs.

Kuchler 90/Live oak - Sea oats  
Davis 1/Coastal Strand  
SCS 1/North Florida Coastal Strand  
2/South Florida Coastal Strand  
Myers Coastal Strand  
SAF N/A  
FLCFC 322/Coastal Scrub  
710/Beaches

other synonyms - upper beach, sea oats zone, pioneer zone

Coastal Berm - old bar or storm debris with sand/shell substrate; xeric-mesic; subtropical or temperate; rare or no fire; marine influence; buttonwood, mangroves, and/or mixed halophytic herbs and/or shrubs and trees.

Kuchler 105/Mangrove  
Davis 1/Coastal Strand  
9/Mangrove Swamp Forests and Coastal Marshes  
SCS 2/South Florida Coastal Strand  
19/Mangrove Swamp  
Myers Coastal Strand  
SAF 105/Tropical Hardwoods  
106/Mangrove  
FLCFC 322/Coastal Scrub  
426/Tropical Hardwoods  
612/Mangrove Swamps

other synonyms - shell ridge, coastal levee, coastal forest,  
buttonwood embankment, mangrove hammock, coastal

hammock

Coastal Grassland - coastal flatland with sand substrate; mesic-hydric; subtropical or temperate; occasional fire; marine influence; salt-tolerant grasses, herbs, and shrubs with or without slash pine and/or cabbage palm or buttonwood.

Kuchler 90/Live oak - Sea oats  
Davis 1/Coastal Strand  
SCS 1/North Florida Coastal Strand  
2/South Florida Coastal Strand  
Myers Coastal Strand  
SAF 74/Cabbage Palmetto  
84/Slash Pine  
  
FLCFC 310/Herbaceous  
322/Coastal Scrub  
419/Other Pines  
428/Cabbage Palm

other synonyms - overwash plain, deflation plain, salt flat, swale

Coastal Rock Barren - flatland with exposed limestone; xeric; subtropical; no fire; marine influence; algae, mixed halophytic herbs and grasses, and/or cacti and stunted shrubs and trees.

Kuchler 105/Mangrove  
Davis 1/Coastal Strand  
SCS 2/South Florida Coastal Strand  
Myers Coastal Strand  
SAF 105/Tropical Hardwoods  
106/Mangrove  
FLCFC 322/Coastal Scrub

other synonyms - littoral rock pavement, algal barren, cactus barren, rocky flat

Coastal Strand - stabilized coastal dune with sand substrate; xeric; subtropical or temperate; occasional or rare fire; marine influence; dense saw palmetto and/or seagrape and/or mixed stunted shrubs, yucca, and cacti.

Kuchler 90/Live oak - Sea oats  
Davis 1/Coastal Strand  
SCS 1/North Florida Coastal Strand  
2/South Florida Coastal Strand

Myers Coastal Strand  
 SAF N/A  
 FLCFC 322/Coastal Scrub  
 426/Tropical Hardwoods

other synonyms - shrub zone, maritime thicket, coastal scrub

Maritime Hammock - stabilized coastal dune with sand substrate; xeric-mesic; subtropical or temperate; rare or no fire; marine influence; mixed hardwoods and/or live oak.

Kuchler 90/Live oak - Sea Oats  
 Davis 1/Coastal Strand  
 SCS 1/North Florida Coastal Strand  
 2/South Florida Coastal Strand  
 Myers Coastal Strand  
  
 SAF 73/Southern Redcedar  
 74/Cabbage Palmetto  
 89/Live Oak  
 105/Tropical Hardwoods  
 FLCFC 322/Coastal Scrub  
 425/Temperate Hardwood  
 426/Tropical Hardwoods  
 427/Live Oak  
 432/Sand Live Oak

other synonyms - coastal hammock, maritime forest, tropical hammock

Shell Mound - Indian midden with shell substrate; xeric-mesic; subtropical or temperate; rare or no fire; marine influence; mixed hardwoods.

