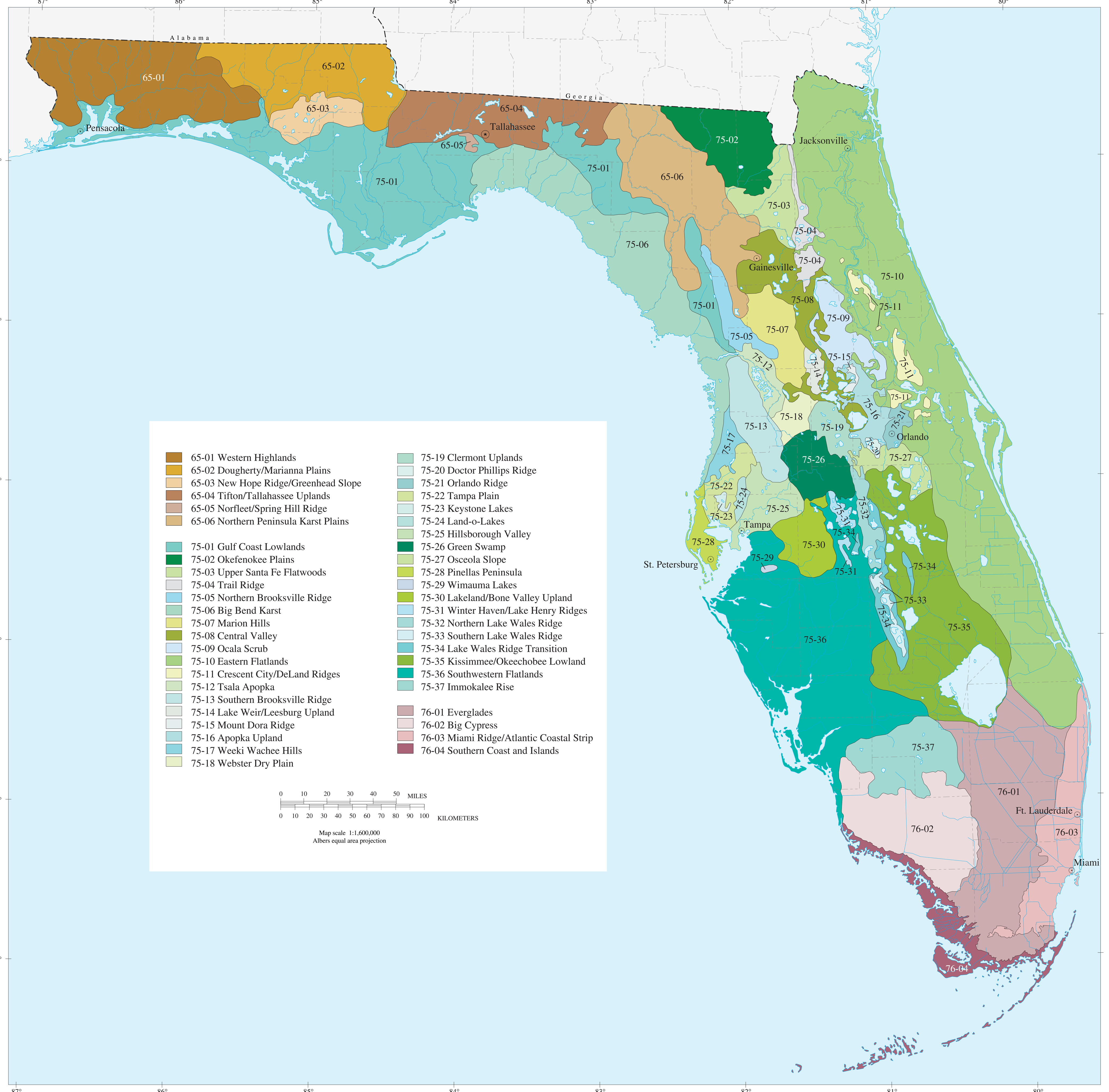
Lake Regions of Florida

Florida's lakes provide important habitats for plants, birds, fish, and other animals, and comprise a valuable resource for human activities and enjoyment. More than 7,700 lakes are found in Florida, and they occur in a variety of ecological settings. The physical, chemical, and biological diversity of these lakes complicates lake assessment and management. In many states, it has been shown that water resources can be managed more effectively if they are viewed within a regional framework that reflects differences in their quality, quantity, hydrology, and their sensitivity or resilience to ecological disturbances. To develop cost-effective lake management strategies that protect or restore water quality in Florida lakes, regional differences in the capabilities and potentials of lakes must be considered. Hydrologic unit or basin frameworks are often used for water quality assessments and ecosystem management activities, but these units or basins do not correspond to the spatial patterns of characteristics that influence the physical, chemical, or biological nature of Florida lakes.

