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The Size and Structure of Florida

Florida is bounded by two nearly straight imaginary lines, by three rivers and by a long shore line. The northeastern boundary is formed by the St. Marys River from its mouth to Ellicotts Mound near the head of the North Prong. From Ellicotts Mound, the line runs to the junction of the Flint and Chattahoochee Rivers at the head of Apalachicola River, from which it continues up the Chattahoochee to the thirty-first parallel of north latitude. These boundaries separate Florida from Georgia. The thirty-first parallel and Perdido River separate Florida from Alabama. The Gulf of Mexico, the Straits of Florida, and the Atlantic Ocean complete the circuit. In 1980 the United States Census Bureau reported these boundaries to enclose an area of 58,677 square miles: 54,153 square miles of land and 4,424 square miles of water. In 1990 the numbers changed to a total of 59,928 square miles: 53,937 square miles of land, 5,991 square miles of water (inland and coastal.) The 2010 Census revised the figures to a total of 65,757 square miles: 53,624 square miles of land, 12,133 square miles of water.

Floridian Plateau

The State of Florida occupies only a part of a much larger geographic unit, the Floridian plateau. The deep water of the Gulf of Mexico is separated from the deep water of the Atlantic Ocean by a partially submerged platform nearly 500 miles long and about 250 to 400 miles wide. This platform, the Floridian Plateau, is attached to the continent of North America. The core of metamorphic rocks, presumably the continuation of the rocks of the Piedmont region of Georgia, is buried under more than 4,000

feet of sedimentary rock, chiefly limestone, which represents the seaward extension of the rocks making up the Coastal Plain of Georgia and Alabama.

The Floridian Plateau has been in existence for many millions of years, during which it has been alternately dry land or covered by shallow seas. During most of this long time, the plateau appears to have been a very stable region not subject to violent crustal movements, and therefore free from earthquakes of local origin. The principal deformation that it has undergone is a very gentle doming that has made the rocks in the north-central part a little higher than the corresponding beds in other parts of the plateau. Dislocations of the rocks (faults), along which takes place the slipping that causes earthquakes, are completely unknown. The Floridian Plateau is one of the most stable parts of the earth's crust.



Florida State Archives

Junction of three rivers where the Jim Woodruff Dam was built, Chattahoochee, 1947. The Apalachicola River is in the foreground, the Chattahoochee River is to the left, and the Flint River is to the right.

The plateau is broad and nearly level. The highest part of the peninsula projects a little more than 325 feet above sea level and forms the State of Florida. An equally great or greater area is submerged beneath the Gulf of Mexico and a smaller area beneath the Atlantic Ocean north of Palm Beach. Both

of these submerged parts (the Continental Shelf) slope gently away from the land at a rate generally less than 3 feet to the mile. The slope at most places near shore is steeper in the Atlantic than in the Gulf. Beyond a depth of approximately 300 feet, the slope of the sea bottom steepens rapidly.

Coastline of Florida Length in Statute Miles

	General Coastline	General Tidal Shoreline	Detailed Tidal Shoreline
Atlantic Coast	580	618	3,331
Gulf Coast	770	1,658	5,095
Total for Florida	1,350	2,276	8,426

Explanation: “General” coastline is the measurement of the general outline of the seacoast. “Tidal” shoreline includes measurement of bays, sounds and other waterbodies where these narrow to a width of three statute miles. “Tidal shoreline, detailed” takes bays, sounds and other bodies either to the head of tidewater or to a point where such waters narrow to 100 feet.

For more information on coastal trends, both national and Florida-specific, visit the National Oceanic and Atmospheric Administration’s Special Projects website at <http://specialprojects.nos.noaa.gov/focus/socio.html>.

Source: Combined statistics from NOAA, 2004; Florida Department of Environmental Protection, *Economics of Beach Tourism in Florida*; Department of Agriculture Technical Bulletin number 52, 2006.

The Sands of Florida

Source: Florida Geological Survey
www.dep.state.fl.us/geology

There are several substances that color the sands on the beaches of Florida. For the most part, the browns and tans are broken pieces of shell, and these represent the color of the shell itself, which was formed as a precipitant about the living animal. Some iron is included, which causes the tan color. Sometimes the shells are dark grey and lend some color to local beaches.

Florida’s beautiful, white beaches are composed of essentially 100 percent quartz sand that is kept bright by the scrubbing action on the beach. Quartz is normally colorless to white. It makes an exceptionally beautiful beach, such as those found along the Mediterranean Sea and along the Panama City area of the Gulf. If allowed to come to rest for long periods of time, such as in the quiet dunes behind the beaches and in the sands inland from the beach areas of the Panhandle, quartz becomes coated with iron and appears tan to cream-colored.



Florida State Archives

Map of Florida circa 1833

The black color, found in the sands of beaches, is a result of the occurrence of heavy minerals in the ocean, such as rutile and ilmenite, which may be concentrated from about 5 to 20 percent along rills on the beaches. The ilmenite, rutile and other minerals can be mined and separated from the beach sands; thus used for man's benefit. Some beaches, such as those at Venice, Florida, contain large quantities of black, phosphatic material, which consists of fragmented and rounded manatee rib bones, phosphate precipitated from the ocean, animal excretions, and some phosphatized shells.

Land and Water Area: Area of the State and Counties of Florida April 1, 2010
(square miles)

County	Total	Land area	Water area*
Florida	65,757.70	53,624.76	12,132.94
Alachua	968.81	875.02	93.79
Baker	588.97	585.23	3.74
Bay	1,033.15	758.46	274.69
Bradford	300.49	293.96	6.53
Brevard	1,557.00	1,015.66	541.33
Broward	1,322.86	1,209.79	113.08
Calhoun	574.31	567.33	6.98
Charlotte	858.30	680.28	178.02
Citrus	773.29	581.70	191.60
Clay	643.55	604.36	39.19
Collier	2,305.02	1,998.32	306.69
Columbia	801.33	797.57	3.75
DeSoto	639.48	637.06	2.42
Dixie	863.65	705.05	158.60
Duval	918.45	762.19	156.26
Escambia	874.70	656.46	218.24
Flagler	570.83	485.46	85.36
Franklin	1,026.49	534.73	491.77
Gadsden	528.53	516.33	12.20
Gilchrist	355.24	349.68	5.56
Glades	986.85	806.01	180.84
Gulf	755.56	564.01	191.55
Hamilton	519.06	513.79	5.27
Hardee	638.34	637.78	0.56
Hendry	1,190.00	1,152.75	37.25
Hernando	589.02	472.54	116.48
Highlands	1,106.04	1,016.62	89.42
Hillsborough	1,265.77	1,020.21	245.55
Holmes	489.05	478.78	10.27
Indian River	617.01	502.87	114.13
Jackson	954.56	917.76	36.80

County	Total	Land area	Water area*
Jefferson	636.54	598.10	38.44
Lafayette	547.91	543.41	4.50
Lake	1,156.96	938.38	218.58
Lee	1,212.46	784.51	427.95
Leon	701.79	666.85	34.94
Levy	1,412.80	1,118.21	294.59
Liberty	843.12	835.56	7.56
Madison	715.68	695.95	19.74
Manatee	892.68	742.93	149.75
Marion	1,662.61	1,584.55	78.06
Martin	752.83	543.46	209.37
Miami-Dade	2,431.18	1,897.72	533.47
Monroe	3,737.52	983.28	2,754.24
Nassau	725.92	648.64	77.28
Okaloosa	1,082.08	930.25	151.83
Okeechobee	891.91	768.91	123.00
Orange	1,003.26	903.43	99.83
Osceola	1,505.91	1,327.45	178.45
Palm Beach	2,383.01	1,969.76	413.25
Pasco	868.45	746.89	121.57
Pinellas	608.13	273.80	334.33
Polk	2,010.55	1,797.84	212.71
Putnam	826.92	727.62	99.30
St. Johns	821.53	600.66	220.87
St. Lucie	688.11	571.93	116.18
Santa Rosa	1,173.78	1,011.61	162.17
Sarasota	725.34	555.87	169.48
Seminole	345.29	309.22	36.07
Sumter	579.83	546.93	32.89
Suwannee	692.26	688.55	3.70
Taylor	1,232.20	1,043.31	188.90
Union	249.75	243.56	6.20
Volusia	1,432.44	1,101.03	331.40
Wakulla	735.73	606.42	129.31
Walton	1,239.60	1,037.63	201.97
Washington	615.95	582.80	33.15

*Water area measurement figures in the 2010 census data reflect all water, including inland, coastal, territorial, new reservoirs, and other man-made lakes.

Source: Florida Statistical Abstract 2011; U.S., Department of Commerce, Census Bureau, Geography Division, Internet site <<http://www.census.gov/>> (accessed 25, March 2011).

Fossils

Florida's fossil record is unusually interesting. Particularly impressive is the record of the Late Pleistocene Age, a geologic period extending 20,000 to 200,000 years ago. Fossils of lions, sabertooth tigers, mammoths, horses, camels and giant armadillos are in many limestone deposits.

For more information on Florida Fossils, visit the Florida Museum of Natural History website at <http://www.flmnh.ufl.edu/exhibits/always-on-display/florida-fossils/>.

Source: Florida Trail, U.S. Department of the Interior

Although the Pleistocene is generally termed the Ice Age, the ice cap did not reach as far south as Florida and the woolly mammoth was never a resident of the peninsula. The remains of the Imperial and Columbian mammoths are among the most common fossil finds in Florida.

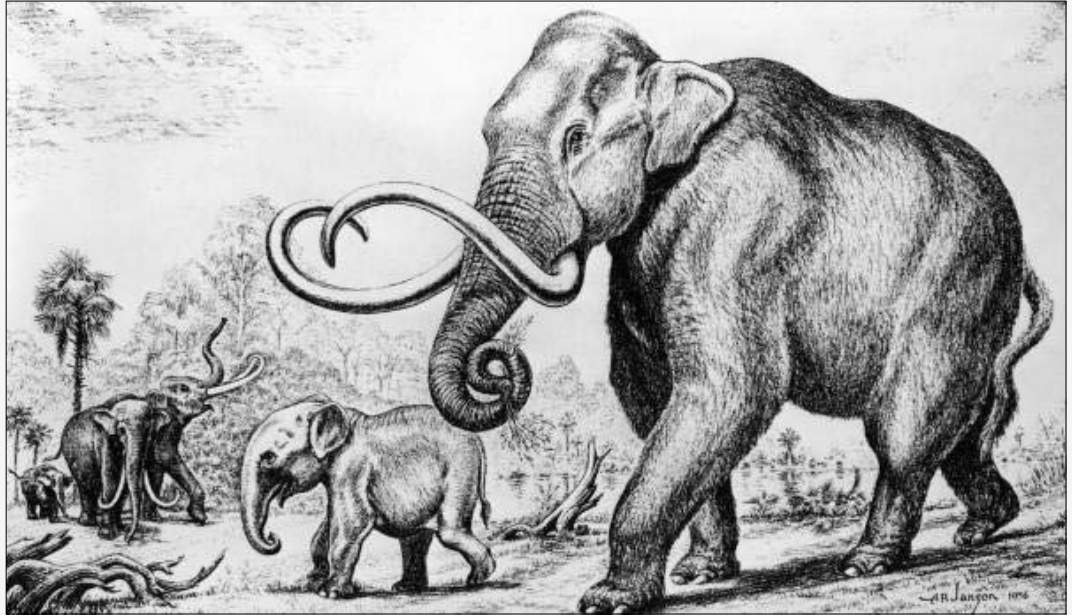


Illustration by Andrew R. Janson

How Florida's Lakes Are Formed

Source: Florida Geological Survey

<http://www.dep.state.fl.us/geology/>

Limestone and dolostone are sedimentary rocks that are composed of calcium- and magnesium-carbonates. These make up the large part of the subsurface of Florida. These rocks are soluble in pure water, with the lapse of long periods of time, under conditions where the structure and composition of the rock favor solution in moving water. In the waters of Florida, this limestone is readily dissolved because the humid climate and prolific vegetation contribute organic and mineral acids to water and make it a highly potent solvent capable of dissolving large amounts of the rock.

The ultimate source of all of Florida's groundwater is rain and moisture from the air. As this moisture is mixed or absorbed in the air it becomes charged with carbon dioxide gas to form carbonic acid. On the ground humic acids from rotting vegetation are added. These are the common natural solvents of limestone. A good portion of this acid-charged water soaks into the ground, and as it moves through limerock small portions of the rock are dissolved. However, relatively little solution occurs until sufficient water enters the rock to completely fill all the available pores. In this portion of the rock, saturated with water and bathed with weak acids, the solution is most active.

Limestone is as a rule jointed vertically and bedded horizontally. Openings along these joints and beds provide easy avenues of travel for water. Because of the pressure of water entering the rock, ground water tends to move horizontally along bedding planes which offer the easiest exit. Thus, cave systems generally

are developed horizontally and one system may lie over another and they may be connected by vertical tubes and rooms.

Any rain water entering the rock from the surface makes its way downward to fill completely all the pores of the rock at some depth. As it moves downward and then into the saturated rock through pores and open spaces it acts as a slow solvent to increase the size of the openings and to connect them to form a continuous system of channels through which streams may run.