Kuchler 90/Live oak - Sea oats  
 105/Mangrove  
 112/Southern Mixed Forest  
 Davis 1/Coastal Strand  
 9/Mangrove Swamp Forests and Coastal Marshes  
 SCS 1/North Florida Coastal Strand  
 2/South Florida Coastal Strand  
 14/Tropical Hammocks  
 19/Mangrove Swamp  
 11/Upland Hardwood Hammocks  
 Myers Coastal Strand

SAF	73/Southern Redcedar 89/Live Oak 105/Tropical Hardwoods
FLCFC	425/Temperate Hardwood 426/Tropical Hardwoods 427/Live Oak

other synonyms - Indian mound or midden, shell midden

MESIC UPLANDS - dry to moist hills of sand with varying amounts of clay, silt or organic material; diverse mixture of broad leaved and needle leaved temperate woody species.

Slope Forest - steep slope on bluff or in sheltered ravine; sand/clay substrate; mesic-hydric; temperate; rare or no fire; magnolia, beech, spruce pine, Shumard oak, Florida maple, mixed hardwoods.

Kuchler	112/Southern Mixed Forest included in 113/Southern Floodplain Forest
Davis	4/Mixed Hardwoods and Pines 12/Hardwood Forests
SCS	5/Mixed Hardwood and Pine 11/Upland Hardwood Hammocks
Myers	Temperate Hammocks - mesic hammocks
SAF	82/Loblolly Pine - Hardwood
FLCFC	431/Beech - Magnolia 434/Hardwood - Conifer Mixed 438/Mixed Hardwoods 439/Other Hardwoods

other synonyms - ravine forest, steephead, beech-magnolia

Upland Glade - upland with calcareous rock and/or clay substrate; hydric-xeric; temperate; sparse mixed grasses and herbs with occasional stunted trees and shrubs, e.g. eastern red cedar.

Kuchler	112/Southern Mixed Forest
Davis	4/Mixed Hardwoods and Pines
SCS	5/Mixed Hardwood and Pine
Myers	Temperate Hammocks - mesic hammocks
SAF	73/Southern Redcedar 82/Loblolly Pine - Hardwood
FLCFC	310/Herbaceous

other synonyms - chalky limestone glade, chalk glade, chalk

barren

Upland Hardwood Forest - upland with sand/clay and/or calcareous substrate; mesic; temperate; rare or no fire; spruce pine, magnolia, beech, pignut hickory, white oak, and mixed hardwoods.

Kuchler 112/Southern Mixed Forest  
Davis 4/Mixed Hardwoods and Pines  
12/Hardwood Forests  
SCS 11/Upland Hardwood Hammocks  
15/Oak Hammocks  
Myers Temperate hammocks - mesic hammocks, xeric hammocks

SAF 76/Shortleaf Pine - Oak  
FLCFC 431/Beech - Magnolia  
434/Hardwood - Conifer Mixed  
438/Mixed Hardwoods

other synonyms - climax hardwoods, southern mixed forest

Upland Mixed Forest - upland with sand/clay substrate; mesic; temperate; rare or no fire; loblolly pine and/or shortleaf pine and/or laurel oak and/or magnolia and spruce pine and/or mixed hardwoods.

Kuchler 112/Southern Mixed Forest  
Davis 4/Mixed Hardwoods and Pines  
12/Hardwood Forests  
SCS 5/Mixed Hardwood and Pine  
11/Upland Hardwood Hammocks  
Myers Temperate Hammocks - mesic hammocks  
SAF 73/Southern Redcedar  
75/Shortleaf Pine  
76/Shortleaf Pine - Oak  
82/Loblolly Pine - Hardwood  
FLCFC 414/Pine - Mesic Oak  
423/Oak - Pine - Hickory  
425/Temperate Hardwood  
434/Hardwood - Conifer Mixed  
438/Mixed Hardwoods

other synonyms - southern deciduous forest, southern mixed forest

Upland Pine Forest - upland with sand/clay substrate; mesic-xeric; temperate; frequent or occasional fire; longleaf pine and/or loblolly pine and/or shortleaf pine, southern red oak, wiregrass.

