Three Lakes Wildlife Management Area (Osceola County) Photo by Caitlin Elam

Dome Swamp

Description: Dome swamp is an isolated, forested, depression wetland occurring within a fire-maintained community such as mesic flatwoods. These swamps are generally small, but may also be large and shallow. The characteristic dome shape is created by smaller trees that grow in the shallower waters of the outer edge, while taller trees grow in the deeper water in the interior of the swamp. Pond cypress (*Taxodium ascendens*) often dominates, but swamp tupelo (*Nyssa sylvatica* var. *biflora*), may also form pure stands or occur as a co-dominant. Other canopy or subcanopy species include red maple (*Acer rubrum*), dahoon (*Ilex cassine*), swamp bay (*Persea palustris*), slash pine (*Pinus elliottii*), sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), and, in South Florida, coco plum (*Chrysobalanus icaco*) and pond apple (*Annona glabra*). Shrubs are typically sparse to moderate, but often are absent in dome swamps with a high fire frequency or dense in swamps where fire has long been absent. Shrubs common in dome swamps include Virginia willow (*Itea virginica*), fetterbush (*Lyonia lucida*), common buttonbush (*Cephalanthus occidentalis*), coastalplain willow (*Salix caroliniana*), wax myrtle (*Myrica cerifera*), titi (*Cyrilla racemiflora*), and St. John's wort (*Hypericum* spp.). Herbaceous species can be dense or absent and include a wide variety of ferns, graminoids, and herbs including Virginia chain fern (*Woodwardia virginica*), royal fern (*Osmunda regalis* var. *spectabilis*), cinnamon fern (*Osmunda cinnamomea*), toothed midsorus fern (*Blechnum serrulatum*), maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), various species of beaksedge (*Rhynchospora* spp.), lizard's tail (*Saururus cernuus*), Carolina redroot (*Lachnanthes caroliana*), taperleaf waterhorehound (*Lycopus rubellus*), false nettle (*Boehmeria cylindrica*), and knotweeds (*Polygonum* spp.). Sphagnum moss (*Sphagnum* spp.) often occurs in patches where the

soil is saturated but not flooded (Monk and Brown 1965). Vines such as eastern poison ivy (*Toxicodendron radicans*), white twinevine (*Sarcostemma clausum*), laurel greenbrier (*Smilax laurifolia*), epiphytes such as Spanish moss (*Tillandsia usneoides*), several species of wild pine (*Tillandsia* spp.), and orchids can be common in dome swamps. The center of the dome swamp contains the largest cypress trees and the understory can be open with deeper water and floating and emergent species such as alligatorflag (*Thalia geniculata*), big floatingheart (*Nymphoides aquatica*), floating water spangles (*Salvinia minima*), duckweeds (*Lemna*, *Spirodela*, and/or *Landoltia*), and bulltongue arrowhead (*Sagittaria lancifolia*).

Dome swamps are most often found on flat terraces, where they develop when the overlying sand has slumped into a depression in the underlying limestone, creating a rounded depression connected to a shallow water table. In uplands with clay subsoils, dome swamps may occupy depressions over a perched water table. Soils in dome swamps are variable (Coultas and Duever 1984) but are most often composed of a layer of peat, which may be thin or absent at the periphery, becoming thicker toward the center of the dome (Monk and Brown 1965). This peat layer is generally underlain with acidic sands or marl and then limestone or a clay lens. In South Florida, dome swamps also occur on peat directly overlying limestone (Ewel 1990). Common soil types include Bladen, Coxville, and Bayboro.

Characteristic Set of Species: pond cypress, swamp tupelo

Rare Species: Dome swamps can host a suite of rare species, including pondspice (*Litsea aestivalis*), panhandle spiderlily (*Hymenocallis henryae*), and small-flowered meadowbeauty (*Rhexia parviflora*) in North Florida, and many-flowered catopsis (*Catopsis floribunda*) in South Florida. Dome swamps provide important habitat for many wildlife species (Casey and Ewel 1998), including several rare animals. They provide critical breeding habitat for flatwoods salamanders (*Ambystoma cingulatum* and *Ambystoma bishopi*) and are important roosting sites for wading birds such as white ibis (*Eudocimus albus*) and wood stork (*Mycteria americana*).