As large caverns are formed, solution cavities of irregular shape are gradually cut out and enlarged. Some of these may be expanded to a point near the surface where surface deposits (largely sand in Florida) will deform into the cavern and a sink is formed. The larger part of Florida's natural lakes, sinks, depressions and ponds are the result of the solution of the underlying limestone. These features range from small pits a few feet in diameter to large depressions several miles broad. Many are perfectly round, others are highly irregular. Some are cone-shaped with rocky bottoms; some have broadly developed flat bottoms and are known as prairies. Still others are vertical tubes, only a few inches in diameter in some cases, that extend as much as one hundred feet down into the limestone. These are "natural wells." Many sinks are dry, but many more are filled with water. The lake water may represent the exposure of the shallow water-table which continues into the lake basin walls to form ground water. Other lakes are composed of artesian water that rises to fill the basin.

Other lake basins are formed by the sea as low places upon a platform of a former sea-bottom. Irregularities in sand dunes blown up from the beaches may cut below the ground-water table and form a lake.

Along some of the Panhandle streams, the association of a stream carrying a heavy sedimentary load with a stream that is clear and spring fed has resulted in the more rapid fill of some valleys and the drowning of the mouths of others to create large lakes. Dead Lake, on the Chipola, is a good example of this type of lake.

Area of Lakes

Source: U.S. Geological Survey

<http://www.usgs.gov/>

Lake Okeechobee is a remnant of a shallow sea, known as the Pamlico Sea, which once occupied what is now the Everglades-Lake Okeechobee basin. This basin was formed when the Florida plateau emerged from the ocean as a result of movement of the earth's crust. Lake Okeechobee, although large in surface area, is shallow, and probably contains less than two cubic miles of water.

Lake Okeechobee is the second largest fresh-water lake entirely within one state. Alaska has the largest freshwater lake, covering 1,033 square miles. Utah's Great Salt Lake, the largest salt lake, covers 1,500 square miles. Lake Okeechobee is the fourth largest natural lake entirely within the United States, Lake Michigan, which touches Wisconsin, Illinois, Indiana and Michigan, being the largest, with 22,400 square miles.

Conservation area No. 3, of the Central and Southern Florida Flood Control District, in the Ever-



Photo by Donn Dughi

glades, has a surface area of 914.5 square miles. It is the largest artificial reservoir in the state.

Natural Fresh-Water Lakes of 10 Square Miles or More in Florida

Source: Florida Fish and Wildlife Conservation Commission <http://myfwc.com/>

Lake	County	Area (sq. miles)
Okeechobee	Hendry, Glades, Okeechobee, Martin, Palm Beach	700
George	Putnam, Marion, Volusia, Lake	71.8
Kissimmee	Osceola, Polk	54.6
Apopka	Orange	47.9
Istokpoga	Highlands	43.2
Tsala Apopka	Citrus	29.8
Tohopekaliga	Osceola	29.3
Griffin	Lake	25.7
Crescent	Putnam	24.9
Harris	Lake	21.5
Orange	Alachua, Marion	19.8
E. Tohopekaliga	Osceola	18.7
Jessup	Seminole	15.6
Monroe	Seminole, Volusia	14.6
Talquin	Gadsden, Leon	13.8
Eustis	Lake	12.1
Weohyakapka	Polk	11.7
Newnan	Alachua	11.6
Hatchineha	Polk, Osceola	10.4
Blue Cypress	Osceola, Indian River	10.2

The Tallahassee Meridian

A small marker southeast of the Capitol in Tallahassee symbolizes the point of beginning for nearly all land descriptions in Florida. The Tallahassee meridian is the zero point from which surveyors identify Florida land.

Highest Known Point

The State Bureau of Geology says the highest known surveyed elevation in Florida is Britton Hill, located in the northeastern part of Walton County. The elevation has been fixed at 345 feet and is just south of the community of Lakewood, located at 30°59'16" N latitude by 86°16'55" W longitude. The Britton Hill website (<http://americasroof.com/fl.shtml>) says it is the lowest high point in the U.S.

Iron Mountain, site of Bok Tower near Lake Wales in Polk County, was regarded for years as the

state's highest known point. This was based upon a private topographic survey which fixed the elevation at 324 feet. An official survey indicated Iron Mountain to be slightly higher than 290 feet but less than 300 feet.

Semiprecious Stones

Chalcedony of rare beauty and structure is found along the valleys of the Suwannee, Santa Fe, Hillsborough and other rivers that have eroded the sediments of the Tampa and Hawthorn formations. In former years, before the expansion of the City of Tampa, excellent collections could be had at numerous places along the shores of Hillsborough Bay. Rare and sometimes excellent specimens were recovered there from dredge tailings. At Davis Island and Ballast Point, which were classic collection areas, heavy seas mined and rolled out good examples of these stones.

These lovely stones are coral heads, the calcite of which has been replaced by chalcedony. The heads range from complete, cherty replacements with solid interiors to heads with large cavities that are lined with layers of black onyx, carnelian, sard, sardonyx, or agate of radiant and varying color combinations. The cavity-type heads, called geodes, are the most sought after for gem purposes.

The original material of the coral, formed as a case about itself by the animal, has been replaced with all of the structure and shape of the coral having been preserved. These pseudomorphs were formed by water dissolving the coral head and simultaneously depositing an equal volume of silica from solution.

This chalcedony is commonly called agatized coral and was named Florida's state stone in 1992.



Florida State Archives

Postcard showing glass-bottom boats at Silver Springs, Ocala.

Springs

There are more than 720 known springs in Florida, with more to be recorded.

Florida's springs represent natural groundwater discharge from the State's vast groundwater storage and circulation systems known as aquifers. In 2006, The Florida Geological Survey determined a conservative estimate of their combined discharge as being over 11 billion gallons a day. In 2005, 6.8 billion gallons per day of freshwater were used in the State for public supply, agricultural, industrial, domestic and thermoelectric power purposes. By comparison,

in 2000 all fresh groundwater pumped in Florida totaled 8.1 billion gallons per day and 5.6 billion gallons per day in 1970.

Springs vary in flow daily, seasonally and from year to year. The flow is related to variations in rainfall, although man's use of ground water affects the flow of some springs. During periods of little rainfall, spring flow, stream flow, and groundwater levels all decline, just as they increase during wet periods.

The springs of Florida are used to a limited degree as a source of water supply by agriculture and industry; however, their primary use is recreational. For this they are well suited because of the natural

beauty of their surroundings, their normal clarity and consistently moderate temperature and the seemingly subtle mystery of water upwelling from the earth. Private spring attractions and parks are a multimillion dollar industry.

First Magnitude Springs

Springs may be classified by the average quantity of water they discharge. First magnitude, 64.6 million gallons per day (mgd) or greater; second magnitude, 6.46 mgd to 64.6 mgd; third magnitude, .646 mgd to 6.46 mgd; fourth magnitude, less than 0.646 mgd.

Florida has more first magnitude springs than any other state: 33. Their total average flow is 2131.8 mgd, or 19 percent of the average flow of all springs in Florida. Silver Springs, with an average flow of 550 mgd, is the largest non-coastal spring although Wakulla Spring has the greatest instantaneous measured flow and also the greatest range of flow. Coastal springs can have a higher discharge than non-coastal springs but their discharge is more variable due to tidal effects.

Why Springs?

Florida is underlain by a thick sequence of limestone and dolomite. These sedimentary rocks were deposited in shallow seas that, at various times in the geologic past, inundated the state. In many places these rocks contain numerous small and large interconnected cavities or caverns that have resulted from solution and removal of limestone by circulating fresh ground water. The fresh water derived from rainfall infiltrated the rocks after the sea level declined and left the surface of Florida above sea level. The majority of Florida's springs emerge from cavities where the rocks open at the land surface. A few springs seep from permeable sands or shell beds that have been deposited over the limestone. These springs are generally small compared with the ones that flow from limestone, and they also are more likely to go dry during long periods of little or no rainfall.

A spring is overflow or leakage from an underground reservoir (aquifer). The source of Florida ground water is rainfall that seeps into the ground

and recharges aquifers in northern and central Florida and southern Alabama and Georgia, where rocks of the aquifers are at or near land surface. Most springs in Florida are permanent, that is, they flow year round.

The water of most Florida springs is of excellent quality. It is low in salinity and of moderate hardness depending, at least in part, on how long the water has been in storage in the aquifer. Dissolved solids are generally less than 250 milligrams per liter (mg/l). The average total dissolved solids of U.S. tap water ranges between 170-410 mg/l. Spring temperatures range between 68° and 77° Fahrenheit (20° to 25° Celsius). Springs located in the southern part of the State tend to be the warmest.



Florida State Archives

Frances Dwight performs underwater ballet as viewed from a theater 8 feet below the surface, Weeki Wachee Springs, 1948.

Spring Names

Spring names used are consistent with previously published reports and maps; local names were used for springs not so identified. Whether “spring” or “springs” appears in the spring-name, bears no relation to whether the spring has a single or a multiple orifice.

NOTE: A listing of first magnitude springs appears in the 1983–1984 and prior editions of *The Florida Handbook*.

Water Use: Freshwater Withdrawals by Category of Use (1975-2005)

Category	1975	1980	1985	1990	1995	2000	2005
Total	6,772.75	6,701.22	6,313.34	7,583.58	7,229.92	8,191.77	6,873.13
Public supply	1,124.10	1,406.40	1,685.44	1,925.15	2,079.24	2,436.79	2,540.52
Domestic self-supplied	227.80	243.50	259.29	299.38	296.74	198.68	190.38
Commercial-industrial-mining	882.55	700.32	708.81	769.94	691.83	563.30	488.33
Agricultural irrigation ¹	2,930.60	3,025.40	2,797.81	3,495.22	3,244.10	3,923.01	2,766.18
Recreational irrigation ²	0.00	0.00	181.49	310.03	280.88	411.73	329.64
Power generation	1,607.70	1,325.60	680.50	783.86	637.13	658.26	558.08

¹Withdrawals for crops, livestock, and fish farming.

²Withdrawals for turf grass and landscaping. Included under agricultural irrigation prior to 1985.

NOTE: Values may not be identical to the data reported by the water management districts due to differences in data collection or revisions. Some data may be revised. Detail may not add to totals because of rounding.

Source: *Florida Statistical Abstract 2011*; U.S., Department of the Interior, Geological Survey, Florida Water Science Center, *Water Withdrawals, Use, and Trends in Florida, 2005*, Scientific Investigations Report 2009-5125, Internet site <<http://fl.water.usgs.gov/>> (accessed 15, August 2011).

Natural Bridges

Source: U.S. Geological Survey

<http://www.usgs.gov/>

Most natural bridges in limestone regions were formed by one of two methods—either by the undermining of neighboring sinks along a subterranean stream, or by the gradual diversion of part of a surface stream through a cavern dissolved by seepage through bedrock above a fall or rapid.

Bridges along a subterranean stream are not ordinarily recognized as bridges until they have reached an advanced stage of development. The existence of a bridge made by the diversion of a surface stream may not be suspected until the stream can be seen to sink in one place and to rise in another. The archway of most such bridges in Florida is completely filled with water.

Caverns

Source: U.S. Geological Survey

<http://www.usgs.gov/>

Although the limestones of Florida are honey-combed with caverns, the water table is generally so

high that most of the passages are submerged. Important exceptions are those in the Florida Caverns State Park in Jackson County, three miles north of Marianna. These caverns include connected rooms, with dazzling formations of limestone stalactites, stalagmites, soda straws, flowstones, and draperies which rival in beauty (though on a much smaller scale) the justly famous caverns of the Shenandoah Valley of Virginia.

A cave tour (for a fee) lasts approximately 45 minutes and is considered to be moderately strenuous. www.floridastateparks.org/floridacaverns/

Harbors

Source: U.S. Geological Survey

<http://www.usgs.gov/>

The harbors of all the world occupy basins that have been deepened by the rising sea level that attended the melting of the last great continental ice sheets. The harbors of Florida are no exception. They differ from those of some other regions, however, because of differences in the topography of the land before the advance of the sea upon it.

Many great harbors occur in regions that were

hilly or mountainous or which were trenched by deep valleys. But there were no mountains or deep valleys in Florida. The surface of the Floridian Plateau laid bare by the retreat of the sea during the last Ice Age and submerged again at its close was a very gently sloping plain across which the streams flowed in very shallow valleys. If the shore line during the last Ice Age lay on the steeper slope at the edge of the Plateau, the streams may have cut trenches at its outer margin, but, if so, the trenches did not extend inland as far as the present coast. It thus happens that there are no very deep harbors in Florida. Their depth is no greater than the normal depth of large rivers flowing over soft bottoms.

The Cross-Florida Barge Canal

Source: U.S. Army Corps of Engineers

Among the early reasons for digging a waterway across Florida were: to provide an escape route from Caribbean pirates, to protect coastal shipping in time of war, to speed the mail between Washington and New Orleans, and to stimulate the development of Florida's interior.

As early as 1928, Congress directed an inquiry into the usefulness of a North Florida waterway to reduce by some 600 miles the voyage of ships rounding the peninsula.

Construction of the Cross-Florida Barge Canal, a 185-mile-long waterway across the upper neck of the Florida peninsula, was started February 27, 1964, when President Lyndon B. Johnson detonated an explosive charge near Palatka to ceremonially begin construction.

But on January 19, 1971, President Richard M. Nixon detonated what was to canal advocates another explosive charge by suspending work on the waterway on which some \$50 million had been invested. The President said it was time to "prevent a past mistake from causing permanent damage"

to the uniquely beautiful Oklawaha valley.