Kuchler	112/Southern Mixed Forest
Davis	4/Mixed Hardwoods and Pines
SCS	5/Mixed Hardwood and Pine
Myers	High Pinelands - longleaf pine ridglands (clayhill)
SAF	70/Longleaf Pine
	75/Shortleaf Pine
	76/Shortleaf Pine - Oak
	80/Loblolly Pine - Shortleaf Pine
	81/Loblolly Pine
	82/Loblolly Pine - Hardwood
FLCFC	414/Pine - Mesic Oak
	423/Oak - Pine - Hickory

other synonyms - longleaf pine - wiregrass, longleaf pine upland forest, loblolly - shortleaf pine upland forest

ROCKLANDS - low, generally flat limestone outcrops with tropical vegetation; or limestone exposed through karst activities with tropical or temperate vegetation.

Pine Rockland - flatland with exposed limestone substrate; mesic-xeric; subtropical; frequent fire; south Florida slash pine, palms and/or hardwoods, and mixed grasses and herbs.

Kuchler	105/Mangrove
	116/Subtropical Pine Forest
Davis	3/Southern Slash Pine Forests
	1/Coastal Strand
SCS	2/South Florida Coastal Strand
	9/Everglades Flatwoods
Myers	Subtropical Forests - subtropical pinelands
SAF	111/South Florida Slash Pine
	74/Cabbage palmetto
FLCFC	411/Pine Flatwoods
	419/Other Pines

other synonyms - Miami rockridge pinelands, Dade County pinelands

Rockland Hammock - flatland with limestone substrate; mesic; subtropical; rare or no fire; mixed tropical hardwoods, often with live oak.

Kuchler	105/Mangrove 116/Subtropical Pine Forest
Davis	1/Coastal Strand 3/Southern Slash Pine Forests 14/Region of open Scrub Cypress 16b/Everglades Region Marshes, Sloughs, Wet Prairies, and Tree Islands
SCS	1/South Florida Coastal Strand 14/Tropical Hammocks
Myers	Subtropical Forests - high or rockland hammocks
SAF	105/Tropical Hardwoods 89/Live Oak
FLCFC	426/Tropical Hardwoods 427/Live Oak

Sinkhole - karst feature with steep limestone walls; mesic-hydric; subtropical or temperate; no fire; ferns, herbs, shrubs, and hardwoods.

Kuchler	112/Southern Mixed Forest 116/Subtropical Pine Forest
Davis	(4/Forests of Mixed Hardwoods and Pines) (12/Hardwood Forests)
SCS	(11/Upland Hardwood Hammocks) (15/Oak Hammock)
Myers	Temperate Hammocks - mesic hammocks and xeric hammocks Subtropical forests - Subtropical hammocks
SAF	89/Live Oak
FLCFC	427/Live Oak 423/Oak - Pine - Hickory

other synonyms - sink, limesink, banana hole

MESIC FLATLANDS - flat, moderately well-drained sandy substrates with admixture of organic material, often with a hard pan.

Dry Prairie - flatland with sand substrate; mesic-xeric; subtropical or temperate; annual or frequent fire; wiregrass, saw palmetto, and mixed grasses and herbs.

Kuchler 79/Palmetto Prairie  
 Davis 13/Grasslands of Prairie Type  
 SCS 6/South Florida Flatwoods  
 7/North Florida Flatwoods ?  
 Myers Flatwoods - mesic flatwoods, dry prairies  
 SAF N/A  
 FLCFC 321/Palmetto Prairies  
 310/Herbaceous

other synonyms - pineland threeawn range

Mesic Flatwoods - flatland with sand substrate; mesic; subtropical or temperate; frequent fire; slash pine and/or longleaf pine with saw palmetto, gallberry and/or wiregrass or cutthroat grass understory.

Kuchler 112/Southern Mixed Forest  
 Davis 2/Pine Flatwoods  
 SCS 6/South Florida Flatwoods  
 7/North Florida Flatwoods  
 8/Cabbage Palm Flatwoods  
 Myers Flatwoods - mesic flatwoods  
 SAF 70/Longleaf Pine  
 74/Cabbage Palmetto  
 83/Longleaf Pine - Slash Pine  
 84/Slash Pine  
 111/South Florida Slash Pine  
 FLCFC 411/Pine Flatwoods  
 414/Pine - Mesic Oak  
 428/Cabbage Palm

other synonyms - pine/palmetto, intermediate pine barren,  
meso-hydrophytic forest, pine savanna

Prairie Hammock - flatland with sand/organic soil over marl or limestone substrate; mesic; subtropical; occasional or rare fire; live oak and/or cabbage palm.