General patterns of geology and physiography have been used previously to explain regional differences in Florida lake water chemistry (Canfield and Hoyer 1988; Pollman and Canfield 1991), and ecosystem characteristics of Florida lakes have been summarized (Brenner et al. 1990). Building on this work, as well as on a Florida ecoregion framework (Griffith et al. 1994), we have defined these forty-seven lake regions as part of the Florida Department of Environmental Protection's (FL DEP) Lake Bioassessment/Regionalization Initiative. The spatial framework was developed by mapping and analyzing water quality data sets in conjunction with information on soils, physiography, geology, hydrology, vegetation, climate, and land use/land cover, as well as relying on the expert judgment of local limnologists and resource managers. This framework delineates regions within which there is homogeneity in the types and quality of lakes and their association with landscape characteristics, or where there is a particular mosaic of lake types and quality. More detailed descriptions of methods, materials, and lake region characteristics can be found in Griffith et al. (1997). The identifier for each lake region consists of two numbers: the first number (65, 75, or 76) relates to the United States Environmental Protection Agency (US EPA) ecoregion number (Omernik 1987; US EPA 1997), and the second number refers to the Florida lake regions within an ecoregion. The Florida lake regions and associated maps and graphs of lake chemistry are intended to provide a framework for assessing lake characteristics, calibrating predictive models, guiding lake management, and framing expectations by lake users and lakeshore residents.



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Small ponds and reservoirs on red sandy soils are typical in region 65-01.

Many clearwater lakes are found in region 65-03, and a few clearwater lakes, such as Lake Cassidy, occur in 65-02.

65-01 The rolling hills of the **Western Highlands** lake region are covered by mixed hardwood and pine forest, with some cropland and pasture. It is a region of streams, but very few natural lakes. The region contains some oxbow lakes and other lowland lakes of the river floodplains. A few ponds and small reservoirs for cattle or recreation have been created by damming up small drainages. Similar to the streams of the region that feed these small reservoirs, they would generally be acidic, softwater, low to moderate nutrient lakes, if lake management inputs were low. However, most lakes in this region, including Karick, Hurricane, and Bear lakes, have been artificially limed and fertilized in an attempt to increase fish production. Phosphorus values have increased for some of these lakes from the 10-20 µg/l range in the 1970s to more than 70 µg/l in the 1990s.

65-02 The **Dougherty/Marianna Plains** lake region is an eroded limestone area that is generally more flat than the regions to the east and west, with agriculture as a dominant land use. Elevations are generally 100 to 200 feet, but include Florida's high point of 345 feet in northwest Walton County. The Floridan aquifer is at or near the surface in much of the region. The solution activity on the limestone bedrock has formed numerous sinks, caverns, springs, and other karst features. Many of the shallow depressions or sinks, often called bays, dome swamps, or gum ponds, contain ponds or small lakes surrounded by cypress trees and other hydrophytic vegetation. The limestone is exposed in some areas, but in other areas, sands and clayey sands reach thicknesses of over 200 feet. The chemical characteristics of lakes in this region can be variable depending upon a lake's contact with bedrock or its isolation from the bedrock by deposits of clays and sands. Most of the lakes can be characterized as relatively clear, acidic to slightly acidic, softwater lakes; generally oligo-mesotrophic or mesotrophic. Merrits Mill Pond is spring-fed and different, with high pH, hard water, and high nitrogen. Lake DeFuniak is surrounded by urbanization, but remains clear and unproductive with low color and low nutrients.

65-03 The **New Hope Ridge/Greenhead Slope** is an upland sand ridge region, 100-300 feet in elevation, with a relatively high density of solution lakes for the Florida Panhandle. Similar to other well-drained upland sand ridge areas in Florida, the region is a high recharge area for the Floridan aquifer. It contains clear, acidic, softwater lakes of extremely low mineral content. The lakes are very low in nitrogen and phosphorus, low in chlorophyll *a*, and are among the most oligotrophic lakes in the United States. Along with lakes in the Trail Ridge region (75-04), these may be some of the most acid-sensitive lakes in Florida. Lakes connected to stream drainages, such as Black Double Lake and Lighter Log Lake in Washington County are more colored.

65-04 The characteristics of the **Tifton/Tallahassee Uplands** region change distinctly from west to east. The region contains a heterogeneous mosaic of mixed forest, pasture, and agricultural land. The dissected Tifton Upland in the western part of the region has few if any natural lakes, but many small ponds and reservoirs created on stream channels. The southwest part of the region consists of thick sand delta deposits and contains one small lake, Lake Mystic (Liberty County), and a large reservoir. Lake Talquin, impounded in 1929, is the second-oldest large reservoir in Florida. To the east of the Ochlockonee River, in Leon County, karst features are more evident with many solution basins, swampy depressions and some large swamp lakes. Some lakes, such as Iamonia and Jackson, drain periodically when their karst drainage system becomes unplugged. Lakes in this region tend to be slightly acidic to neutral, colored, softwater lakes with moderate nutrient values. Some lakes have high pH and conductivity values because groundwater is pumped in to counteract draining.