Mr. Nixon said he had made his decision on the recommendation of his Council on Environmental Quality. He said the Council told him that "the project could endanger the unique wildlife of the area and destroy this region of unusual and unique natural beauty."

Congress deauthorized the canal in 1986, providing repayment of \$32 million to the State and six counties for money advanced.

When construction was halted, the estimated cost of the waterway was \$169,000,000 to the Federal government and \$16,000,000 to Florida, a total of \$185,000,000. The 12-foot-deep and 150-foot wide barge canal, stretching 107 miles from Palatka on the St. Johns River to Yankeetown on the Gulf of Mexico, was to be a high-level ribbon of water with five navigation locks intended to assure the safety of the natural groundwater level. Completion had been scheduled for 1977.

The U.S. Army Corps of Engineers had completed three of the locks, three highway bridges and 25 miles of canal excavation. Rodman Reservoir, covering about 13,000 acres, was filled in 1968 and attracts thousands of boaters, fishermen and campers.



Florida State Archives

Cross-Florida Barge Canal along US Highway 19, Inglis, circa 1965.

Major Canals of Florida

	<u>Length in miles</u>
Caloosahatchee River (Lake Okeechobee to Gulf)	69
Hillsboro Canal	52
Miami Canal	81
North New River Canal	65
St. Lucie Canal (Lake Okeechobee to Atlantic Ocean)	40
West Palm Beach Canal	42

The Keys

Source: U.S. Geological Survey

<http://www.usgs.gov/>

The limestone floor of the Everglades continues southward beneath the shallow waters of Florida Bay and emerges again in the Florida Keys. These islands are of two types. The eastern keys, which terminate at Loggerhead Key, are long, narrow islands composed of limestone (Key Largo limestone) containing large heads of corals in place, just as they grew. They evidently were formed as a coral reef that grew at the edge of deep water in the Pamlico Sea, to whose surface they did not quite reach. The western keys, which lie behind the eastern keys and extend beyond them to Key West, were merely a shoal in the Pamlico Sea. They are similar in origin to the rim of the Everglades and are composed of the same kind of oolitic limestone. This shoal extended, with a few breaks, westward to the Dry Tortugas. Its continuation beyond Key West is marked by the Marquesas Keys and a few smaller islands.

Florida's Islands

Source: "Islands of America," a special report published by the U.S. Department of the Interior, Bureau of Outdoor Recreation, August 1970

Florida has 4,510 islands 10 acres or larger in size, the second highest total in the U.S. (behind Alaska). The state is third, behind Alaska and Louisiana, in total island acreage, with 840,727 acres.

By size class they number:

10–99 Acres	2,444
100–499 Acres	837
500–999 Acres	1,112
1,000 Acres or more	117

Facts about Streams

Source: Department of Environmental Protection

<http://www.dep.state.fl.us/>

Sunday Rollaway, Bothereation, Fiddlestring Bay and Fodderstack Slough. Whiskey George, Brandy Branch and Rudy Slough. Chassahowitzka, Alapaha, Alaqua, Attapulgas and Loxahatchee.

These imagination-ticklers are the names of a few of the 1,711 streams, rivers, and creeks in Florida. The Department of Natural Resources, now known as the Department of Environmental Protection, catalogued all of the particulars in a publication called the "Gazetteer of Florida Streams" in 1966.

Some noteworthy facts:

Total length of all streams is about 10,550 miles.

Some 277 streams are named after people, 200 after animals, 49 after trees, 44 after colors, seven after towns and three after states—including the improbable California Creek. Okaloosa's Brandy Branch shares its spirituous name with Gin Branch in Liberty County.

The Indian names in many cases have unusual derivations. Chassahowitzka means “hanging pumpkin.” And California may have first been Califonee, which has been translated as “home camp.”

The names are suggestive of historical events, too. Starvation Branch in Liberty County is thought to refer to a famine in this area. Burnt Grocery Creek in Santa Rosa County suggests an outpost was destroyed by fire in the War Between the States.

Lagoons

Source: U.S. Geological Survey

The entire East Coast of Florida is bordered by a once-continuous series of lagoons, which is followed by the Intracoastal Waterway. North of Jacksonville the lagoons have the form of broad salt marshes, through which wander crooked tidal rivers. This northern part of the coast is a continuation of the Sea Island region, which extends northward to Charleston, S.C. South of Jacksonville, the lagoons run parallel to the coast and many of them are broad and open.

Indian River is the longest and one of the straightest lagoons in Florida. It extends from a point about 13 miles north of Titusville to St. Lucie Inlet near Stuart, a length of nearly 120 miles. It is widest (about 5½ miles) near the northern end, where a short passage connects it with Mosquito Lagoon, and a longer, crooked channel passes around the northern end of Merritt Island to Banana River. Its average width is about 2 miles. It is narrower and much obstructed by marshy islands between Sebastian and Vero Beach. Indian River is deepest between Cocoa and Melbourne, where a depth of 10 feet is common and depths of 15 feet are rarely attained. Tidal currents have scoured the narrow channel connecting it with the south end of Banana River to a maximum depth of 27 feet.

The longest river is the St. Johns with a length variously calculated from 273 miles (U.S. Geological Survey) to 318 (State Board of Conservation), that river’s headwaters being so ill defined because of the swampy nature. Rudy Slough in Northwest Florida is the shortest at four-tenths of a mile.

NOTE: A listing of rivers appears in the 1983–1984 and prior editions of *The Florida Handbook*.

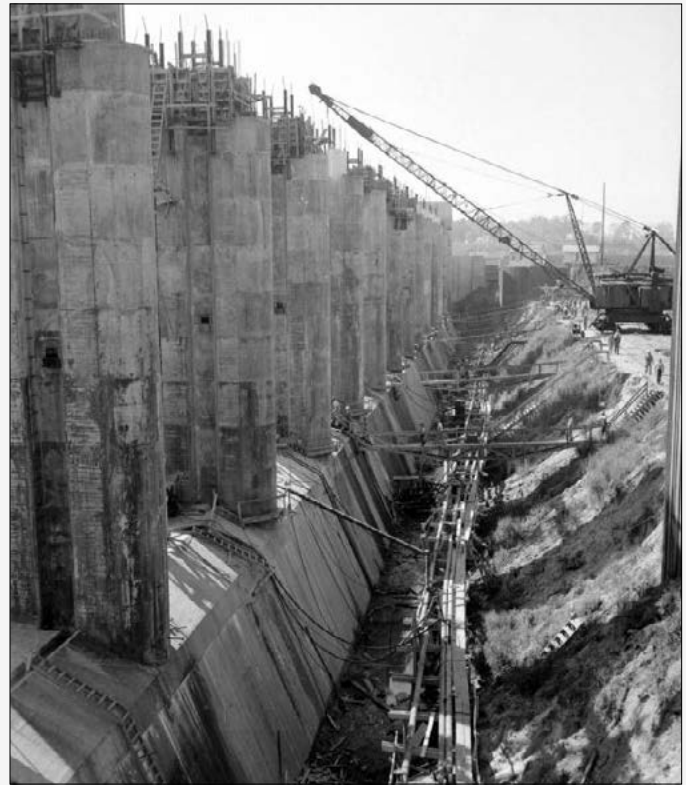


Photo by Red Kerce

Construction of the Jim Woodruff lock and dam, 1953.

Jim Woodruff Lock and Dam

Source: U.S. Army Corps of Engineers

The Jim Woodruff Lock and Dam is located on the Apalachicola River about 1,000 feet below the point where the Chattahoochee and Flint Rivers unite to form the Apalachicola. It lies across the Georgia-Florida state line, about one and a half miles northwest of Chattahoochee, Florida.

The principal purposes are: (1) the provision of navigation channels, nine feet deep by 100 feet wide, in the Chattahoochee River to Columbia, Alabama, and in the Flint River to Bainbridge, Georgia, and (2) the production of hydroelectric power, with an average annual energy output of 220 million kilowatt hours. The dam has also created a large lake for recreational activities.

The lock and dam was designed by the U.S. Army Corps of Engineers and built by private contractors. Construction was started in the fall of 1947 and completed in the spring of 1957 at a cost of \$46.5 million. The project was named for Jim Woodruff, Sr., of Columbus, Georgia, who had, for more than 40 years, advocated development of the rivers for navigation.



Florida Regional Names

In 1952, Mayor Samuel G. Johnson of St. Petersburg organized the Suncoast League of Municipalities and invited cities in counties from Citrus to Collier to become members. Two years later, as the area was preparing to celebrate the opening of the Sunshine Skyway bridge, the *St. Petersburg Times* started referring to the 10-county area from Citrus to Collier as the Suncoast. This was primarily done to popularize a colorful name to compete with the Gold Coast designation of the Palm Beach-Miami area.

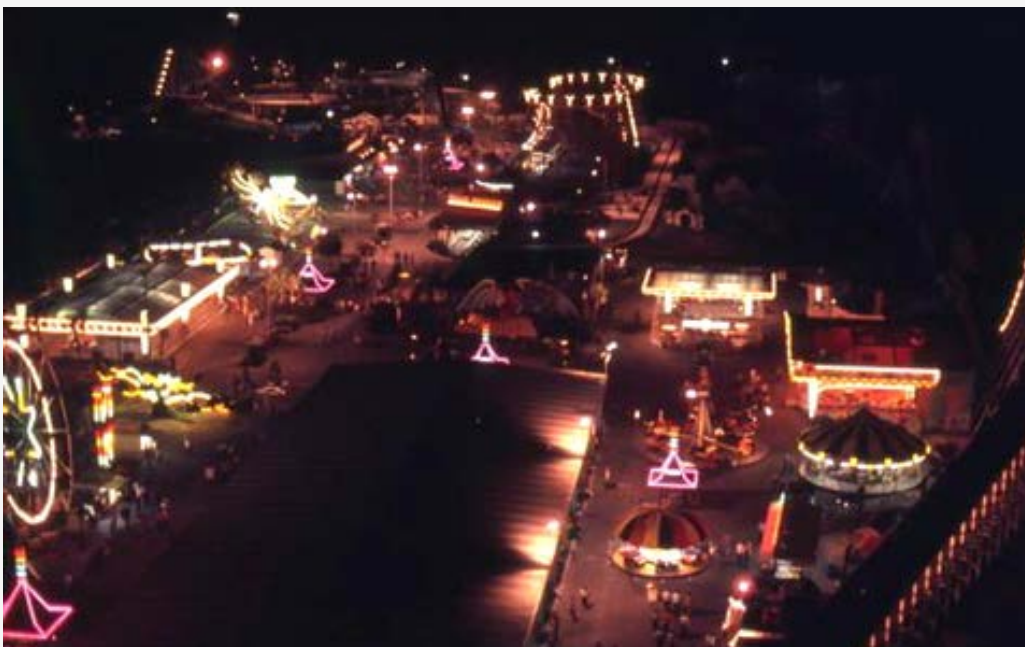
Malcolm B. Johnson, then Editor of the *Tallahassee Democrat*, coined “Big Bend” to designate its dominant circulation area between the Aucilla-Wacissa and the Chipola-Apalachicola river systems. Johnson afterwards said it was a spur-of-the-moment designation “before sober reflection could produce

something like ‘Gulf Bend’ or ‘Apalachee Bend,’ which I would much prefer.”

With hopes of increasing tourism in the area, the 1992 Legislature declared eight counties along the Gulf from Wakulla to Pasco and the city of Dunnellon as the “Nature Coast.”

The northern coast from Panama City to Cedar Key has been called the “Forgotten Coast.” In 2002, St. Joe Company (a Florida-based land development company in the Panhandle), started a movement to call the area “Florida’s Great Northwest.”

The “Florida Crown,” embracing 15 counties fanning out from Jacksonville, was selected in 1964 in a contest sponsored by the Northeast Florida Council of Chambers of Commerce. The name was separately proposed by two Jacksonville men, Ken-



The “Miracle Strip” amusement park at night, Panama City, 1975. Family-owned, the park was opened by Jimmy Lark in 1963 and closed by Billy Lark in 2004.

Photo by Karl E. Holland

neth H. Smith and William A. Heard. The judges said “Florida Crown” made clear the location of the area in relation to the rest of the state and that it suggested solidity, influence, and historical background. By 1984, however, the name “Florida Crown” had given way to “Florida’s First Coast,” embracing Baker, Clay, Duval, Nassau, and St. Johns counties.

A roving newsman, Claude Jenkins, first used the name “Miracle Strip” in the Defuniak Springs weekly, *The Breeze*, having been struck by the beauty of the coast after topping a hill in Walton County where U.S. 98 runs along the Gulf of Mexico. The “Miracle Strip” is regarded as being the area of coast between Panama City Beach and Fort Walton Beach. More recently it has been called the “Emerald Coast.” The informal tag of “Redneck Riviera” will likely disappear as expensive homes and condominiums replace small motels and amusement park rides.

The Cocoa newspaper *Florida Today* refers to Brevard and Indian River Counties as the “Space Coast.” Eric Lassiter of *Florida Today* reports Indian River County is also sometimes referred to as part of the “Treasure Coast,” which includes Martin, St. Lucie, and Palm Beach counties.

There are other, more local designations such as Imperial Polk (county), The Magic City (Miami), America’s Riviera (Coral Gables), City Beautiful (Orlando), Cigar City (Tampa), City of Azaleas (Palatka), City of Five Flags (Pensacola), Cultural Coast (Sarasota, Anna Maria Island, Siesta Key and Lido Key) and Lee Island Coast (Lee County’s coastline).