Kuchler 112/Southern Mixed Forest  
 Davis 15/Forests of abundant Cabbage Palms  
 SCS 13/Cabbage Palm Hammocks  
 Myers Temperate Hammocks - live oak/cabbage palm hammocks  
 SAF 74/Cabbage Palmetto  
 89/Live oak  
 FLCFC 428/Cabbage Palm  
 425/Temperate Hardwood

427/Live Oak

other synonyms - palm/oak hammock, hydric hammock, pod of  
cabbage palms

Scrubby Flatwoods - flatland with sand substrate; xeric-mesic; subtropical or temperate;  
occasional fire; longleaf pine or slash pine with scrub oaks and wiregrass understory.

Kuchler	112/Southern Mixed Forest
Davis	2/Pine Flatwoods
SCS	6/South Florida Flatwoods 7/North Florida Flatwoods
Myers	Flatwoods - scrubby, xeric, or dry flatwoods
SAF	71/Longleaf Pine - Scrub Oak 72/Southern Scrub Oak 84/Slash Pine 111/South Florida Slash Pine
FLCFC	411/Pine Flatwoods 419/Other Pines

other synonyms - xeric flatwoods

PALUSTRINE - Wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10% or more of the growing season. Includes nontidal wetlands; tidal wetlands with ocean derived salinities less than 0.5 ppt and dominance by salt-intolerant species; small (less than 8 ha), shallow (less than 2 m deep at low water) water bodies without wave-formed or bedrock shoreline; and inland brackish or saline wetlands.

WET FLATLANDS - flat, poorly drained sand, marl or limestone substrates.

Hydric Hammock - lowland with sand/clay/organic soil, often over limestone; mesic-hydric; subtropical or temperate; rare or no fire; water oak, cabbage palm, red cedar, red maple, bays, hackberry, hornbeam, blackgum, needle palm, and mixed hardwoods.

Kuchler	113/Southern Floodplain Forest
Davis	8/Swamp Forests 12/Hardwood Forests
SCS	12/Wetland Hardwood Hammocks
Myers	Temperate Hammocks - hydric hammocks
SAF	73/Southern Red Cedar 74/Cabbage Palmetto

FLCFC 617/Mixed Wetland Hardwoods

other synonyms - Gulf Hammock

Marl Prairie - flatland with marl over limestone substrate; seasonally inundated; tropical; frequent to no fire; sawgrass, spikerush, and/or mixed grasses, sometimes with dwarf cypress.

Kuchler 91/Cypress Savanna  
Davis 14/Region of open Scrub Cypress  
17/Wet to Dry Prairie-Marshes on Marl and Rockland  
SCS 16/Scrub Cypress  
24/Sawgrass Marsh  
Myers Freshwater Marshes - marl prairie  
SAF 100/Pondcypress  
FLCFC 621/Cypress  
641/Freshwater Marshes

other synonyms - marl flat, sedge flat, spikerush marsh, cypress  
savanna, coastal prairie, coastal marsh, dwarf  
cypress

Wet Flatwoods - flatland with sand substrate; seasonally inundated; subtropical or temperate; frequent fire; vegetation characterized by slash or pond pine and/or cabbage palm with mixed grasses and herbs.