65-05 The **Norfleet/Spring Hill Ridge** lake region contains small, upland, clear, low-nutrient, acidic lakes that differ from the darker, swampy, moderate nutrient lakes of the Tifton/Tallahassee Uplands (65-04) and Gulf Coast Lowlands (75-01) regions. It is somewhat of an anomalous area of xeric sand hills that extend into the Gulf Coast Lowlands, with elevations generally 60-120 feet. Acid-tolerant aquatic plants are found here, as most of the lakes have pH levels less than 5.5. Some lakes and ponds show some color associated with rain events, especially Moore Lake and Loften Ponds.

65-06 The **Northern Peninsula Karst Plains** region is generally a well-drained flat to rolling karst upland containing a diverse group of small lakes. The natural vegetation consisted of longleaf pine/turkey oak, or hardwood forests on the richer soils, but agriculture is now extensive in much of the region. With some areas underlain by the geologically diverse Miocene Hawthorn Group or by undifferentiated Quaternary sediments, nutrient levels are variable, but many lakes have high phosphorus. The region's nutrient values are some of the highest in northern Florida. Many of the lakes are located in an area between Live Oak and Lake City. Groundwater connections as well as human activities elevate the conductivity and phosphorus in some lakes around Lake City. The mosaic of lake types in this region has a wide-ranging distribution of chemical and physical characteristics, but in general the lakes tend to be slightly acidic, with low to moderate alkalinity, high nutrients, and some color.

Clearcut logging around Lake Five-0 in region 65-03.

Lake conditions vary in this suburbanized residential area north of Tallahassee, region 65-04.

Some coastal dune lakes in 75-01 contain freshwater fish, with saltwater fish in the more saline bottom layers.

Sportfishing for largemouth bass, bluegill, and black crappie is an important recreational activity on Florida lakes. (Lake Crosby, 75-03)

White quartz sand surrounds crystal-clear Sheelar Lake and other acidic lakes in the Trail Ridge region, 75-04.

Aquatic plants and algal mats are found on many of the eutrophic lakes of the Central Valley, 75-08. (Lochloosa Lake)

Marshes near Lake Apopka and Lake Griffin in region 75-08, as well as near Lake Okeechobee in region 76-01, were channelized and drained for use as cropland on the dark, muck soils.

Sellers Lake is one of many acidic, clear lakes in the Ocala National Forest, 75-09.

75-01 Several types of lakes occur in the **Gulf Coast Lowlands** lake region, including coastal dune lakes, flatwood lakes, "edge lakes", river floodplain or oxbow lakes (Dead Lake), and reservoirs (Deer Point Lake). Most of the lakes tend to be darkwater, acidic, softwater lakes with low to moderate nutrients. Coastal dune lakes have higher sulfate, sodium, and chloride levels than inland lakes, and can freshen or turn salty depending on rainfall, saltwater input, or salt spray. Flatwood lakes receive the majority of their water from direct rainfall and runoff from surrounding poorly drained soils. Sag ponds or "edge lakes" are found at the foot of relict marine terrace scarps or where soluble limestone that is near the surface abuts an upland of thick insoluble sands. An example is Chunky Pond near the western edge of the Northern Brooksville Ridge (75-05).

75-02 The **Okefenokee Plains** lake region consists of flat plains and terraces with pine flatwoods and swamp forests over peat, muck, clayey sand, and phosphatic deposits. The few lakes in the region are primarily in the southern part, and include Ocean Pond, Palestine Lake, Swift Creek Pond, and Lake Fisher. These are highly acidic, darkly colored, softwater lakes. The region's median pH value of 4.7 is the lowest of all the Florida lake regions. Although Ocean Pond is one of Florida's most acidic lakes, it supports a sustained sport fishery for largemouth bass, black crappie, bluegill, and other centrarchids. Phosphorus values for the lakes are generally in the 10-20 µg/l range, but Swift Creek Pond has higher phosphorus values and there may be other phosphatic areas.

75-03 The **Upper Santa Fe Flatwoods** region, with elevations generally 120-180 feet, is an area of pine flatwoods with some swamp forests. Lakes in this region include Alto, Butler, Crosby, Hampton, Hickory Pond, Little Santa Fe, Punchbowl, Rowell, Sampson, and Santa Fe. The lakes occur on thin Plio-Pleistocene sediments that overlie the deeply weathered sand and kaolinitic clay of the Miocene Hawthorn Group. The lakes of the region are slightly acid, colored, with low to moderate nutrients. The pH and alkalinity levels are slightly higher than the Okefenokee Plains (75-02) to the north, and phosphorus levels of the lakes are relatively low, averaging in the 10-15 µg/l range. Lakes Rowell and Sampson have different water chemistry values due to wastewater treatment plant discharges from the city of Starke via Alligator Creek.