Range: Dome swamps are most common in Central Florida but occur throughout the state, except in the Florida Keys. Similar cypress swamps in shallow depressions also occur throughout the southeastern coastal plain (Casey and Ewel 1998).

Natural Processes: Dome swamps are often formed when poor surface drainage causes water to move downward and dissolve the limestone bedrock. These depressions then fill in with peat or marl (Duever et al. 1984). Dome swamps derive much of their water through surficial runoff from surrounding uplands (Fowlkes et al. 2003). Water levels in dome swamps naturally fluctuate with seasonal rainfall changes (Heimburg 1984). They may also be connected directly to the aquifer, where groundwater influences the hydrological regime, especially during periods of drought (Heimburg 1984). Dome swamps can function as reservoirs that recharge the aquifer (Heimburg 1984; Casey and Ewel 1998). The normal hydroperiod for dome swamps is 180 to 270 days per year (Casey and Ewel 1998), with water being deepest, and remaining longest, near the center of the dome creating a larger buildup of peat there. Ewel (1995) suggests the most likely reason for the domed profile, where trees grow faster in the center of the dome swamp

(Ewel and Wickenheiser 1988) is due to deeper peat and lower competition from other species.

Dome swamps experience a wide range of water level variation (Kurz and Wagner 1953; Brown 1981). Prolonged dry periods as well as prolonged wet periods can have a significant effect on cypress regeneration. Although adult cypress trees are tolerant of extended inundation, their seeds cannot germinate under water and cypress seedlings may not survive if submerged (Vernon 1947; Kurz and Wagner 1953).

Fire is essential for maintaining the structure and the species composition of a dome swamp community (Ewel and Mitsch 1978). Without periodic fires cypress may become less dominant as hardwood or bay canopy species increase and peat accumulates. Cypress have fairly thick, fire-resistant bark and are tolerant of light surface fires, but catastrophic fires burning into the peat can kill cypress trees, especially when fire has long been absent. The consumption of muck fuels from such a catastrophic wildfire can lower the ground surface and transform a dome swamp into a pond, wet prairie, or shrub bog. Fire frequency is generally greatest at the periphery of the dome and least in the interior, where long hydroperiods and deeper peat, and/or water, maintain high moisture levels (Kurz and Wagner 1953). The normal fire cycle might be as short as three to five years along the outer edge and as long as 100 to 150 years towards the center (Frost 1995). The domed profile of these swamps may be partly attributable to this frequent, peripheral fire regime. Fire in a long-unburned dome swamp may result in higher cypress mortality in the center of the dome where fire burns through a deeper layer of accumulated peat and kills the cypress roots (Ewel and Mitsch 1978). Emergent marshes can develop in the center of such dome swamps.

Topographic microsites can be important areas for tree, shrub, and herbaceous seedling recruitment in dome swamps (Huenneke and Sharitz 1986). Raised mats of root fiber and peat form hummocks at the bases of trees and shrubs, on old tree stumps, or among cypress knees, often creating microsites for more diverse and mesic species to establish above the water surface (Monk and Brown 1965).

Community Variations: Dome swamps are classically small (relative to other swamp types) and circular or elliptical in shape but can occur in any size or shape on the landscape, especially if the swamp is shallow. Dome swamps can completely surround, or appear as fringes, on the edge of basin or depression marshes. Some dome swamps have marsh vegetation or a small pond in their center, creating a "doughnut" appearance when viewed from above. Although most dome swamps are isolated on the landscape they can also be loosely connected to one another by wet prairie or depression marsh. They also may be present as a series of swamps connected together forming a shallow drainageway where water flows only during periods of heavy rain.

Variation in species composition is partly attributable to geographic distribution. Dome swamps in South Florida have a higher component of tropical species but the dominant species (i.e., pond cypress, swamp tupelo) are mostly temperate. Dome swamps generally have an epiphytic component throughout their range, with the highest density and diversity occurring in South Florida (Oberbauer et al. 1996). Dome swamps within the Everglades basin occur in a matrix of marl prairie or glades marsh and form where peat accumulates in limestone depressions or rises, and are locally referred to as "cypress

domes" and "cypress heads," respectively (Olmsted et al. 1980). These dome swamps often consist of a canopy of cypress over an understory of baygall vegetation (Olmsted and Loope 1984). Myrtle-leaved holly (*Ilex cassine* var. *myrtifolia*) may dominate shallow dome swamps in upland pine, sandhill, or scrub communities in North Florida.