Kuchler 112/Southern Mixed Forest  
Davis 2/Pine Flatwoods  
SCS 6/South Florida Flatwoods  
7/North Florida Flatwoods  
8/Cabbage Palm Flatwoods  
Myers Flatwoods - wet flatwoods and seepage savannas  
SAF 74/Cabbage Palmetto  
84/Slash Pine  
85/Slash Pine - Hardwood  
98/Pond Pine  
FLCFC 411/Pine Flatwoods  
419/Other Pines  
428/Cabbage Palm  
622/Pond Pine  
624/Cypress - Pine - Cabbage Palm  
630/Wetland Forested Mixed

other synonyms - hydric flatwoods, pine savanna, cabbage palm savanna, moist pine barrens

Wet Prairie - flatland with sand substrate; seasonally inundated; subtropical or temperate; annual or frequent fire; maidencane, beakrush, spikerush, wiregrass, pitcher plants, St. John's wort, mixed herbs.

Kuchler	112/Southern Mixed Forest
Davis	13/Grasslands of Prairie Type
	2/Pine Flatwoods
SCS	6/South Florida Flatwoods
	7/North Florida Flatwoods
	23/Pitcher plant bog
	26/Slough
Myers	Freshwater Marshes - wet prairies
SAF	N/A
FLCFC	310/Herbaceous
	641/Wet Prairies

other synonyms - sand marsh, savanna, pitcher plant prairie

SEEPAGE WETLANDS - sloped or flat sands or peat with high moisture levels maintained by downslope seepage.

Baygall - wetland with peat substrate at base of slope; maintained by downslope seepage, usually saturated and occasionally inundated; subtropical or temperate; rare or no fire; bays and/or dahoon holly and/or red maple and/or mixed hardwoods.

Kuchler	112/Southern Mixed Forest
Davis	2/Pine Flatwoods
	8/Swamp Forests, mostly of Hardwoods
SCS	12/Wetland Hardwood Hammocks
	22/Shrub Bog
Myers	Freshwater Swamp Forests - titi swamps, bayheads
SAF	85/Slash Pine - Hardwood
	104/Sweetbay-Swamp Tupelo-Redbay
FLCFC	611/Bay Swamps
	614/Titi Swamps

other synonyms - seepage swamp, bayhead, bay swamp, sandhill bog

Seepage Slope - wetland on or at base of slope with organic/sand substrate; maintained by downslope seepage, usually saturated but rarely inundated; subtropical or temperate; frequent or occasional fire; sphagnum moss, mixed grasses and herbs or mixed hydrophytic shrubs.

Kuchler	112/Southern Mixed Forest
Davis	2/Pine Flatwoods
SCS	10/Cutthroat Seeps 23/Pitcher Plant Bog
Myers	Flatwoods - wet flatwoods and seepage savannas Freshwater swamp forests - Shrub bogs
SAF	70/Longleaf Pine 84/Slash Pine 85/Slash Pine - Hardwood 97/Atlantic White Cedar 98/Pond Pine
FLCFC	310/Herbaceous

other synonyms - herb bog, pitcher plant bog, grass-sedge bog, shrub bog, seep, cutthroat seep

FLOODPLAIN WETLANDS - flat, alluvial sand or peat substrates associated with riverine Natural Communities and subjected to flooding but not permanent inundation.

Bottomland Forest - flatland with sand/clay/organic substrate; occasionally inundated; temperate; rare or no fire; water oak, red maple, beech, magnolia, tulip tree, sweetgum, bays, cabbage palm, and mixed hardwoods.

Kuchler	113/Southern Floodplain Forest
Davis	8/Swamp Forests, mostly of Hardwoods
SCS	21/Swamp Hardwoods 20/Bottomland Hardwoods
Myers	Freshwater Swamp Forests - floodplain forests
SAF	61/River Birch - Sycamore 74/Cabbage Palmetto 82/Loblolly Pine - Hardwood 88/Willow Oak - Water Oak - Diamondleaf Oak 92/Sweetgum - Willow Oak 97/Atlantic White Cedar
FLCFC	615/Stream and Lake Swamps (Bottomland) 617/Mixed Wetland Hardwoods 623/Atlantic White Cedar 630/Wetland Forested Mixed

other synonyms - bottomland, river bottom, stream bottom, white cedar swamp

Floodplain Forest - floodplain with alluvial substrate of sand, silt, clay or organic soil; seasonally inundated; temperate; rare or no fire; diamondleaf oak, overcup oak, water oak, swamp chestnut oak, blue palmetto, cane, and mixed hardwoods.