75-04 From a narrow ridge in the north, the **Trail Ridge** lake region broadens to the south, becoming a karstic landscape with numerous solution depressions and lakes. The region is dominated by well-drained, nutrient-poor upland soils, such as the Candler, Apopka, Astatula, and Tavares series, with longleaf pine-xerophytic oak vegetation. Lakes in the Trail Ridge region are mostly small, acid, clear, oligotrophic lakes. To the south, conductance and macrophytes in the lakes tend to increase. Atmospheric deposition might be contributing to some acidification of lakes in this region. Kingsley Lake is one of the largest lakes in the region and one of the deeper lakes in Florida. It differs from other Trail Ridge lakes, with higher pH, alkalinity, and a different cation/anion mix that reflects groundwater inputs.

75-05 The **Northern Brooksville Ridge** region has an irregular land surface, with elevations varying over short distances from about 70-170 feet. It is an area of internal drainage and xeric sand hills, with natural vegetation of longleaf pine and turkey oak. Soils are of the Candler-Apopka-Astatula association. The thick sand sequence is underlain by clayey phosphatic sediments of the Alachua Formation. It is these underlying relatively insoluble Miocene-age clastics that provide the ridge's resistance to solution and lowering of elevation compared to surrounding limestone plains areas. Several ponds are located west of Archer and another group of lakes is located in the southern end in the Rainbow Lakes Estates area. These lakes are generally acidic, with moderately low nutrients and color.

75-06 In the **Big Bend Karst** region, Miocene to Eocene-age limestone is at or near the surface from eastern Wakulla County south to Pasco County. The inland parts of the region are typified by pine flatwoods and swamp forest on poorly drained Spodosol soils. The Big Bend coast is characterized by coastal salt marshes and mangrove, rather than the barrier islands or beaches of the Gulf Coast Lowlands (75-01). Reflecting the limestone influence, pH, alkalinity, and conductivity values in lakes are very high for this part of Florida; nutrients are moderately low and lake color is variable but generally low. Lake Rousseau is a large reservoir on the Withlacoochee River at the Levy/Citrus county line, and often has an abundance of hydrilla plant growth.

75-07 The **Marion Hills** lake region, generally 75-180 feet in elevation, is an area of horse farms, pasture for cattle, cropland, and mixed evergreen and deciduous hardwood forests. Miocene-age Hawthorn Group sediments of clayey sands compose much of the hill systems, with the Eocene-age Ocala Limestone near the surface in much of the intervening karst terrain. The region has few if any lakes, but contains about a dozen small ponds and some wet prairie areas. Pond chemistry is likely to be alkaline in locations influenced by the near-surface limestone, and less so for sites in the hilly Hawthorn sands.

75-08 **Central Valley** lakes tend to be large, shallow, and eutrophic, although lake size and type are variable. The lakes tend to have abundant macrophytes or are green with algae. Total phosphorus values are mostly in the 20-80 µg/l range, alkalinity values range widely, and pH values are generally greater than 6.5. The northern lakes in sandy deposits, such as Lake Eaton, Lochloosa Lake, Newnans Lake, Orange Lake, and Lake Wauberg, are characterized as softwater eutrophic lakes, and tend to have lower pH and darker water than the southern lakes. The southern lakes, such as Apopka, Carlton, Beauclair, Dora, Harris, Eustis, Yale and Griffin, often receive mineralized groundwater as well as surface inflows through nutrient-rich soils, and are eutrophic to hypereutrophic hardwater lakes. Canals have altered the natural flow patterns for many of these southern lakes in the Oklawaha chain, and agricultural activities on the muck soils, along with municipal and industrial wastes, have added chemicals and nutrients to the connected surface water system.

75-09 The **Ocala Scrub** is a region of ancient dunes with excessively drained, deep sandy soils (Candler and Astatula series) and sand pine scrub forests. The western two-thirds of the region is underlain by deeply weathered Miocene-age Hawthorn Group deposits, and contains more clayey sand with areas of longleaf pine and turkey oak. Elevations range from 75-180 feet. The eastern portion is lower in elevation and contains medium to fine sand and silt developed on Pleistocene-age sand dunes. The Ocala Scrub contains acid, mostly clearwater, low-nutrient lakes. The clear lakes are generally on the higher sandy ridges, moderate color lakes are in lower transitional areas, and some prairie lakes can have darker water.

75-10 Due to landform variety and latitudinal extent, the **Eastern Flatlands** forms a diverse lake region. It is ribbed by low sand ridges, intervening valleys, and swampy lowlands that parallel the coast. The St. Johns River and its associated large lakes are the dominant physical features of the area. There are a mix of different lake types in the region. The St. Johns River lakes tend to be alkaline, hardwater, eutrophic, colored lakes. To the south, the upper St. Johns marsh lakes are also alkaline, mesotrophic to eutrophic, darkwater lakes, but the chemical concentrations are somewhat lower than in the north. Flatwoods lakes in the region are acid to slightly acid, colored, softwater lakes of moderate mineral content, with variable trophic states. Coastal ridge lakes and dredged "build" ponds are found along the more populated seaboard area.