Photo by Thomas E. Liddle, Jr.

Miami Beach, circa 1965. Miami was once called “The Magic City.”



Climate and Weather

Geographic Facts

Never more than 95 miles wide, the Florida peninsula does not end its meanderings until its last land formation is some 600 miles south of the southern boundary of the state of California.

Yet, Florida is not quite in the tropics (if we are to be technical), lacking a hundred miles. The state lies between the 31st and 24th parallels, North latitude. The southern tip of Florida is 1,700 miles north of the equator, but is nearer the equator than any other part of the continental United States.

Topographic features: Florida, situated between latitudes 24° to 30' and 31°N. and longitudes 80° and 87° 30'W., is largely a lowland peninsula comprising about 54,100 square miles of land area and is surrounded on three sides by the waters of the Atlantic Ocean and the Gulf of Mexico. Countless shallow lakes, which exist on the peninsula and range in size from small cypress ponds to Lake Okeechobee, account for approximately 4,400 square miles of additional water area.

No point in the state is more than 70 miles from salt water, and the highest natural land in the Northwest Division is only 345 feet above sea level. Coastal areas are low and flat and are indented by many small bays or inlets. Many small islands dot the shorelines. The elevation of most of the interior ranges from 50 to 100 feet above sea level, though gentle hills in the interior of the peninsula and across the northern and western portions of the state rise above 200 feet.

A large portion of the southern one-third of the peninsula is the swampland known as the Everglades.

An ill-defined divide of low, rolling hills, extending north-to-south near the middle of the peninsula and terminating north of Lake Okeechobee, gives rise to most peninsula streams, chains of lakes, and many springs. Stream gradients are slight and often insufficient to handle the runoff following heavy rainfall. Consequently, there are sizable areas of swamp and marshland near these streams.

Soils are generally sandy and low in natural fertility, the main exception being a large area of peat and muck soils in the Everglades. About one-third of Florida's soils can be classified as uplands or ridge soils that are generally well- to excessively well-drained. Soils in the remaining two-thirds of the state, including the muck soils, generally have imperfect to very poor natural drainage. Large areas of Florida are underlain by compact subsoils that intensify the effects of both wet and dry weather.

Climate

The climate is probably Florida's greatest natural resource. General climatic conditions range from a zone of transition between temperate and subtropical conditions in the extreme northern interior to the tropical conditions found on the Florida Keys. The chief factors of climatic control are: (1) latitude, (2) proximity to the Atlantic Ocean and Gulf of Mexico, and (3) numerous inland lakes. Summers throughout the state are long, warm, and relatively humid; winters, although punctuated with periodic invasions of cool or occasionally cold air from the north, are mild due to the southerly latitude and relatively warm adjacent sea waters. The Gulf Stream, which

flows around the western tip of Cuba through the Florida Straits and northward around the lower east coast, exerts a warming influence to the southern east coast largely because the predominate wind direction is easterly. Coastal areas in all sections of the state average temperatures slightly warmer in winter and cooler in summer than do inland points at the same latitude.

Some Climatic Extremes

Some notable Florida climatic extremes are: Highest recorded temperature, 109° at Monticello on June 29, 1931; lowest recorded temperature, -2° at Tallahassee on February 13, 1899; and greatest 24-hour rainfall, 38.7 inches on September 5–6, 1950, at Yankeetown.

Tropical Climate

Visitors can experience a tropical climate in Florida. A tropical climate is defined as one in which the average temperature of the coldest month is 64.4° or above. The climate along the east coast from Vero Beach southward and along the west coast from Punta Gorda southward fits that definition.



Postcard image by Curt Teich

Flamingos in Sarasota Jungle Gardens, 1955.

Temperature

Mean annual temperatures range from the upper 60s in the northern sections to the middle 70s on the southern mainland, and reach nearly 78° at Key West. Summertime temperatures are about the same throughout the state, 81° to 82°; during the coolest months, temperatures average about 13° lower in the north than in the south. July and August average the warmest in all areas, and December and January average the coolest in the northern and central areas. January and February, on the average, are the coolest months in the extreme south and in the Keys.

Wintertime minimum temperatures are deceptive. While stations in northern Florida can record 10 to 20 days a year with minimum temperatures of 32° or below, there have been fewer than 10 days in the past 75 years at Jacksonville where the maximum temperature for the day has failed to climb above freezing.

Maximum temperatures during the warmest months average near 90° along the coast and slightly above 90° in the interior; minimum temperatures average in the low 60s but are slightly higher along the immediate coast and in the Keys than inland. During June, July, and August, maximum temperatures exceed 90° on about 2 days in 3 in all interior areas; in May and September, 90° or higher can be expected about 1 day in 3 in the northern interior and about 1 day in 2 in the southern interior. Extreme heat waves, characteristic of continental districts, are felt occasionally—but in a modified form—over the northern interior. Temperatures of 100° or higher are infrequent in the northern sections, rare in the central portion, and practically unknown in the southern areas. The summer heat is tempered by sea breezes along the coast and by frequent afternoon or early evening thunderstorms in all areas. During the warm season, sea breezes are felt almost daily within several miles of the coast and occasionally

20 to 30 miles inland. Thundershowers, which on the average occur on about half the summer days, frequently are accompanied by a rapid 10° to 20° drop in temperature, resulting in comfortable weather for the remainder of the day. Breezes occur almost daily in all areas and serve to further mitigate the oppressiveness that otherwise would accompany the prevailing summer temperature and humidity conditions. Since most of the large scale wind patterns affecting Florida have passed over water surfaces, hot drying winds seldom occur.

Annual and Seasonal Rainfall

Rainfall in Florida is quite varied both in annual amount and in seasonal distribution. Individual station annual averages range from about 50 to 65 inches. In the Florida Keys, annual averages are only about 40 inches. The main areas of high annual rainfall are in the extreme northwestern counties and at the southern end of the peninsula. Rainfall varies greatly from year to year. Many localities have received more than 80 inches in a calendar year and a few places more than 100 inches. In contrast, most all localities have received less than 40 inches in a calendar year.

The distribution of rainfall within the year is quite uneven. In the summer “rainy season,” there is close to a 50-50 chance some rain will fall on any given day. During the remainder of the year, the chances are much less, some rain being likely on 1 or 2 days per week. The seasonal distribution changes somewhat from north to south. In the northwestern areas there are two high points—late winter or early spring and again during summer—and one pronounced low point in October; a secondary low point occurs in April and May. On the peninsula, the most striking features of the seasonal distribution are the dominance of summer rainfall (generally more than half the average annual total falls in the 4-month period, June through September) and the rather abrupt start and end of the summer “rainy season” (June average rainfall tends to be nearly double that of May, and in fall, the average for the last month of the wet season tends to be about double that of the following month). October, on average, is the driest month in northwest Florida but in general is among the wettest on the southeast coast and Keys. The start and end of

the “rainy season” varies considerably from year to year. According to past records, it has begun as soon as early May and has been delayed as late as June. Late September or early October usually marks the end of the wet season except for a narrow strip along the entire east coast where relatively large October rainfalls are frequently noted. The tendency for relatively large October rainfall diminishes quite rapidly westward.



Tallahassee Democrat Collection

Lynda West, 13, Gary Buiman, 12, and Jean Buiman, 11, swim in the rain-flooded front yard of R.L. West, Tallahassee, September 1957.

Summer Rainfall

Most of the summer rainfall is derived from “local” showers or thundershowers. Many places average more than 80 thundershowers per year, and some average more than 100. Showers are often heavy, usually lasting only an hour or two, and generally occur near the hottest part of the day. The more severe thundershowers are occasionally attended by hail or locally strong winds which may inflict serious local damage to crops and property. Day long summer rains are usually associated with tropical disturbances and are infrequent. Even in the wet season, the duration of rainfall is generally less than 10% of the time. Because most summer rains are local in character, large differences in monthly and annual totals at nearby points are common, but these differences disappear when comparison is made on the basis of long period averages. However, large differences in the long period averages do exist within short distances. For ex-

ample, the normal annual rainfalls for Miami Beach and the Miami Airport are 46.26 and 59.76 inches, respectively, yet it is less than 10 airline miles from the beach to the airport. Similar conditions undoubtedly exist elsewhere among the immediate coast.

Droughts

Florida is not immune from drought even though annual rainfall amounts are relatively large. Prolonged periods of deficient rainfall are occasionally experienced even during the time of the expected “rainy season.” Several such dry periods in the course of a year or two can lead to lowered water tables and lake levels which, in turn, may cause serious water shortages for those who depend upon lakes and shallow wells for water.

Worst Drought

Florida’s second worst drought since 1895 occurred in 2007.

Florida’s worst drought in recorded history occurred in 2000. By midyear in parts of north Florida the rainfall deficit was 20 inches for the year, 42 inches for the previous 30 months, and 70 inches overall since 1995.

Since 1950, droughts have occurred in south Florida in 1955-56, 1961-62, 1970-71, 1980-82, 1984-85, 1998-2002, and 2006-07. During the 2006-07 drought (a 1-in-100-year event) in July, 2007, Lake Okeechobee dropped to the lowest water level recorded to that time, 8.82 feet.

Frost and Freezing

Although average minimum temperatures during the coolest months range from the middle 40s in the north to the middle 50s in the south, no place on the mainland is entirely safe from frost or freezing. An occasional cold wave of the more severe type brings minimums ranging from 15° to 20° over the northern areas to freezing or below to the southern limits of the peninsula. These cold waves, except in rare instances, seldom last more than 2 or 3 days at a time. It is extremely rare for temperatures to remain below freezing throughout the day at any place. On the first night of a cold wave, there usually is con-

siderable wind which, because of the continual mixing of the air, prevents marked temperature differences between high and low ground. By the second night, winds usually have subsided and radiational cooling under clear skies accelerates the temperature fall after sundown. On such occasions, marked differences in temperature are noticeable at places not far apart, depending upon such factors as topography and proximity to bodies of water. These facts are of primary concern in selecting sites for growing plants not tolerant of cold.

Some winters—occasionally several in succession—pass without widespread freezing in the southern areas; others may bring several severe cold waves. Winters with more than one severe cold wave interspersed with periods of relative warmth are especially distressing to the agriculture industry because the later freeze almost always finds vegetation in a tender stage of growth and highly susceptible to additional cold damage.

Snowfall

Snowfall in Florida is unusual, although measurable amounts have fallen in the northern areas at irregular intervals, and a trace of snow has been recorded as far south as Fort Myers. The greatest recorded snowfalls in Florida occurred on February 13 in 1899 and 1958. In 1899, 4.0 inches were measured at Lake Butler in Union County and one half inch at Bartow in Polk County. On the night of February 12–13, 1958, most all of Florida west of the Suwannee River received 2 to 3 inches of snow; areas east of the Suwannee River and north of about latitude 30° received 1 to 2 inches of snow on this same night. The 3 inches measured at Tallahassee on this date is the greatest ever measured there since records began in 1886, and the 1.5 inches measured at Jacksonville is second only to the 1.9 inches that fell on February 13, 1899.

Notable Florida Snowfalls

1774 (day unknown): There was a snow storm that extended over parts of Florida. Inhabitants long afterwards remembered the extraordinary “white rain.”

1797 (day unknown): Surveyor Andrew Ellcott

reported 8" near the source of the St. Mary's River in what is now Baker County.

January 10, 1800: Surveying party measured 5" at Point Peter near the mouth of the St. Mary's River.

January 13, 1852: ½" at Jacksonville. Press report of 2" at Tallahassee.

December 5, 1886: ½" reported at Pensacola.

January 5, 1887: 1" of snow fell at Pensacola.

January 14, 1892: Pensacola reported 0.4".

February 14–15, 1895: 3" measured at Pensacola, 2" at Tallahassee, and 1" at Lake City. A trace was reported as far south as Leesburg.

February 12–13, 1899: 4" at Lake Butler, 3.5" at Marianna, 3" at Lake City. Trace amounts were reported as far south as Fort Myers, Avon Park, and Titusville.

November 27–28, 1912: ½" at Mt. Pleasant in Gadsden County.

December 29–31, 1917: ½" reported at many stations in Panhandle and north Florida as far south as Crescent City.

January 22–23, 1935: 1" at Panama City and 0.2" at Apalachicola.

February 2–3, 1951: 2" at Crescent City and St. Augustine. Trace amounts as far south as Lakeland.

March 6, 1954: 4" at Milton, 3" at Niceville, and 2" at Pensacola. Trace amounts reported by many stations in northern Florida.

March 28, 1955: 1" at Marianna and 0.4" at Tallahassee. Trace amounts reported as far south as Palatka.

February 12–13, 1958: Second only to snowfall of 1899. Three inches reported at many stations from Niceville to Jasper. Measurable amounts at almost all stations north of 30° N.

February 9–10, 1973: First measurable snow since 1958. There was 3.3" at Milton and 2" at Pensacola, De Funiak Springs, and Quincy. Trace amounts reported as far south as Clermont. Unofficial reports of 6" to 8" in the vicinity of Jay.

Mid-January, 1977: State endured in week-long cold, with traces of snow observed as far south as Miami.

March 2, 1980: About 0.25" of snow covers car tops and patio furniture in Jacksonville.

March 1, 1986: 0.5" of snow accumulates overnight in Jacksonville before melting within 30 minutes due to the morning sun.

December 23, 1989: Light rain in Jacksonville turns to freezing rain as temperatures drop, and later changes to snow. The snow totals several inches in some locations, and results in the first White Christmas in the city's history.