Two common variants of dome swamp occur within Florida.

Variants: GUM POND – depressions dominated by swamp tupelo instead of cypress and found primarily in the Florida Panhandle, commonly occurring within upland pine. These swamps are underlain by a clay lens, have a longer hydroperiod and lower fire frequency than cypress-dominated dome swamps (Ewel 1990).

STRINGER SWAMP – narrow linear swamps dominated by pond cypress occurring within a pyrogenic community along an intermittent stream that only flows during times of heavy rainfall. Stringer swamps often burn with the adjoining uplands.

Associated Communities: Dome swamps only occur within a suite of pyrogenic matrix communities: mesic flatwoods, dry prairie, glades marsh, upland pine, wet flatwoods, and sandhill. They are often encircled by wet prairie or depression marsh. These dense and diverse herbaceous communities serve as a transition from the swamp to the adjacent upland community and can help carry fire into the swamp.

The species composition of dome swamps overlaps that of strand swamp, basin swamp, baygall, and floodplain swamp. Distinguishing features of dome swamps include their isolation (within the landscape) and relatively shallow nature. Dome swamps generally have fewer canopy species than other swamp types in Florida due to their more frequent fire regime and smaller size. Dome swamps can be distinguished from baygall by the dominance of deciduous species (i.e., cypress) rather than evergreen bay species (Monk 1966). Fire-excluded dome swamps, and especially those where cypress has been logged out, may succeed to baygall as evergreen bay species shade out the ground layer and peat accumulates (Monk and Brown 1965). Dome swamps have an isolated landscape position as opposed to floodplain swamps which occur along perennial streams. Distinguishing between basin, strand, and dome swamps is complicated and requires thorough ground and aerial investigation. Dome swamps are always found within fire-maintained communities and are generally, although not always, smaller, have a greater fire frequency, less peat accumulation, and lower species diversity than basin or strand swamps.

Management Considerations: Dome swamps often suffer from anthropogenic alterations or influences such as regional hydrological modifications (Rochow 1985), logging, nutrient enrichment, pollution from agricultural runoff, and invasive exotic species invasion (USFWS 1999; Fowlkes et al. 2003). Conversion of the adjacent uplands to pasture, development, or agriculture impedes natural fire and alters the hydrology of dome swamps that are left unconverted (Kirkman et al. 1999). The hydroperiod also may be substantially shortened through ditching, or conversely increased by impoundment. It is important to maintain natural hydroperiods and natural (both seasonal and long term) fluctuations in water level in dome swamps. Extended

hydroperiods can limit tree growth and prevent reproduction. Shortened hydroperiods can permit the invasion of mesophytic species, which can change the character of the understory and eventually allow hardwoods to replace cypress. Regional lowering of the water table can cause drastic effects (i.e., cypress mortality) in dome swamps, including colonization by herbaceous marsh or upland species (FNAI 2006).

Since fire is important in the ecology of dome swamps, it should be allowed to burn into dome swamps from the adjacent uplands and extinguish naturally. The practice of putting firebreaks around dome swamps has been used in Florida to prevent fire from entering dome swamps, mostly in an effort to control peat fires. This practice negatively affects the structure and function of the dome swamp by altering drainage from adjoining uplands (Means 2008), degrading the wet prairie buffer, and impeding fire. Within the dome swamp, a heavy shrub layer resulting from fire suppression impedes wildlife movement between the swamp and uplands, and increases the likelihood of catastrophic wildfire. Additionally, the natural upland buffers around dome swamps are important for many dome swamp inhabitants such as turtles and salamanders, who use the buffer zones for specific stages of their life cycle (Burke and Gibbons 1995). Firebreaks should not be created around dome swamps and should be restored where present in the landscape (Means 2008).