75-11 The **Crescent City/DeLand Ridges** lake region includes several sandy upland ridges such as Palatka Hill, Crescent City Ridge, Deland Ridge, and the Geneva-Chuluota-Oviedo Hills area. Thick sandy soils of the Candler and Astatula series are typical, with natural vegetation of longleaf pine/xerophytic oak forests and some sand pine scrub forests. Many lakes in the region are clear, acid, oligotrophic lakes of low mineral content that obtain the majority of water from direct rainfall and surface/subsurface inflows through well-drained sandy soils. More mesotrophic lakes of moderate mineral content that receive inputs of groundwater also occur. Some lakes at the edge of the ridges receive water inputs from poorly-drained soils, and are included with the darker, small lakes of the Eastern Flatlands (75-10).

75-12 **Tsala Apopka** is an erosional valley with thin surficial sands over Eocene-age Ocala limestone. Limestone is at the surface on the east side of the Withlacoochee River within the region. Tsala Apopka Lake to the west of the Withlacoochee River is an area of interconnected swamps, marshes, ponds and lakes. There are generally three open-water pool areas: the Floral City Pool, the Inverness Pool, and the Hernando Pool. The "lake" gets shallower and turns to marsh as one moves east. Tsala Apopka water bodies are alkaline, hard-water, and eutrophic. The average lake pH is often greater than 7.5. Color decreases and conductivity increases as one moves from the Floral City Pool in the south to Hernando Pool in the north.

75-13 The **Southern Brooksville Ridge** has a very irregular surface, similar to the Northern Brooksville Ridge (75-05), but reaches higher elevations, with several hills between 200 and 300 feet. These thick sand hills are often covered by hammock, turkey oak, and longleaf pine vegetation communities, and drainage is generally internal to the Floridan aquifer. Orange to reddish-orange clayey sands occur the length of the ridge and cap many of the hills in the limestone area near Brooksville. The lakes tend to have higher pH, alkalinity, conductivity, and nitrogen than lakes in the Northern Brooksville Ridge. Although a few lakes are acidic, most are neutral to alkaline, slightly colored, mesotrophic or meso-eutrophic lakes. Some lake phosphorus values appear low due to dense aquatic macrophyte growth.

75-14 The **Lake Weir/Leesburg Upland** region, with elevations generally 75-125 feet, stretches from Lake Weir in the north to the city of Leesburg in the south. Soils are mostly the sandy, well-drained Candler, Apopka, and Astatula series, and the underlying material consists of deeply weathered clayey sand of the Miocene Hawthorn Group. The natural vegetation was primarily longleaf pine and xerophytic oaks. Lake Weir is the largest lake in the region and there are numerous small lakes among citrus groves. These are generally clear, acidic to neutral, low nutrient lakes.

75-15 The **Mount Dora Ridge** lake region is composed of high sand hills, 75-180 feet in elevation, with well-drained acid soils of the Astatula and Apopka series. There are many small, circumneutral, clear lakes of low color, having low nutrients, low chlorophyll *a*, and moderate alkalinity. Nutrient and color values tend to be slightly less than the adjacent Apopka Upland (75-16), and pH, alkalinity, and conductivity are higher than the Lake Weir/Leesburg Upland (75-14). Steeply sloping sand hills and old orange groves surround the lakes.

75-16 The **Apopka Upland** region consists of residual sand hills modified by karst processes, with many small lakes and scattered sinkholes. Candler, Apopka, and Tavares are typical well-drained upland soils, and elevations range from 70-150 feet. The physical and chemical characteristics of the lakes are varied, and lake water levels can fluctuate during drought periods. There are a few acidic, clear, softwater lakes of low mineral content, but most are neutral to alkaline clear lakes with low to moderate nutrients. Some of the higher nutrient lakes may lack macrophytes. Darker water lakes that are circumneutral to alkaline also occur.

75-17 The **Weeki Wachee Hills** are an area of Pleistocene sand dunes, 20-80 feet in elevation, with numerous solution basins. The region includes mostly upland-type, well-drained sandy soils, such as Candler, Astatula, and Tavares series, and natural vegetation of longleaf pine/turkey oak and sand pine scrub. The lakes have circumneutral pH, with moderately low alkalinity and nutrients, and low chlorophyll *a* values. Nutrient values are slightly lower than the adjacent Southern Brooksville Ridge (75-13). Although some have slight color, these are mostly clearwater lakes.

75-18 The low-relief **Webster Dry Plain**, with elevations generally 75-125 feet, has only a thin veneer of sand or clayey sand over the Ocala Limestone and contains few lakes. The drainage is primarily internal, and only during wet years and high water tables do shallow, temporary lakes exist in the solution depressions. The small shallow lakes can vary widely in their characteristics; some having high pH, alkalinity, and conductivity with variable nutrients, color, and clarity, while other prairie lakes are more acidic and dark.