December 24, 1989: Light flurries fall in the Tampa metro area early in the day and even during an early afternoon NFL game. One death is reported in Tampa, two in Miami, and one in Jacksonville because of the extreme cold.

March 12, 1993: The 1993 Superstorm produces up to 4" of snow along the Florida Panhandle.

January 8, 1996: Snow flurries are reported from Crystal River to New Port Richey with no accumulation.

December 18, 1996: A plume of cold air causes snow to form in the northwestern portion of Escambia County.

January 24, 2003: Light snow flurries along the eastern coastline. The snow reaches as far south as Fort Pierce. Locations along the Florida Panhandle receive a dusting of snow.

November 21, 2006: Very light dusting and snowflakes in central Florida. It is the first snow in November in the state since 1912.



Florida State Archives

Snow fell in Tallahassee on February 13, 1899, in sufficient quantity for this snowball fight on the steps of the Capitol.

January 8-9, 2010: Very light dusting of snow seen in the eastern Jacksonville area. Light snow also fell in parts of central Florida, which briefly accumulated in Ocala and other parts of Marion County. Snow was isolated across the Orlando area, Tampa, and also in Melbourne. Isolated flurries were reported from West Palm Beach to as far south as Kendall.

February 12, 2010: Portions of northwestern Florida experience snowfall totals of around 1".

February 14, 2010: 0.5" of snow fell across the northern halves of Escambia, Santa Rosa, Walton, and Okaloosa Counties.

December 28, 2010: Light snow was reported in Tampa following a rare freezing fog event around midnight.

January 28, 2014: Light snow and freezing rain accompanied a winter storm that resulted in school closures and Interstate-10 being completely shut down between Pensacola and Crestview.

Prevailing Winds

Prevailing winds over the southern peninsula are southeast and east. Over the remainder of the state, wind directions are influenced locally by convectional forces inland and the "land and sea breeze" effect near the coast. Consequently, prevailing directions are somewhat erratic but, in general, follow a pattern of northerly in winter and southerly in summer. March and April average the windiest months. High local winds of short duration occur occasionally in connection with thunderstorms in summer and with cold fronts moving across the state in other seasons.

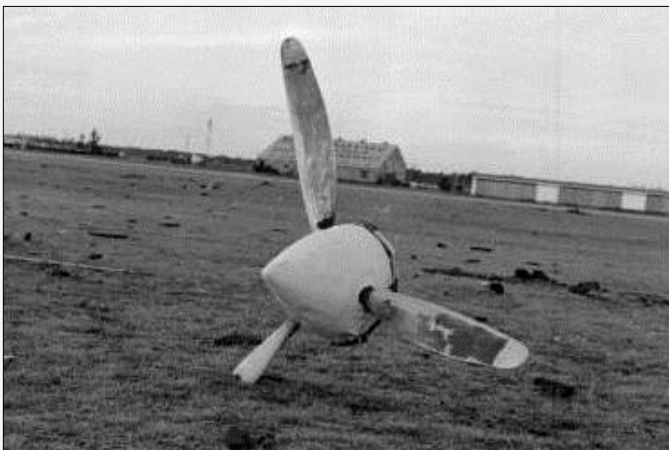


Photo by Robert E. Fisher

Airplane propeller stuck in the ground at Craig Municipal Airport after a tornado, Jacksonville.

Trade Winds

Few people realize that the peninsula of Florida, jutting out to the southeastward from the American continent, is almost the only well-watered area on the earth's surface between latitudes 24° and 31° north. Following this belt of latitude around the world, all the rest of the land between those parallels is dry, sandy, or mountainous waste—only coastal China between Shanghai and Canton, and coastal Texas are exceptions, with Florida, to the desert rule. Our rains in Florida are the result of the trade winds sweeping westward out of the warm Atlantic Ocean. These winds pick up a tremendous amount of water in their passage across the ocean. When they strike the Florida peninsula, convection currents raise these moisture-laden breezes further aloft where they are suddenly cooled and release rain.

Tornadoes

Tornadoes, funnel clouds, and waterspouts also occur, averaging 10 to 15 per year. Occasionally waterspouts come inland, but they usually dissipate soon after reaching land and affect only very small areas. Tornadoes have occurred in all seasons but are most frequent in spring. Tornadoes also occur in connection with tropical storms. Generally, tornado paths in Florida are short, and damages have not been extensive. A dramatic exception occurred when a series of seven El Niño driven twisters, some with winds in excess of 200 mph, hit central Florida on February 22-23, 1998. More than 260 people were injured and 42 people died, exceeding the human cost of Hurricane Andrew. The estimated damage to about 4,800 homes and businesses was \$336 million.

Tornadoes are rated by miles per hour of wind speed and damage that can be expected from the storm:

Category	Wind Speed	Damage Expected
F-0	40-72 mph	Light
F-1	73-112 mph	Moderate
F-2	113-157 mph	Significant
F-3	158-206 mph	Severe
F-4	207-260 mph	Disastrous
F-5	261-318 mph	Incredible

Humidity and Fog

The climate of Florida is humid. Inland areas with greater temperature extremes enjoy slightly lower relative humidity, especially during hot weather. On the average, variations in relative humidity from one place to another are small; humidity ranges from about 85% to 95% during the night and early morning hours to about 50% to 65% during the afternoons. Heavy fog is usually confined to the night and early morning hours in the late fall, winter, and early spring months. It occurs on about 35 to 40 days per year, on average, over the extreme northern portion; 25 to 30 days per year in the central portion; and downward to less than 10 days per year in the extreme southern areas. Fog usually dissipates or thins soon after sunrise, and heavy daytime fog is seldom observed in Florida.

Sunshine

Florida is called the “Sunshine State” even though a 2004 National Weather Service report says that five other states (Arizona, California, Nevada, New Mexico, and Texas) are sunnier. Florida has more days where between 20% and 70% of the sun is blocked by clouds than anywhere else in the continental U.S. Sunshine measurements made at widely separated points in the state indicate the sun shines about two-thirds of the time sunlight is possible during the year and ranges from more than 70% in April and May to slightly more than 60% in December and January. In general, southern Florida enjoys a higher percentage of possible sunshine than does north Florida, but Apalachicola has more clear days than any other city in the state with an average of 128 a year. Key West sees sun an average 76% of its available daylight hours—the most in the state—followed by Miami with 70%.

Florida’s sunshine is strong because it is in the subtropics. Rays arrive at a steep angle bringing a high degree of ultraviolet radiation. Although it is partly cloudy most days, the rays received are very intense.

The length of day operates to Florida’s advantage. In winter when sunshine is highly valued, the sun can shine longer in Florida than in the more northern latitudes. In summer, the picture reverses

itself with the longer days returning to the north. While sunshine hours in Miami are 66% in December as compared to 51% in New York City, greater difference is reflected in the amount of solar radiation that leads to temperature contrasts. New York City receives only an average 116 langley (a unit of solar radiation) on a horizontal surface each day during December. In contrast, Miami receives an average of 317 langley, almost three times as much solar radiation.

Air Pollution

Meteorological conditions that aggravate air pollution do not often occur any place and are probably the least frequent in the southeastern areas. The air over the state is usually sufficiently unstable—a condition conducive to the development of cumulus clouds and thunderstorms—to disperse pollutants to higher levels. This fact, plus the relative constancy of the easterly trade winds in the southeastern areas, greatly reduces the general pollution problem in Florida.



Photo by Dale M. McDonald

Heron on the hunt, Key West, 1987.

Earthquakes in Florida

Most of Florida lies in two zones whose chance of an earthquake is regarded as nil by the National Oceanic and Atmospheric Administration. These zones are Florida south of a line drawn straight west across the peninsula from approximately Daytona Beach and Florida west of the Apalachicola River.

However, earthquakes of low to medium intensity have been recorded since 1780.

Earthquakes in Florida

Date	County	Modified Mercalli	Richter
1780, Feb. 6	Escambia	VI	
1879, Jan. 13	Alachua	VI	
1880, Jan. 22, 23	Monroe	na	
1886, Aug., Sept., Oct., Nov.	Duval	IV	
1893, June 21	Duval	IV	
1900, Oct. 10, 31	Duval	V	
1902, May 21	St. Johns	II	
1905, Sept. 4	Manatee	III	
1930, July 19	Monroe	V	
1935, Nov. 14	Putnam	IV	
1940, Dec.	Hillsborough	na	
1942, Jan. 19	Hendry	IV	
1945, Dec. 22	Dade	III	
1948, Nov. 8	Lee	IV	
1952, Nov. 18	Gadsden	IV	
1953, Mar. 26	Orange	IV	
1973, Oct. 27	Seminole	V	3.5
1973, Dec. 5	Seminole	III	
1975, Dec. 4	Volusia	IV	2.9
1997, Oct. 24	Escambia		4.9
2006, Sept. 10	the Gulf *		6.0

*(technically not Florida but felt along the Gulf coastline)

Thunderstorm Capital

The Florida peninsula is the “thunderstorm capital” of the northern hemisphere. Werner A. Baum, writing in *The Florida Handbook*, 1957, said “only in limited portions of the southern hemisphere, particularly in the heart of South Africa, are thunderstorms more frequent than over the Florida peninsula.”

Fred Power, of the U.S. Weather Service at Tallahassee, said “it is because we have the heat and ample moisture plus other air-mass dynamics that induce thunderstorms.”

The Atlas of Florida, edited by Edward Fernald, identifies two Florida areas that average 90 or more days per year of thunderstorm activity (Lakeland and Fort Myers); three areas with 81-89 days (Tallahassee, Orlando, and Tampa); three areas with 71-80 days (Pensacola, Daytona Beach, and West Palm Beach); and three with 70 or less (Apalachicola, Jacksonville, and Key West).

Lightning is the most lethal component of the thunderstorm. On average, 73 deaths occur annually in the nation, 15 in Florida. In most years, Florida has the largest number of lightning deaths of any

state. Tampa is the state's lightning capital with 83 thunderstorm days per year. Since lightning and thunder occur at the same time, and we know sound travels at roughly 1,000 feet per second, we can calculate our distance from the bolt by measuring the time between seeing the lightning and hearing the thunder. If 5 seconds pass between a lightning flash and the sound, the distance from the strike would be 1 mile. Researchers at the Lightning Research Laboratory of the University of Florida estimate that an average resident of the state can expect to be within half a mile of 10 to 15 lightning bolts per year that have reached the ground. In Florida, 28% of injuries and deaths from lightning occur in open fields and playgrounds, 26% in the water or on boats, and 10% under trees. The most recent tally shows that between 1959 and 2004 lightning killed 428 people in Florida and injured another 1,689.

According to an article by Frank Stephenson in Florida State University's publication *Research in Review* in 2001, officials of Florida Power and Light contacted FSU meteorologist Henry Fuelberg and told him the company was interested in underwriting research into developing a better, more reliable method for forecasting lightning strikes in their 11 most lightning-prone districts. By 2005, Fuelberg and a small team of graduate students had a tool which Florida Power and Light began to use. The company uses its computers to create a lightning forecast based on daily weather balloon data from the National Weather Service and run through algorithms supplied by FSU. The forecasts are highly reliable estimates of the number of strikes each district is likely to receive and where most of the activity is likely to occur. Although Florida Power and Light dispatchers would like accurate predictions of what hours of the day the heaviest lightning will occur, the project is not complete and there is hope that a new model will predict when, where, and how much lightning will occur. Instead of having a separate forecast for each of Florida Power and Light's 11 districts, the forecast will be for the whole state. Presently, in addition to Florida Power and Light, the forecasts go to the



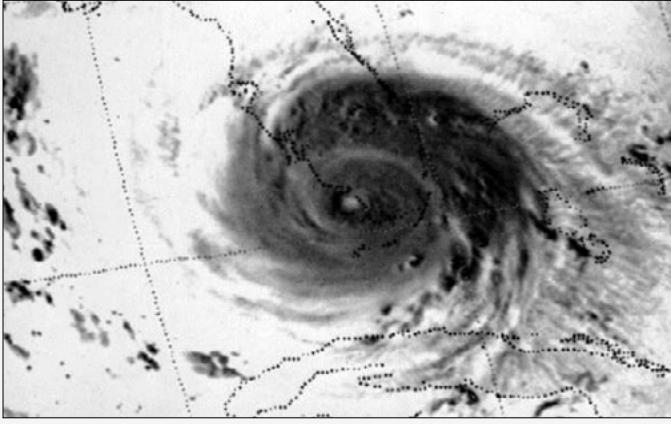
Tallahassee Fire Department Collection

Two piles of highly resinous pine at the Newport Industries Plant burned fiercely after being struck by lightning, Telogia, 1962.

National Weather Service offices in Miami, Tampa, Melbourne, and Jacksonville. The agency incorporates FSU's data into its own forecasting methods.

Rainfall During Storms

Some of the world's heaviest rainfalls have occurred within tropical cyclones. Over 20 inches in 24 hours is not uncommon. The intensity of the rainfall, however, does not seem to bear any relation to the intensity of the wind circulation. For example, a storm entered the west coast of Florida in October 1941. It was never of hurricane intensity, yet over a 3-day period it produced a total of 35 inches at Trenton. The 24-hour total for this same storm was about 30 inches. A hurricane in 1947 caused a rainfall of about 6 inches in 1 hour at Hialeah. A detailed survey of the September 1950 hurricane, conducted by the U.S. Corps of Engineers, Jacksonville, Florida District, indicated an amount near 34 inches fell in a 24-hour period in the Cedar Keys area. The 38.70 inches of rainfall that fell during the 24-hour period at Yankeetown on September 5–6, 1950, during Hurricane Easy was the record 24-hour rainfall for the nation until 1979 when Hurricane Claudette dumped 43 inches of rain on Alvin, Texas. Such extremes are relatively rare, although Tropical Storm Fay on August 25–27, 2008, dropped 26.7 inches on Melbourne and an unofficial record 18–20 inches on Tallahassee



Satellite view of Hurricane Andrew, 1992.

that surpassed the official 10-13 inches from Tropical Storm Allison on June 11-12, 2001.