Dome swamps have long been used for their timber resources. In fact, most cypress trees in the southeast were harvested in the late nineteenth and early twentieth centuries (Brandt and Ewel 1989). Unlike most pine plantations, cypress harvested in Florida generally is cut from natural stands and few areas are ever replanted. Although cypress trees are capable of regenerating, or resprouting from cut stumps, cypress regeneration in most dome swamps is from seed. It is therefore important that at least a few seed trees be left in place for canopy regeneration. Cypress seeds are water-dispersed and are infrequently moved from one depression to another. The short-lived seeds will not germinate in standing water and seedling plants are intolerant of prolonged inundation. Young cypress trees are also vulnerable to fire, especially in logged dome swamps that are undergoing canopy regeneration (Ewel 1995). If cypress saplings and seedlings are destroyed by fire, or if cypress seed trees are removed, bay species, coastalplain willow, and swamp tupelo are likely to invade the swamp (Gunderson 1984; Ewel 1995).

Dome swamps are sometimes used as treatment areas for secondarily treated wastewater (Casey and Ewel 1998). This causes increased nutrients, organic matter, and minerals to flow into the dome swamp, which can have negative effects such as an increased cover of duckweed, decreased oxygen in the water, and declines in amphibian populations. Dome swamps treated with sewage can have higher water levels, litter production, and wood production (Brown 1981).

Invasive exotic plant species can be a problem in dome swamps through competition for light and nutrients. Species of particular concern include melaleuca (*Melaleuca quinquenervia*), both species of climbing fern (*Lygodium japonicum* and *L. microphyllum*), and Chinese tallow (*Sapium sebiferum*).

Exemplary Sites: Eglin Air Force Base (Walton, Okaloosa, and Santa Rosa counties), Three Lakes Wildlife Management Area (Osceola County), Everglades National Park (Miami-Dade and Monroe counties), Big Cypress National Preserve (Monroe County)

Global and State Rank: G4/S4

Crosswalk and Synonyms:

Kuchler	113/Southern Floodplain Forest
	112/Southern Mixed Forest
Davis	7/Cypress Swamp Forests
SCS	17/Cypress Swamp
Myers and Ewel	Freshwater Swamp Forests - depression or basin wetlands
SAF	85/Slash Pine - Hardwood
	100/Pondcypress
	103/Water Tupelo - Swamp Tupelo
FLUCCS	613/Gum Swamps
	616/Inland Ponds and Sloughs
	621/Cypress

Other synonyms: cypress dome (Olmsted et al. 1980) or pond, cypress head (Vernon 1947; Monk and Brown 1965; Olmsted et al. 1980; Olmsted and Loope 1984), gum pond, cypress gall, pine barrens pond, cypress doughnut (Vernon 1947), cypress ponds (Wharton 1978)

References:

Brandt, K., and K.C. Ewel. 1989. Ecology and management of cypress swamps: a review. Florida Cooperative Extension Service, Gainesville, Florida.

Brown, S. 1981. A comparison of the structure, primary productivity, and transpiration of cypress ecosystems in Florida. Ecological Monographs 51:403-427.

Burke, V.J., and J.W. Gibbons. 1995. Terrestrial buffer zones and wetland conservation: a case study of freshwater turtles in a Carolina bay. Conservation Biology 1365-1369.

Casey, W.P., and K.C. Ewel. 1998. Soil redox potential in small pondcypress swamps after harvesting. Forest Ecology and Management 112:281-287.

Coultas, C.L., and M.J. Duever. 1984. Soils of cypress swamps. Pages 51-59 in K.C. Ewel and H.T. Odum, editors. Cypress Swamps. University of Florida Press, Gainesville.

Duever, M.J., J.F. Meeder, and L.C. Duever. 1984. Ecosystems of the Big Cypress Swamp. Pages 294-303 in K.C. Ewel and H.T. Odum, editors. Cypress Swamps. University of Florida Press, Gainesville.

Ewel, K.C. 1990. Swamps. Pages 281-323 in R.L. Myers and J.J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

Ewel, K.C. 1995. Fire in cypress swamps in the southeastern United States. Pages 111-116 in S.I. Cerulean and R.T. Engstrom, editors. Fire in Wetlands: A Management Perspective. Proceedings of the Tall Timbers Fire Ecology Conference, No. 19. Tall Timbers Research Station, Tallahassee, Florida.