Kuchler	113/Southern Floodplain Forest
Davis	8/Swamp Forests, mostly of Hardwoods
SCS	20/Bottomland Hardwoods 21/Swamp Hardwoods
Myers	Freshwater Swamp Forests - floodplain forests
SAF	61/River Birch - Sycamore 88/Willow Oak - Water Oak - Diamondleaf Oak 91/Swamp Chestnut Oak - Cherrybark Oak 92/Sweetgum - Willow Oak
FLCFC	615/Stream and Lake Swamps (Bottomland) 617/Mixed Wetland Hardwoods 630/Wetland Forested Mixed

other synonyms - bottomland hardwoods, seasonally flooded basins or flats, oak-gum-cypress, elm-ash-cottonwoods, NWTC Zones III - V, second bottom, levees, point bars, terraces

Floodplain Marsh - floodplain with organic/sand/alluvial substrate; seasonally inundated; subtropical; frequent or occasional fire; maidencane, pickerel- weed, sagittaria, buttonbush, and mixed emergents.

Kuchler	113/Southern Floodplain Forest
Davis	13/Grasslands of Prairie Type 16/Fresh Water Marshes
SCS	25/Freshwater Marsh and Ponds
Myers	Freshwater Marshes - riverine or floodplain marshes
SAF	N/A
FLCFC	641/Freshwater Marshes

other synonyms - river marsh, freshwater marsh

Floodplain Swamp - floodplain with organic/alluvial substrate; usually inundated; subtropical or

temperate; rare or no fire; vegetation characterized by cypress, tupelo, black gum, and/or pop ash.

Kuchler	113/Southern Floodplain Forest
Davis	7/Cypress Swamp Forests 8/Swamp Forests, mostly of Hardwoods
SCS	17/Cypress Swamp 21/Swamp Hardwoods
Myers	Freshwater Swamp Forests - floodplain forests
SAF	101/Baldcypress 102/Baldcypress - Tupelo 103/Water Tupelo - Swamp Tupelo
FLCFC	613/Gum Swamp 621/Cypress

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

Freshwater Tidal Swamp - rivermouth wetland; organic soil with extensive root mat; inundated with freshwater in response to tidal cycles; rare or no fire; cypress, bays, cabbage palm, gums and/or cedars.

Kuchler	113/Southern Floodplain Forest
Davis	7/Cypress Swamp Forests 8/Swamp Forests, mostly of Hardwoods
SCS	17/Cypress Swamp 21/Swamp Hardwoods
Myers	Freshwater Swamp Forests - floodplain forests
SAF	73/Southern Red Cedar 74/Cabbage Palmetto 101/Baldcypress 102/Baldcypress - Tupelo 104/Sweetbay - Swamp Tupelo - Redbay
FLCFC	613/Gum Swamp 615/Stream and Lake Swamps 621/Cypress 624/Cypress - Pine - Cabbage Palm

other synonyms - tidewater swamp, rivermouth swamp

Slough - broad, shallow channel with peat over mineral substrate; seasonally inundated; flowing water; subtropical; occasional or rare fire; pop ash and/or pond apple or water lily.

Kuchler 113/Southern Floodplain Forest  
Davis 7/Cypress Swamp Forests  
SCS 17/Cypress Swamp  
21/Swamp Hardwoods  
Myers Freshwater Swamp Forests - sloughs and strands  
SAF 101/Baldcypress  
FLCFC 621/Cypress

other synonyms - flag pond, gator hole

Strand Swamp - broad, shallow channel with peat over mineral substrate; seasonally inundated; flowing water; subtropical; occasional or rare fire; cypress and/or willow.

Kuchler 113/Southern Floodplain Forest  
Davis 7/Cypress Swamp Forests  
SCS 17/Cypress Swamp

Myers Freshwater Swamp forests - sloughs and strands  
SAF 101/Baldcypress  
FLCFC 621/Cypress

other synonyms - cypress strand, stringer

Swale - broad, shallow channel with sand/peat substrate; seasonally inundated; flowing water; subtropical or temperate; frequent or occasional fire; sawgrass, maidencane, pickerelweed, and/or mixed emergents.