Hurricanes and Tropical Storms

Florida, extending into the seas between the subtropical Atlantic and the Gulf of Mexico, is the most exposed of all states to tropical cyclones since they approach from the Atlantic to the east, the Caribbean to the south, and the Gulf of Mexico to the west.

Since the beginning of records in 1886, the state has never gone more than 3 years without a tropical storm nor longer than 5 years without a hurricane. The longest period without a major hurricane is 12 years, 1897–1908. Hurricane Donna, which crossed the Florida Keys and then moved northeastward across the state from about Fort Myers to near Daytona Beach on September 9–10, 1960, was the most financially destructive hurricane experienced in Florida to that time. This hurricane caused an estimated \$305 million damage in Florida. The total of only 13 fatalities during this very intense hurricane indicates the great value of the modern hurricane warning service now available in hurricane threatened areas. Three hurricanes (Cleo, Dora, and Isabel) in 1964, caused the greatest damage in any one year, \$362 million, until Andrew in 1992 established a new record with more than \$30 billion lost.

The vulnerability of the state varies with the progress of the hurricane season. Early and late in the season (June and October) the region of maximum hurricane activity is in the Gulf of Mexico and the western Caribbean. Most systems that move into

Florida approach the state from the south or southwest, entering the Keys or along the west coast. Mid-season (August and most of September) the tropical cyclones normally approach the state from the east or southeast.

One of the most intense hurricanes of modern times affected the state on Labor Day, 1935. The third lowest sea-level pressure ever recorded in the Western Hemisphere, 26.35 inches, was recorded at that time. The maximum winds in that hurricane were not recorded since the wind measuring equipment was blown down before the peak of the hurricane was reached. However, engineers have calculated that winds of 200 to 250 mph would have been required to account for some of the damage that occurred during the severe hurricane. During the hurricane of August 1949, winds at West Palm Beach reached 110 mph with gusts to 125 mph before the anemometer was blown away. The highest sustained speed was estimated at 120 mph with gusts to 130. A privately owned anemometer, the accuracy of which is unknown, recorded gusts to 155 mph.

The highest winds in a hurricane are seldom measured since these usually occur at isolated points where no anemometers are installed. It seems likely that winds of 150 mph occasionally accompany major hurricanes, which (since 1900) have occurred in Florida on the average of once every 4 years.

Newsweek, in words and pictures, perhaps conveyed the scene left in August 1992 by Hurricane Andrew as well or better than anyone else:

“Like Hiroshima, it was Hurricane Andrew, the most costly storm in U.S. history, that turned south Dade County (around Homestead) into a zone of ruination that stretched for miles and miles.”

“Find the neighborhood and you couldn’t find the street. Find the street and you couldn’t find the house. Find the house and all you saw was debris. There was no water, no electricity no phone—only the stench of rotting garbage and here and there spray-painted signs that showed at least some homeowners were hanging on. ‘Manned and armed,’ these graffiti said. ‘You loot, we shoot.’”

“Into this valley of desolation last week marched one of the more remarkable relief forces of modern times—a composite corps of Army, Navy, Air Force, and Marine personnel, not to mention the Red Cross, the National Guard, hundreds of federal bureaucrats

and thousands of well-meaning civilian volunteers from all over the United States.”

“There was, finally, a joint federal, state, and local response—and it was for the most part, reasonably well coordinated.”

Andrew’s toll was listed by the Federal Emergency Management Agency, American Insurance Services Group, Dade County Planning Office, other county officials, and the National Hurricane Center: residents left homeless - 160,000; houses damaged - 85,000, more than half of them severely or beyond repair; apartments damaged - 38,000, two-thirds of them severely or beyond repair; businesses destroyed or damaged - 82,000; jobs lost - 85,000; 38 deaths - in Florida (52 including the Bahamas and Louisiana); estimate of insured losses - \$10.7 billion; total estimated losses in all areas - \$27 billion; insurance claims - 610,000; debris - 8.3 million cubic yards; travel trailers or temporary mobile homes set up for victims - 1,388; meals served - 4.7 million; water distributed - 192 million gallons; emergency housing grants - \$84.1 million; individual and family assistance grants - \$120.6 million; loans for repairing homes and replacing property - \$178.3 million approved, \$29.6 million disbursed; business loans - \$31.1 million approved, \$2.7 million disbursed; cleanup costs - \$225 million for debris removal, \$21 million for plastic tarps, \$10 million for portable showers, \$10 million for pumps and generators, \$6 million for portable toilets. A third of a million people in Dade County left their homes, of which only two thirds had returned by late 1994.



Photo by Chris Duval

Waves hit Navarre Pier hard during Hurricane Ivan’s approach, Navarre Beach, 2004.

Hurricane Opal was the worst of the 19 named storms in 1995, the busiest hurricane season since 1933. More homes and businesses were damaged or destroyed by the storm surge from Opal than all other coastal storms in Florida since 1975 combined.

A major hurricane has sustained wind speeds of at least 111 mph, making it a category 3 or higher on the Saffir-Simpson scale. Only 3 major hurricanes, of the more than 30 which had formed in the Atlantic Basin, made landfall in the U.S. between 1995 and 2003. The four hurricanes which struck Florida in 2004 matched the most to hit a single state since 1886 (when Texas set that record and official record keeping began). Within 6 weeks the storms killed 117, destroyed 25,000 homes, and damaged another 40,000 homes. More than 8.8 million customers lost power. Nurseries, timber, sugar, vegetables, fruit, peanuts, and cotton losses were over \$1 billion. The beef cattle and aquaculture industries lost over \$250 million. Total damage was \$42 billion, of which over \$18 billion was insured. Insurance claims numbered \$1.7 million, more than double the \$700,000 from Hurricane Andrew. President Bush and Congress approved over \$12 billion in federal aid to Florida and other southeastern states. Aid distributed included 78.5 million pounds of ice, 9.8 million gallons of water, 14 million ready-to-eat meals, and 560,000 tarps.

The 2005 hurricane season set many records. Hurricane Dennis was the first major hurricane, category 3 or above, to hit Florida in the month of July. It was the fifth of six named storms that month (another record), two of which were major hurricanes (another record). Seven tropical storms formed before August 1 (another record). There were 27 named storms in the season (another record), 15 of which became hurricanes (another record). Seven of the hurricanes became major hurricanes, including three (Katrina, Rita, and Wilma) which reached category 5 intensity (another record). Hurricanes Dennis, Katrina, Rita, and Wilma brought death and major destruction to Florida. Katrina was the costliest hurricane (\$80 billion+) and the deadliest since 1928 (at least 1,200 fatalities, 14 of them in Florida).

In two consecutive years, five major hurricanes made landfall in Florida. Zeta, the last storm of the 2005 season, tied a record for the latest developing named storm and set a record for the longest-lived December-January storm.

Devastating Florida Hurricanes and Tropical Storms since 1900

DATES OF HURRICANE	AREAS MOST AFFECTED	LAND STATION WITH HIGHEST WIND SPEED*	DEATHS (U.S. ONLY)	CATEGORY#	DAMAGE
1903, September 11	South and West Florida	Jupiter, 84 mph	14	1	Surges of 8' at Jupiter and 10' at Apalachicola, with ships driven ashore.
1906, September 27	Florida and Alabama	Pensacola, 94+ mph	134	3	10' surges, great losses to waterfront and railroads at Pensacola and Mobile.
1906, October 17-18	Southern Florida	Florida Keys, 77 mph	193	1	Devastated Flagler's railroad construction in the Keys.
1909, October 10-11	Southern Florida	Key West, 94 mph†	34	3	Over 400 buildings destroyed in Key West.
1910, October 17-18	Southern Florida	Florida Keys, 125 mph†	101	3	Early warnings reduced losses. Destroyed 10% of the state's citrus crop.
1915, September 4	West Florida	Apalachicola, 70 mph	21	1	Waterfront damage.
1916, June 29- July 10	Mississippi to northern Florida	Mobile, AL, 99 mph	7	2	Very destructive along the coast from Mobile to Pensacola.
1919, September 2-15	Florida, Louisiana, and Texas	Sand Key, 72 mph†	287	4	Hurricane was severe both in Florida and in Texas. Over 500 casualties in ships lost at sea.
1926, September 11-22	Florida and Alabama	Miami, 96 mph, Miami Beach, gust 132 mph	243	4	The "Great Miami Hurricane" — very severe in the Miami area and from Pensacola into southern Alabama. According to U.S. Weather Bureau, it was "probably the most destructive hurricane to strike the United States" up until that time.
1928, September 6-20	Southern Florida	Lake Okeechobee, 75 mph	1,836	4	Wind-driven waters of Lake Okeechobee overflowed into populated areas, causing most of the casualties.
1933, August 31- September 7	Florida	Jupiter Inlet, 125 mph	2	3	Much property damage on the coast from Vero Beach; property damage inland was minor; citrus loss nearly complete near the coast.

DATES OF HURRICANE	AREAS MOST AFFECTED	LAND STATION WITH HIGHEST WIND SPEED*	DEATHS (U.S. ONLY)	CATEGORY#	DAMAGE
1935, August 29- September 10	Southern Florida	Tampa, 86 mph	408	5	“Labor Day Storm” — barometer reading of 26.35” on Long Key is third lowest of record in the Western Hemisphere. Peak winds were estimated 150-200 mph on some Keys.
1935, October 30- November 8	Southern Florida	Miami, 94 mph	5	1	“Yankee Storm” — so-called because it moved into the Miami area from the northeast. It was quite small — destructive winds covered only a narrow path.
1944, October 12-23	Florida	Dry Tortugas, 120 mph	18	3	Warnings and evacuation prevented heavier casualties.
1945, September 11-20	Florida, Georgia, and South Carolina	Carysfort Reef Light, 138 mph	4	4	Damage very heavy in Dade County (Miami). Evacuation of exposed locations prevented heavy loss of life.
1947, September 4-21	Florida and Middle Gulf Coast	Hillsboro Light, 121 mph ¹ gust, 155 mph	51	3	Very large and intense storm. Wind and water damage heavy on Florida east coast and in Louisiana and Mississippi.
1947, October 9-16	Southern Florida, Georgia, and South Carolina	Hillsboro Light, 92 mph	1	1	Heavy to excessive rains in Florida climaxed a very wet season. Heavy damage also occurred in the Savannah, GA area from wind and along the South Carolina-Georgia coast from high tides.
1948, September 18-25	Southern Florida	Key West, 78 mph [†]	3	1	Many lulls and calms reported from widely separated points simultaneously; two lulls near Okeechobee several hours apart.
1948, October 3-15	Southern Florida	Sombrero Key, est. 100 mph ¹	0	2	Damage not as great as could be expected, since much of area had been hit by September storm.

DATES OF HURRICANE	AREAS MOST AFFECTED	LAND STATION WITH HIGHEST WIND SPEED*	DEATHS (U.S. ONLY)	CATEGORY#	DAMAGE
1949, August 23-31	Florida to the Carolinas	West Palm Beach, 110 mph ⁵ Juniper, gust 153 mph	2	2	Storm center passed over Lake Okeechobee. Levees built since 1928 prevented overflow and casualties.
1950, September 1-9 EASY	Florida	Cedar Keys, 120 mph	2	3	Unusual double loop in storm track in the Cedar Keys area. Coast from Sarasota northward suffered extensive wind and tide damage.
1950, October 13-19 KING	Florida	Miami, 120 mph	4	3	A small violent storm which passed directly over Miami, then up the entire Florida peninsula.
1956, September 21-30 FLOSSY	Louisiana to northern Florida	Burrwood, LA, 88 mph ⁵ gust, 110 mph	15	2	Damage over area from New Orleans and mouth of Mississippi eastward to western Florida.
1960, August 29-September 13 DONNA	Florida to New England	Block Island, RI, 95 mph gust, 130 mph Ft. Myers, 92 mph Cape Henry, VA, 80 mph	50	4	Record amount of damage in Florida. First storm with hurricane force winds in Florida, Middle Atlantic States, and New England in 75-year record. Winds estimated near 140 mph, with gusts 175-180 mph on central Florida Keys.
1964, August 20-September 5 CLEO	Southern Florida, Eastern Virginia	Miami, 110 mph	0	2	First hurricane in Miami area since 1950. Moderate wind damage extensive along Florida lower east coast. Record rainfall and wide-spread flooding from Hampton Roads area southward in Virginia. Tornadoes in southeast Florida and the Carolinas.
1964, August 28-September 16 DORA	Northeastern Florida, Southern Georgia	St. Augustine, 125 mph	5	3	First storm of full hurricane force on record to move inland from the east over northeastern Florida.