75-19 The **Clermont Uplands** is a region of prairies, swamps, solution lakes, and low to high sand hills covered by citrus groves. Elevations range from 100 feet in the lower swamp and prairie areas to 300 feet on the highest hills of the Sugar Loaf Mountains. The natural vegetation consists of pine flatwoods, water-tolerant grasses, and hardwood swamp forests in the lowlands, and longleaf pine/xerophytic oaks on the well-drained uplands. Lakes of this region tend to be slightly acidic, softwater lakes that are oligotrophic to slightly mesotrophic. Some lakes have low color and high Secchi values, while other lakes that receive drainage from the Green Swamp (75-26), such as Lake Louisa, are very dark.

75-20 **Doctor Phillips Ridge** is a small ridge of thick sands with elevations of 100-170 feet, and contains over 30 solution depression lakes. The sandy soils of the Tavares-Zolfo-Millhopper association are predominant. The lakes in this region are generally clear, circumneutral, and low in nutrients. As a group, these are some of the clearest lakes in central Florida. The clearest lakes tend to be deeper than the others in the region, and the slightly darker lakes, such as Lake Sheen, are lower in elevation or have wetter, lowland-type soils near the lake. Lake Floy is darker with unusually high nutrients, but is heavily impacted by road and stormwater drainage.

75-21 The **Orlando Ridge** is an urbanized karst area of low relief, with elevations from 75-120 feet. Longleaf pine and xerophytic oaks were the dominant trees of the natural vegetation, with soils primarily of the Tavares, Smyrna, and Pomello series. Miocene-age coarse quartz sands and pebbles imbedded in kaolinitic clay form the ridge. Phosphatic sand and clayey sand are at a shallow depth. Lakes in this region can be characterized as clear, alkaline, hardwater lakes of moderate mineral content. They are mesotrophic to eutrophic, with phosphorus levels generally between 20-50 µg/l, but it is difficult to distinguish between effects of urbanization and natural phosphorus levels here. Lakes are more phosphatic than the Crescent City/DeLand Ridges (75-11), and only slightly more than the Apopka Upland (75-16).

75-22 The low-relief **Tampa Plain** lake region is drained mostly by the Pithlachascotee, Anclote, and Lake Tarpon basins, with elevations ranging from 5 to 90 feet. Pine flatwood vegetation was dominant in this area. Medium to fine sand and silt cover the Miocene Tampa Member limestone and the Quaternary Ft. Thompson Formation clastics and shell deposits. The region has slightly acidic, darkwater, mesotrophic lakes, in contrast to the clearer lakes of the bordering Keystone Lakes (75-23) and Land-o-Lakes (75-24) regions.

75-23 The **Keystone Lakes** region is a small, well-drained, sandy upland area within the Tampa Plain, with elevations generally 30 to 60 feet and numerous lakes. These are slightly acidic, low nutrient, mostly clearwater lakes. The region has lower pH, alkalinity, and nitrogen values than in the nearby Land-o-Lakes region (75-24), and there is also less citrus and residential development.

75-24 **Land-o-Lakes** is a sandy upland with poorly drained soils interspersed. The region has a high density of lakes with elevations ranging from 30 to 80 feet and separates the Tampa Plain and Hillsborough Valley. Natural vegetation was dominated by longleaf pine and turkey oaks, now mostly removed for citrus groves and residential development. The lakes are neutral to slightly alkaline, low to moderate nutrient, clearwater lakes.

75-25 The **Hillsborough Valley** lake region is a plain of low-relief containing relatively sluggish surface drainage of the Hillsborough River watershed. Natural vegetation is varied, including longleaf pine/turkey oak, pine flatwoods, and hardwood swamp forests. There are karst features, but almost no lakes in this region. Data for three lakes indicate that generally alkaline, moderate to high nutrient, darkwater lakes are found in this region. The eutrophic Lake Thonotosassa is the largest, and receives high nutrient loadings from urban and industrial sources, causing algae blooms and fish kills.

75-26 The **Green Swamp** is a distinctive area of flatland and swampland at a relatively high elevation, 75-150 feet, and contains the headwaters of the Withlacoochee, Oklawaha, and Hillsborough rivers. The Green Swamp lake region overlies the Eocene-age Ocala Limestone in the west, and Miocene-age Hawthorn Group sediments to the east. The vegetation includes cypress in the swampy areas, pine flatwoods, and some pine and oak in the better-drained upland areas. The water table is at or near the surface in much of the region, with large areas of standing water after heavy rainfall. Surface waters are generally colored and acidic, but there are few, if any, natural lakes.

75-27 The **Osceola Slope** is composed of Pleistocene lagoonal deposits with a top layer of medium to fine sands and silts. Elevations are generally 60-90 feet, with Smyrna, Myakka, and Tavares soils on the better-drained low ridges and knolls, and Basinger and Samsula soils in the wet and swampy areas adjacent to parts of some lakes. Vegetation is primarily pine flatwoods, but some low, dry ridges have turkey oak and sand scrub. Osceola Slope lakes are acidic, relatively low nutrient, colored lakes. The lakes have lower color, pH, alkalinity, conductivity, and nutrient values than lakes in the Kissimmee/Okeechobee Lowland (75-35).