Kuchler 92/Everglades  
Davis 16a/Everglades Saw Grass Marshes  
16b/Everglades Region Marshes, Sloughs, Wet Prairies, and  
Tree Islands  
SCS 24/Sawgrass Marsh  
Myers Freshwater Marshes - swale  
SAF N/A  
FLCFC 641/Freshwater Marshes

643/Wet Prairies ?

other synonyms - slough, river of grass, glades

BASIN WETLANDS - shallow, closed basin with outlet usually only in time of high water; peat or sand substrate, usually inundated; wetland woody and/or herbaceous vegetation.

Basin Marsh - large basin with peat substrate; seasonally inundated; temperate or subtropical; frequent fire; sawgrass and/or cattail and/or buttonbush and/or mixed emergents.

Kuchler	80/Marl Everglades 112/Southern Mixed Forest
Davis	13/Grasslands of Prairie Type 16/Fresh Water Marshes
SCS	25/Freshwater Marsh and Ponds
Myers	Freshwater Marshes - basin or depression marshes
SAF	N/A
FLCFC	641/Freshwater Marshes 643/Wet Prairies 644/Emergent Aquatic Vegetation

other synonyms - prairie

Basin Swamp - large basin with peat substrate; seasonally inundated; still water; subtropical or temperate; occasional or rare fire; vegetation characterized by cypress, blackgum, bays and/or mixed hardwoods.

Kuchler	113/Southern Floodplain Forest
Davis	7/Cypress Swamp Forests 8/Swamp Forests, mostly of Hardwoods
SCS	17/Cypress Swamp
Myers	Freshwater Swamp Forests - depression or basin wetlands
SAF	85/Slash Pine - Hardwood 100/Pondcypress 103/Water Tupelo - Swamp Tupelo
FLCFC	614/Gum Swamps 616/Inland Ponds and Sloughs 621/Cypress

other synonyms - gum swamp, bayheads

Bog - wetland on deep peat substrate; moisture maintained by capillary action, soil usually saturated, occasionally inundated; subtropical or temperate; rare fire; sphagnum moss and titi and/or bays and/or dahoon holly, and/or mixed hydrophytic shrubs.

Kuchler 112/Southern Mixed Forest  
Davis 8/Swamp Forests, mostly of Hardwoods ?  
SCS 22/Shrub Bog  
Myers Freshwater Swamp forests - shrub bogs  
SAF N/A?  
FLCFC 310/Herbaceous

other synonyms - bog swamp, shrub bogs, evergreen shrub bogs, wet scrub/shrub systems

Depression Marsh - small rounded depression in sand substrate with peat accumulating toward center; seasonally inundated; still water; subtropical or temperate; frequent or occasional fire; maidencane, fire flag, pickerelweed, and mixed emergents, may be in concentric bands.

Kuchler 112/Southern Mixed Forest  
Davis 13/Grasslands of Prairie Type  
SCS 25/Freshwater Marsh and Ponds  
Myers Freshwater Marshes - basin or depression marshes  
SAF N/A  
FLCFC 641/Freshwater Marshes  
644/Emergent Aquatic Vegetation

other synonyms - flatwoods pond, St. John's wort pond, pineland depression, ephemeral pond or marsh, flag pond, gator hole

Dome Swamp - small rounded depression in sand/limestone substrate with peat accumulating toward center; seasonally inundated; still water; subtropical or temperate; occasional or rare fire; cypress, blackgum, or bays, often tallest in center.

Kuchler 113/Southern Floodplain Forest  
112/Southern Mixed Forest  
Davis 7/Cypress Swamp Forests  
SCS 17/Cypress Swamp  
Myers Freshwater Swamp Forests - depression or basin wetlands  
SAF 85/Slash Pine - Hardwood  
100/Pondcypress

FLCFC 103/Water Tupelo - Swamp Tupelo  
613/Gum Swamps  
616/Inland Ponds and Sloughs  
621/Cypress

other synonyms - cypress dome or pond, cypress head, gum pond,  
cypress gall, pine barrens pond