Ewel, K.C., and W.J. Mitsch. 1978. The effect of fire on species composition in cypress dome ecosystems. Florida Scientist 41:25-30.

Ewel, K.C., and L.P. Wickenheiser. 1988. Effect of swamp size on growth rates of cypress (*Taxodium distichum*) trees. American Midland Naturalist 120:362-370.

Florida Natural Areas Inventory FNAI. 2006. Natural community descriptions to accompany a vegetation map of Upper Hillsborough. Unpublished report to the Southwest Florida Water Management District. Florida Natural Areas Inventory, Tallahassee, Florida.

Fowlkes, M.D., J.L. Michael, T.L. Crisman, and J.P. Prenger. 2003. Effects of the herbicide Imazapyr on benthic macroinvertebrates in a logged pond cypress dome. Environmental Toxicology and Chemistry 22:900-907.

Frost, C.C. 1995. Presettlement fire regimes in southeastern marshes, peatlands, and swamps. Pages 39-60 in S.I. Cerulean and R.T. Engstrom, editors. Fire in Wetlands: A Management Perspective. Proceedings of the Tall Timbers Fire Ecology Conference, No. 19. Tall Timbers Research Station, Tallahassee, Florida.

Gunderson, L.H. 1984. Regeneration of cypress in logged and burned strands at Corkscrew Swamp Sanctuary, Florida. Pages 349-357 in K.C. Ewel and H.T. Odum, editors. Cypress Swamps. University Press of Florida, Gainesville.

Heimburg, K. 1984. Hydrology of north-central Florida cypress domes.

Huenneke, L.F., and R.R. Sharitz. 1986. Microsite abundance and distribution of woody seedlings in a South Carolina cypress-tupelo swamp. American Midland Naturalist 115:328-335.

Kirkman, L.K., S.W. Golladay, L. Laclaire, and R. Sutter. 1999. Biodiversity in southeastern, seasonally ponded, isolated wetlands: management and policy perspectives for research and conservation. Journal of the North American Benthological Society 18:553-562.

Kurz, H., and K.A. Wagner. 1953. Factors in cypress dome development. Ecology 34:157-164.

Means, R. 2008. Management strategies for Florida's ephemeral ponds and pond breeding ambhibians. FWC Agreement Number 05039. Coastal Plains Institute, Tallahassee, Florida. Available at: http://www.coastalplains.org/pdf/Final%20Report%202008.pdf

Monk, C.D. 1966. An ecological study of hardwood swamps in north-central Florida. Ecology 47:649-654.

Monk, C.D., and T.W. Brown. 1965. Ecological consideration of cypress heads in northcentral Florida. American Midland Naturalist 74:126-140.

Oberbauer, S.F., K. von Kleist, K.R.T. Whelan, and S. Koptur. 1996. Effects of Hurricane Andrew on epiphyte communities within cypress domes of Everglades National Park. Ecology 77:964-967.

Olmsted, I.C., and L.L. Loope. 1984. Plant communities of Everglades National Park. Pages 167-184 in P.J. Gleason, editor. Environments of South Florida: Present and Past II. Miami Geological Society, Coral Gables.

Olmsted, I.C., L.L. Loope, and R.E. Rintz. 1980. A survey and baseline analysis of aspects of the vegetation of Taylor Slough, Everglades National Park. Report T-586. South Florida Research Center, Everglades National Park, Homestead, Florida.

Rochow, T.F. 1985. Hydrologic and vegetational changes resulting from underground pumping at the Cypress Creek Well Field, Pasco County, Florida. Florida Scientist 48:65-80.

United States Fish and Wildlife Service USFWS. 1999. Pond swamps. South Florida multi-species recovery plan - Ecological communities. United States Fish and Wildlife Service.

Vernon, R.O. 1947. Cypress domes. Science 105:97-99.

Wharton, C.H. 1978. The Natural Environments of Georgia. Geologic and Water Resources Division and Resource Planning Section, Office of Planning and Research, Georgia Department of Natural Resources, Atlanta.

Eglin Air Force Base (Okaloosa County) Photo by Don Herring