75-28 The northern part of the **Pinellas Peninsula** is underlain by deeply weathered sand hills of the Miocene-age Hawthorn Group, with Pleistocene-age sand, shell, and clay deposits in the south. Besides the coastal strand, the natural vegetation consisted of longleaf pine/xerophytic oak in the northwest, and pine flatwoods in the southeast. The dominant characteristic of the region now is the Clearwater/St. Petersburg urbanization. Several small, high nutrient lakes are found in this region, and the nutrient levels may be a result of phosphoritic pebbles in the Hawthorn Group sediments, as well as due to anthropogenic impacts. Alkalinity, pH, and conductivity values are also very high.

75-29 The **Wimauma Lakes** region is a very small area that includes only two lakes, Lake Wimauma and Carlton Lake. These are clear, acidic, low nutrient, small water bodies. The soils in this area are a complex mosaic of alkaline and acid sands. The existence of other relatively anomalous clear, acidic, oligotrophic lakes within the Southwestern Flatlands (75-36) region is not known, although there are probably very few others similar to Wimauma and Carlton.

75-30 The **Lakeland/Bone Valley Upland** region includes the sand hills of the Lakeland Ridge, and the more poorly drained flatwoods areas of parts of the Bone Valley Uplands and Bartow Embayment. All of these areas are covered by phosphatic sand or clayey sand from the Miocene-Pliocene Bone Valley Member of the Peace River Formation. The region generally encompasses the area of most intensive phosphate mining, but phosphate deposits and mining activities are also found south of this region. As one would expect, the dominant characteristic of all lakes in this region is high phosphorus, nitrogen, and chlorophyll *a* values. The lakes are alkaline, with some receiving limestone-influenced groundwater.

75-31 The **Winter Haven/Lake Henry Ridges**, an upland karst area 130-170 feet in elevation, has an abundance of small to medium sized lakes. Candler-Tavares-Apopka is the soil association of the well-drained upland areas, with longleaf pine and xerophytic oak natural vegetation. Pliocene quartz pebbly sand and the phosphatic Bone Valley Member (Peace River Formation) comprise the underlying geology. The lakes can be characterized as alkaline, moderately hardwater lakes of relatively high mineral content, and are eutrophic.

75-32 The **Northern Lake Wales Ridge** lake region extends from the Clermont Uplands in Lake County to the Livingston Creek drainage in Highlands County. The narrow ridge, 100-300 feet in elevation, forms the topographic crest of central Florida. The well-drained sandy soils are dominated by the Candler-Tavares-Apopka association, covered by citrus groves, pasture, and urban and residential development. The lakes are mostly alkaline, low to moderate nutrient, clearwater lakes. Nitrogen values tend to be high. These lakes are richer in nutrients than lakes in the Southern Lake Wales Ridge (75-33).

75-33 The **Southern Lake Wales Ridge** region contains part of the southern ridge and the Intraridge Valley where there are mostly clearwater lakes. Elevations range from 70-150 feet, and soils are generally in the sandy, well-drained Astatula-Paola-Tavares association. The landcover is primarily citrus groves, with rapidly expanding urban and residential areas. Lakes in the region range from acidic to alkaline, but almost all are clear with low color and low nutrients.

75-34 The **Lake Wales Ridge Transition** includes the ridge margin or transition lakes that are darker colored with higher nutrients than the lakes found on the Southern Lake Wales Ridge (75-33). Elevations are 70-130 feet, and there are more extensive areas of poorly-drained soils, such as the Satellite and Basinger series. Peaty muck Samsula soils border many of the lakes. The lake region also includes the narrow Bombing Range Ridge on the east, and a small area of upland soils near Lake Buffum on the west. Most of the lakes are acidic, although about one-third of them tend to be alkaline. They have low to moderate nutrients, and are slightly to moderately colored.

75-35 The **Kissimmee/Okeechobee Lowland** region includes most of the Kissimmee Valley, a lowland with prairie type grasslands, flatwoods, and some swamp forest. The wet prairies are seasonally flooded, and dry prairies on seldom-flooded flatland have mostly been converted to pasture. Pleistocene lagoonal deposits of coastal sand and shelly silty sand characterize the geology. Lakes are alkaline, eutrophic, and colored. The shallow, subtropical Lake Okeechobee is one of the largest lakes in the United States. Encircled by a flood-control dike, the lake serves as a water supply for urban and agricultural areas, as well as supporting habitat for migratory waterfowl and a valuable fishery.

75-36 The **Southwestern Flatlands** lake region includes barrier islands, Gulf coastal flatlands, and gently sloping coastal plain terraces at higher elevations. The elevations range from sea level to 150 feet. Much of the pine flatwoods and wet and dry grassland prairies have been converted to extensive areas of pasture, rangeland, and young citrus groves. Coastal areas are rapidly urbanizing. Lakes in this region range from slightly acidic to alkaline, but almost all are eutrophic and have dark colored water. Some lakes at the higher elevations near the upland ridges have more moderate levels of nutrients and color, similar to the Lake Wales Ridge Transition region (75-34).