DATES OF HURRICANE	AREAS MOST AFFECTED	LAND STATION WITH HIGHEST WIND SPEED*	DEATHS (U.S. ONLY)	CATEGORY#	DAMAGE
1965, August 27- September 12 BETSY	Southern Florida, Louisiana	Port Sulpher, LA, 136 mph	75	4	Much of the damage was caused by flooding, particularly in Louisiana.
1972, June 14-23 AGNES	Florida to New York	Key West, 43 mph Jacksonville, gusts 56 mph Storm tide 6.4 ft. above normal Apalachicola	122	Tropical Storm	One of the costliest natural disasters in U.S. history — \$20 billion. Devastating floods from North Carolina to New York with many record-breaking river crests. Tornadoes —15 in Florida and 2 in Georgia.
1975, September 13-24 ELOISE	Florida Panhandle and eastern Alabama	5 miles north- west of Ozark, AL, 104 mph	4	2	Major (almost total) storm surge and wind damage to structures along beach strip from Fort Walton Beach to Panama City. High winds destroyed property and crops over eastern Alabama. Flooding and miscellaneous damage from heavy rains over northeastern U.S.
1985, November 21, KATE	Florida Panhandle, Big Bend	Crooked Island near Mexico Beach, 98 mph	6	2	36-foot storm surge at Cape San Blas. Many downed trees and extensive power outages. Latest hurricane in season on record to hit United States.
1992, August 22-26 ANDREW	Bahamas, South Florida	Miami, 164 mph	38	4	Costliest hurricane in U.S. history to date. \$30.5 billion in damages.
1995 September 27- October 6 OPAL	Florida Pan- handle	125 mph	9	3	More homes and businesses damaged or destroyed by storm surge than all other coastal storms since 1975 combined.
2001 June 11 ALLISON	North Florida, Texas	70 mph gusts in TX, LA	50	Tropical Storm	Costliest tropical storm in U.S. history to date. \$4 billion in damages. More than 10 inches of rain in 24 hours in Florida, 36 inches in Houston, 18 inches in Louisiana.

DATES OF HURRICANE	AREAS MOST AFFECTED	LAND STATION WITH HIGHEST WIND SPEED*	DEATHS (U.S. ONLY)	CATEGORY#	DAMAGE
2004, August 13 CHARLEY	Southwest Florida	Captiva Island, 150 mph	10	4	Damage \$5.4 billion; 8 direct fatalities, 16 indirect fatalities, and 792 injuries.
2004, September 1-7 FRANCES	Entire state of Florida	Stuart	7	2	Supersized storm. Impacted entire state from Tallahassee to Key West.
2004, September 16 IVAN	Northwest Florida	Gulf Shores, AL, 120 mph	54	3	A portion of the I-10 bridge across Escambia Bay collapsed, U.S. 90 causeway heavily damaged. Much of Perdido Key destroyed.
2004, September 26 JEANNE	Central Florida	Stuart, 120 mph	5	3	The center with a 60-mile-wide eye made landfall in Florida at Stuart at virtually the identical spot as Frances did just 3 weeks earlier.
2005, July 10 DENNIS	Florida Panhandle	Santa Rosa Island, 120-125 mph	15	3	\$1.5 billion in damage, 14 deaths in Florida.
2005, August 2 KATRINA	South Florida	Hallendale Beach, 80 mph, Buras, LA, 125 mph	14	1	Costliest hurricane in U.S. Deadliest and most destructive hurricane in recent years, although most of the damage occurred in Louisiana and Mississippi.
2005, October 19-24 WILMA	South Florida	Naples, 115 mph.	6	3	Most intense storm on record in the Atlantic Basin at that time.
2008, August 18-24 FAY	South-Central Florida	Florida Keys, 60 mph	11	Tropical Storm	Fay actually gained strength over Florida's inland waters, including the vast expanses of the Florida Everglades and Lake Okeechobee. Spawned a number of tornadoes which caused significant damage.

#Saffir-Simpson Hurricane Wind Scale

*Fastest mph unless otherwise noted.

†Wind measuring equipment disabled at speed indicated. Highest winds probably higher.

‡One-minute maximum speed.

§Five-minute maximum speed.



Florida's Freshwater Resources

Cynthia Barnett*

Nineteenth century Florida was defined by draining off the water. In the 20th century, it was over-pumping groundwater. In the 21st century, Floridians are turning toward a water-conservation ethic.

Water defines us as Floridians no matter where we live: Idyllic beaches surround us on three sides. Rivers and streams flow for ten thousand miles through the peninsula. Our state is blessed with nearly eight thousand lakes and seven hundred freshwater springs—the largest concentration of springs on the planet. The rainfall, too, is a gift from heaven: Florida averages 54 inches a year, among the highest in the nation. Finally, as much water as we can see in Florida, there's more we cannot: More than a quadrillion gallons lie underground, in the deep cracks, channels, and pores of the state's limestone foundation.

This bounty makes it hard to fathom how any one of Florida's regions could have depleted its share, but every region has: Tampa Bay area cities and counties were the first to tap out their corner of the Floridan Aquifer, leading to decades-long water wars. In recent years, Southeast Florida's communities have learned they can no longer rely on their traditional supply, the Biscayne Aquifer. They're struggling to figure out new sources even as the Everglades' plumbing system drains an average 1.7 billion gallons of freshwater a day to the sea. In Central Florida, withdrawals for mining and

agriculture helped erase lakes, wetlands, and springs most people don't even remember, along with some we sorely miss: Kissingen Springs, a once-popular tourist attraction that bubbled up thirty cubic feet of water a second, was the first major spring in Florida lost to intense withdrawals. It may not be the last. In North Florida, residents fret that metropolitan areas will someday run a pipeline to pull water from the Suwannee River. But an invisible pipeline has been doing so for fifty years: Scientists with the U.S. Geological Survey report a 25 percent decline in flow in that time in the spring-fed Ichetucknee River, a tributary of the Suwannee, which they link to pumping in south Georgia and northeast Florida, now the equivalent of pulling 80 million gallons of freshwater a day to the east. Even along the slower-growing coastal Panhandle, some water levels in the sand-and-gravel aquifer have plummeted more than 100 feet since 1950, causing utilities to punch their wells farther and farther inland.

Half a century's scientific reports, legal opinions, newspaper articles, and books can be boiled down to two big water mistakes: The first, taking too much from our natural systems by draining, dredging, and groundwater pumping; and the second,

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Florida State Archives

Dredging the Miami Canal, 1926.

over-relying on large infrastructure fixes. Florida's environmental history has shown repeatedly that the larger the technical solution today, the larger the headaches it may bring Floridians tomorrow. Take the Kissimmee River: Taxpayers spent \$35 million to channelize it in the first place; we've spent more than 10 times that, or more than \$500 million, to restore those parts of the river that we can.

In the 19th century, Floridians were guided by how much water we could push off the land. In the 20th, we were guided by how much we could pump. In the 21st century, Floridians must finally be guided by our consciences.

What Florida needs now is a new way to value water. We need a water ethic.

In 1972, the Legislature passed The Water Resources Act, based on late University of Florida law Dean Frank Maloney's Model Water Code, which foretold the current water crisis with remarkable prescience. The law declared Florida's waters "a public resource benefiting the entire state" and called for planning, permitting, and water-management districts drawn along surface-water rather than political boundaries.

Florida's water law and what became the five districts were far-sighted accomplishments. Legal scholars call the state's water-management system among the most progressive in the nation for balanc-

ing the needs of water users with the public interest. Since 1972, Florida supplied water to 11 million new residents even as it carried out some of the most successful restoration projects in the nation, including those in the Upper St. Johns River and Tampa Bay, where 6,000 acres of sea grasses have made a comeback in an ecosystem shared with millions of Floridians and the Port of Tampa.

Yet after four decades' experience managing water, we haven't been able to shake the mistakes of history: over-tapping natural waters and turning first to costly technologies that future generations of Floridians may not appreciate.

Florida's permitted water use is demonstrably more than our natural systems can

handle. During the freeze of January 2010, farmers in the Plant City area pumped a billion gallons a day from the Floridan Aquifer to protect berry and citrus crops. Eleven nights of nonstop pumping dropped parts of the aquifer here by 60 feet. One hundred and forty sinkholes opened up in surrounding communities. Seven hundred and fifty residential wells went dry. An underground chasm closed Plant City's Trappnell Elementary School for three months. Another sunk part of Interstate 4, impeding traffic for days.

Water managers called it a rare event, and the volume of water pumped was allowable under the permits granted by them; no farm took more than its legal share. But the permitted use cost Florida taxpayers millions in public repairs and helped lead to property insurance hikes, not to mention the direct harm to private homeowners and the area's real estate market: The Wall Street Journal called the eastern Hillsborough County communities affected "sinkhole subdivisions."

When it comes to large infrastructure projects, Tampa Bay Water's 25-million-gallon-a-day desalination plant is another cautionary tale. This is not to say that regional infrastructure projects cannot be part of the solution, but we must be mindful of their consequences: The plant, which has been plagued with technical difficulties, cost about \$50 million more than promised. But among less-foreseen consequences are its enormous energy demands and carbon emissions. According to an analysis by the

University of Florida's Program for Resource Efficient Communities, between 2006 and 2009, as Tampa Bay Water gradually upped its reliance on the plant, the utility's annual electricity costs went up 138 percent—by an additional \$10 million. In 2009, the plant accounted for half of Tampa Bay Water's carbon emissions while producing only 10 percent of water supplies.

On the other side of the Sunbelt, in the American West, scientists and policymakers are raising serious questions about the ability of arid regions to thrive in a future era of water scarcity. Any business person working to locate, say, a microchip plant or Google server farm, both of which require large amounts of water, is poring over climate-change and water reports to avoid those parts of the country where scarcity or conflict could worsen.

Florida is at a crossroads. We could keep to the current road of extracting too much, and using too much, which has led to both scarcity and conflict. Or, we could take a new path to a statewide water ethic. Unlike some other states, our water wealth, along with technological breakthroughs lining up with fresh political leadership and keen new interest in water sustainability among residents and businesses, give us an unprecedented opportunity to do so.

The conventional wisdom maintains that the answer to our water woes is to continue raising water prices and tapping state funding to fortify the penin-

sula with new water-supply projects. Pricing water right is part of the answer. But businesses—including the innovative new industries around which Florida is trying to reorient its economy—want to figure out how to use a lot less water, rather than have to pay for more.

Businesses are beginning to put water conservation on par with greenhouse-gas reductions as integral to sustainability plans. Filtration advances make recycled water an option for even those industries that require the purest water. U.S. food giant Kraft—which has cut global water use by 20 percent, or three billion gallons, in less than three years—switched to recycled water to cool coffee grinders at its Maxwell House plant in Jacksonville, keeping 20 million gallons a year in the St. Johns River.

Such innovations are possible—and many of them already happening—in every corner of Florida, from citrus fields that use 65 percent less water with micro-irrigation, to green buildings that collect rain from rooftops to flush toilets and irrigate landscaping.

A building with water-efficient designs and products has an average 15 percent lower water use, 10 percent lower energy use, and 12 percent lower operating costs, according to McGraw-Hill Construction. But surprisingly, some of the most innovative water-conservation strategies remain difficult to permit in parts of the state, including green-building practices such as capturing rain-water for toilets and clothes washers, or low-impact designs such as swales instead of curbs, narrow streets and other elements that can shrink a community's water footprint.

These are small challenges we will easily overcome if we buy into the bigger vision for Florida's future—the water ethic. At its most basic, the water ethic means we come together as Floridians to use less, avoid the mistakes of the past, and build a future of water sustainability so that the way we use water today will not jeopardize our children and grandchil-



Florida State Archives

With the high costs of fertilizer, mortgage, fuel and seed, irrigation systems like this became an insurance policy for farmers who couldn't afford to lose an occasional crop. Leon County, 1981.

dren's ability to use and enjoy water in the future. This is a moral, rather than political, call: A Moral Water Code to bolster our Model Water Code.

Florida's political water-planning assumption is that we must find more and more water to grow and prosper. The Department of Environmental Protection's statewide water plan says that, 20 years from now, we'll need to have added an additional 2 billion gallons of water to our current, 6.8-billion daily supply.

A moral water-planning assumption would hold that the opposite is true: The most prosperous societies of the 21st century will be those that figure out how to use less water—relieving pressure on both ecosystems and economies.

Other parts of the world, the United States, and in fact our own state have proven that economic prosperity and population growth need not mean greater and greater water use. Florida today uses less water total than in 2000, when we tapped more than 8 billion gallons a day, even though our population grew 15 percent in that time.

Water managers point out that 2000 was a drought year, meaning we irrigated more than usual and perhaps haven't accomplished as much as the numbers indicate. During some times of the year, we still pour as much as half of our potable water on lawns—water we developed from new sources, and treated at significant cost to meet standards for drinking. That makes significant conservation gains all the more possible.

From the University of Queensland to the University of Florida, researchers are showing how everything we do as a society can be done with far less water. Agricultural researchers have figured out strawberry-irrigation techniques that require as little as one-fourth the water customarily used for freeze-protection. But these practices require new or modified irrigation systems—not easily affordable for many farm operations.

In the wake of last year's sinkhole emergency, the Southwest Florida Water Management District offered to share 75 percent of the cost for any upgrade that would cut a farm's pumping in half. Farmers lined up to install "tailwater recovery" ponds that collect excess irrigation and rainwater for reuse, soil-moisture probes and weather stations to prevent over-watering, and other technologies. The price tag

for Floridians is a fraction of what it costs to develop new water sources, much less to repair sinkhole damage.