75-37 The **Immokalee Rise** is an area of slightly elevated land, 25-35 feet, that includes the Immokalee Rise, Corkscrew Swamp, and Devils Garden areas. Pine flatwoods and wet prairies are dominant natural vegetation types. Poorly-drained sandy soils overlie Miocene-age sands and clays or Pleistocene-age calcareous sand and shell deposits. Lake Trafford is the largest lake in the region. It is an alkaline, hardwater lake of high mineral content and high nutrients. There are few other lakes in the region, and these tend to be small, swampy, and seasonal.

Although still threatened by habitat loss and toxic contamination, alligator populations have increased in Florida lakes and wetlands since the 1970s.

Tannic, acidic water from the Green Swamp (75-26) colors the water of Lake Louisa in the adjacent Clermont Upland region (75-19).

Urban and suburban modifications to lakes are common in the Orlando Ridge region (75-21).

Although citrus groves can increase nitrogen inputs to lakes, their effect on lake eutrophication may be less than suburban development because many lakes in the citrus belt are phosphorus-limited.

Phosphate mining on the Bone Valley Member of the Peace River Formation is widespread in region 75-30, and surface waters are nutrient-rich.

Residential land inputs and stormwater runoff contribute nutrients to this algae-dominated lake in an area of low-nutrient clearwater lakes (75-33).

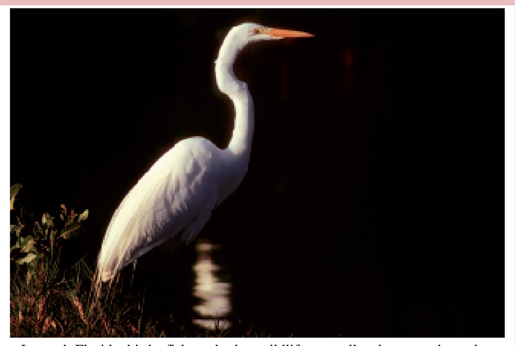
A few small ponds occur on the freshwater marl prairie of the Everglades.

76-01 The **Everglades** lake region begins south of Lake Okeechobee to include the Everglades Agricultural Area, the water conservation areas, and the sawgrass and sloughs of the national park. The flat plain of saw-grass marshes, tree-islands, and marsh prairies, with cropland in the north, ranges in elevation from sea level to twenty feet. Peat, muck, and some clay are the main surficial materials over the limestone. Wide sloughs, marshes, and some small ponds contain most of the surface waters in this "River of Grass" region. Canals drain much of the water in some areas.

76-02 The **Big Cypress** is a flat region, 5 to 30 feet in elevation and slightly higher than the Everglades, covered by pine flatwoods, open scrub cypress, prairie type grasslands, and extensive marsh and wetlands. Poorly drained soils overlie limestone, calcareous sandstones, marls, swamp deposit mucks, and algal muds. Lakes are generally absent from the region.

76-03 The **Miami Ridge/Atlantic Coastal Strip** is a heavily urbanized region, sea level to 25 feet in elevation, with coastal ridges on the east and flatter terrain to the west that grades into the Everglades. The western side originally had wet and dry prairie marshes on marl and rockland and sawgrass marshes, but much of it is now covered by cropland, pasture, and suburbs. To the south, the Miami Ridge extends from near Hollywood south to Homestead and west into Long Pine Key of Everglades National Park. It is a gently rolling rock ridge of oolitic limestone that once supported more extensive southern slash pine forests and islands of tropical hardwood hammocks. The northern part of the region is a plain of pine flatwoods and wet prairie, and coastal sand ridges with scrub vegetation and sand pine. There are very few natural lakes in the region, but three types of ponded surface waters occur: 1) Pits dug deep into underlying "rock" containing water that is clear, high pH and alkaline, with moderate nutrients; 2) Shallow, surficial dug drains that are darker water; and 3) flow-through lakes (e.g., Lake Osborne) that are colored and nutrient rich.

76-04 The **Southern Coast and Islands** region includes the Ten Thousand Islands and Cape Sable, the islands of Florida Bay, and the Florida Keys. It is an area of mangrove swamps and coastal marshes, coral reefs, various coastal strand type vegetation on beach ridge deposits and limestone rock islands. Although freshwater habitats are limited or non-existent in this region, any freshwater that does occur for periods of time may have great ecological significance. Coastal rockland lakes are small in size and number, occurring primarily in the Florida Keys. These waters are alkaline, with high mineral content and highly variable salinity levels. The rockland lakes provide important habitat for several kinds of fish, mammals, and birds of the Keys. Reductions in the fresh groundwater lens that floats on the denser saline groundwater can severely affect these lakes.



In south Florida, birds, fish, and other wildlife, as well as humans, depend on freshwater flows from the Kissimmee/Okeechobee Lowland to the north.