Since farmers account for the largest portion of Florida's water use, at 40 percent of the total, agriculture is the most logical—and symbolically important—catalyst for the water ethic. As some of Florida's largest private landowners, agricultural companies are already becoming part of the solution for the state's water storage and water clean-up challenges. In Australia, the government is spending \$5.8 billion on "sustainable rural water use and infrastructure" for the agricultural industry, almost half the nation's 10-year, \$12.9 billion Water for the Future plan that includes both new-construction and conservation solutions.

Public supply—the water we use in our homes and yards—comes a close second in Florida's total water use, 37 percent. That makes it another key target for saving water and money. Water-efficiency programs cost too: between 45 cents and \$1.60 for every thousand gallons they free up, according to national averages from the Chicago-based Alliance for Water Efficiency. But every other new source costs considerably more, with desalination the most expensive. The Tampa plant costs about \$4.16 per thousand gallons, including subsidies and other costs, according to Tampa Bay Water.

At those prices, we would be wise to send a brigade of plumbers across the peninsula to switch out every toilet installed before 1996—freeing up 11,000 gallons a year per commode—before we break ground on the next desalination plant.



Florida State Archives

Home swallowed by sinkhole, Frostproof, 1991.

The Miami-Dade County Water & Sewer Department has done just that. Utility officials there have found that toilet rebates for families, and full retrofits for elderly residents who can't afford them, are the cheapest way to obtain "new" water. These and other water-conservation investments have proven so successful, the utility recently canceled two planned Floridan Aquifer projects, saving further pressure on the aquifer and millions of dollars.

Miami-Dade's stance stands in sharp contrast to other South Florida utilities that in 2010 fought permanent lawn-irrigation limits sought by the South Florida Water Management District. The utilities argued that conservation cuts too deeply into revenues—at just the time they must invest heavily in new water sources.

Florida's water managers deserve credit for the extent to which they've reduced groundwater pumping, and damage from excessive withdrawals, without a federal judge making them. Likewise, it shouldn't require a crisis for Florida to take the next step toward water sustainability—creating a state-wide water ethic.

Many Florida communities are already there. Sarasota County once had its share of over-watered lawns, and its average water use was about 140 gallons a day. Two droughts ago, in 2002, the County Commission passed irrigation rules, including once-a-week watering and conservation-rate pricing—customers who use a little water pay a little, those who use a lot pay a lot. Other local governments passed drought restrictions, too, but lifted them when the rain started falling again. Sarasota decided to keep them on the books. In the years since, the county has built an unmistakable ethic among citizens and businesses and slashed average water use in half, to less than 80 gallons.

Other Florida governments have become national leaders in reuse. Two wastewater facilities in Orlando, for example, help the city recycle 100 percent of its wastewater, treated to irrigate more than 2,900 acres of citrus, 1,400 acres of golf courses, 2,100 acres of parks, and more than 3,600 lawns.

Yet, the water ethic has never caught on state-wide as have other conservation ethics such as the near-elimination of littering on Florida's beaches. That cultural shift required leadership from top levels of government, which set standards by making laws, and from private industry, which committed to changing long-time practices such as manufacturing cans with pop-tops. Littering studies show that most responsible for the turnaround since 1969 was that citizens came to believe littering was ethically wrong. But they weren't willing to change until government and corporations proved they would do their part.

Plant City resident Bruce Allen, one of the homeowners impacted by the 2010 sinkholes, articulated a common frustration when he asked water managers how it was that they could impose lawn-watering restrictions on citizens, then allow billion-gallon-a-day pumping for farmers. Floridians have long uttered variations on this theme, often: Why should I save water when you're going to hand it to the golf course next door?

They have a point. But the water ethic will transcend such conflict if it's taken seriously by elected officials and as industry begins to show the dramatic water savings possible in all sectors of Florida's economy. Over time, the water ethic will ripple out into communities, from college campuses to civic groups to churches to citizens.

Finding common ground is often difficult for Floridians, with our people and places as different as Miami-Dade's Little Havana is from Gadsden County's town of Havana. But water is the one bond we share as Floridians. Water is our common passion whether we live along the coast or in the lake-dotted interior. It's our common economic interest whether we do business in Fort Lauderdale or Fort Walton Beach. It's what brought us here, and what keeps us here, no matter our politics.

Water is the defining element—the essential elixir—of the good life here in Florida. That makes it easier to find common ground. Especially when it's the high ground.



Water Management Districts

Florida has five regional water management districts responsible for the restoration, preservation, and protection of the state's water resources both above and below the ground. Each district is an agency of the state with an area of jurisdiction defined by natural boundaries of water, not by arbitrary political boundaries.

The central mission of the water management districts is to provide flood control, ensure an adequate water supply, protect water quality, and protect natural systems. To accomplish this mission, the districts use their regulatory authority to issue permits; conduct research and data collection; restore and protect lakes, rivers, and wetlands; monitor and protect aquifers; purchase and manage environmentally sensitive lands; and develop educational programs.

The framework for the state's water management system was established by the Florida Legislature in 1972 with the passage of the Water Resources Act (Chapter 373, *Florida Statutes*). In 1976, voters approved a statewide referendum which gave water management district governing boards the authority to levy ad valorem taxes. These govern-

ing board members are appointed by the Governor and approved by the state Senate. Along with ad valorem monies, the districts receive funding from a variety of state and federal sources.

The state's five water management districts include the South Florida Water Management District covering all or part of 16 counties; the Southwest Florida Water Management District covering all or part of 16 counties; the St. Johns River Water Management District covering all or part of 19 counties; the Suwannee River Water Management District covering all or part of 15 counties; and the Northwest Florida Water Management District covering all or part of 17 counties.



Multipurpose recreational waterway; flood control and water management canal in South Florida, circa 1955.

Florida Park Service Collection



The Everglades

Jeanne Bellamy, Martha Musgrove, and Robert F. Sanchez*

“There are no other Everglades in the world.” That’s how Marjory Stoneman Douglas (1890-1998) began her seminal book, *The Everglades: River of Grass*. The book’s publication in 1947 was especially timely in that it coincided with disastrous flooding in southeast Florida, where rapid development of “reclaimed” swamps had brought urban sprawl to wetlands that were once an integral part of the Everglades.

A wet summer and two hurricanes left water standing over 15,000 square miles. Bob Graham, who would later become Florida’s Governor and a three-term member of the United States Senate, was a young boy. He recalls watching cows on his family’s dairy farm struggle to stand on a ridge and rowing a boat through Hialeah’s flooded streets to get to City Hall. As waters slowly receded, the public demand for “flood control” quickly led to the 1948 creation of the Central and Southern Florida Flood

Control District, which has since evolved into the South Florida Water Management District.

The district and U.S. Army Corps of Engineers constructed a massive network of canals, dikes, locks, floodgates, and pumping stations. The system was designed to get rid of water. In Central Florida the project included cutting a 56-mile channel across the oxbows of the meandering 103-mile Kissimmee River to speed the flow of water into Lake Okeechobee. The lake would become a harbinger of the new problems created by the project. In terms of flood-control the project has been a tremendous success. In 2004, when an unprecedented series of hurricanes dumped large amounts of rain over South and Central Florida, there was no widespread flooding.

Soon after this elaborate flood-control system was finally in place and functioning, however, Florida’s cyclical weather patterns delivered several years of below-average rainfall. Wells dried up. The water

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**Martha Musgrove is a consulting editor/writer and president of Decision Makers Forum Inc., presenting educational forums on Everglades restoration issues. She retired in 2001 from the Miami Herald as associate editor of editorial and opinion pages and was a specialist on Everglades, environmental and health issues. She had also been an editorial writer and Tallahassee bureau chief for the Cox Newspapers and the Palm Beach Post.*

**Robert F. Sanchez was an editorial writer for the Miami Herald, specializing in education, state government and politics, from 1974 until 2000. He is now Policy Director for the James Madison Institute in Tallahassee.*



Florida State Archives

An American egret and its young nesting in Everglades National Park, circa 1970.

in some of the underground aquifers near the coast turned to brine. And the parched brush on the former wetlands caught fire, blackening the skies west of Southeast Florida's coastal cities. Project managers acquired a second mandate: ensure a stable supply of water, not only drinking water for the fast-growing coastal cities but also irrigation water for agriculture. The balance between drainage and water supply has been difficult to achieve.

Concerns about the environmental impact were initially ignored or brushed aside. District officials were genuinely surprised when an algal bloom the color of pea soup spread across 100 square miles of Lake Okeechobee in 1986. The bloom was fed by nutrient-laden runoff from the dairies and ranches of the Kissimmee Valley to the north and back-pumped into the lake by vegetable and sugar growers south of the lake. In the years since, district water managers have sought to integrate environmental preservation and restoration more carefully with flood-control objectives.

In response to the algal bloom, the State and the water management district together relocated dairies and imposed best-management practices to reduce fertilizer-like nutrients. Pollution-reduction targets for the lake, however, have never been met. The combination of high water and turbidity in the lake, which is confined by a dike, has obliterated the shallow-water and shoreline filtering plants that also serve as nurseries. Fish populations are crashing. By every measure, the problems of Lake Okeechobee are staggering.

Downstream, the flood control project diverted trillions of gallons of water to the Atlantic Ocean and Gulf of Mexico that historically moved slowly through the Everglades in a shallow sheet—the proverbial “River of Grass.” Everglades National Park, at the end of the Florida peninsula, has starved for fresh water while once-productive lagoons and estuaries on the east and west coast have been destroyed by repeated surges of drainage water released via canals.

Everglades bird counts have dropped sharply with wood storks, snail kites, and the Cape Sable Seaside Sparrow nearing extinction; so too, the Florida panther. At one point, even alligators were declared endangered, though under protection they have staged a comeback.

The problem isn't merely a matter of too much water or too little. The quality of the water released into the Everglades, its timing and distribution also emerged as new problems. Any plan to “fix” the Everglades, scientists reported, would have to mimic the natural weather cycles and recreate a “sheet flow.”

The year 2000 marked a turning point in the battle to redesign the drainage system and save the Everglades. Late in its session, Congress adopted the Comprehensive Everglades Restoration Plan scientists had called for, and on December 11th, President Bill Clinton signed the legislation committing the federal government to pay half the costs of implementation. The Florida Legislature had previously voted its approval. At that time costs were estimated at \$7.8 billion over 30 years. Today costs are estimated at \$13.5 billion. Neither estimate includes previously authorized projects such as the Kissimmee River restoration or changes to old projects such as adding bridges to the Tamiami Trail (U.S. 41) to improve the flow of water into Everglades National Park.

The Comprehensive Everglades Restoration Plan came not a moment too soon. Only about half of the once-vast marsh remains, and restoration scientists candidly admit the Everglades will never be exactly the same as it was 60 years ago. Yet scant progress has been made in implementing the plan. In its 2008 review, The National Academy of Sciences described implementation as “bogged down in budgeting, planning, and procedural matters while the ecosystem that it was created to save is in peril.”

The Everglades can be described as the delta of a single watershed comprised of the Kissimmee River, Lake Okeechobee, and vast sawgrass marshes. The region's water comes from its plentiful rain, which averages about 60 inches per year and falls mostly in summer and fall. The broad, shallow "sheet-flow" of water across a porous limestone base established a ridge-and-slough landscape. Expanses of sawgrass and open water are dotted with tear-drop shaped "tree islands" supporting rookeries and occasional hardwood hammocks. Over a period of 5,000 years, decaying sawgrass and other vegetation accumulated to form deep and fertile muck soils, which attracted early settlers who looked for ways to drain "the swamp," farm the muck and get their crops to market. They dug ditches to lower the water table and dredged canals to link Lake Okeechobee and the coasts. They learned to tolerate winter's droughts and to fear summer's floods. The construction of dikes along Lake Okeechobee's south shore precedes all other flood-control projects in the area.

During the disastrous hurricanes of 1926 and 1928, high winds pushed huge walls of water out of Lake Okeechobee, killing as many as 3,000 people. An engineer running for president, Herbert Hoover, took notice, decried the devastation, and promised it would never happen again. He was elected, and construction of the 143-mile dike that now bears his name began in 1932. The 1948 Central and Southern Florida Flood Control Project raised and strengthened the dike. Hurricane Katrina's devastation of New Orleans awakened safety concerns and another reconstruction of the 143 mile Lake Okeechobee dike began in 2008. After spending \$361 million to complete 22 miles, the U.S. Army Corps of Engineers is looking for ways to reduce costs.

With a ready supply of irrigation water and vastly improved drainage system, sugar-cane farms spread over 80 percent of the 700,000 congressionally designated Everglades Agricultural Area. Exposed to air, the muck soils dried out and oxidized, or

subsided. By the late 1970s subsidence had reached an alarming rate. By keeping canal levels high and flooding fallow fields, subsidence has been reduced to slightly more than half an inch per year from what was once put at 12 inches every 10 years. Speculation continues as to how long farming can be sustained.

The great flood of 1947 was receding in December when President Harry Truman dedicated Everglades National Park, declaring, "We have permanently safeguarded an irreplaceable primitive area." He didn't know that the 1,500,000-acre expanse of land and water was dependent largely on water from upstream. Neither did most people realize that life in the Everglades is tuned to a seasonal shift from too much water to too little. Nor did they understand that water in the Glades replenishes the underground reservoirs that feed drinking-water wells along South Florida's coasts.

As construction began on the flood-control project, neither did anyone recognize the peril the project posed to the very existence of the new national park and Everglades ecosystem. Old canals were widened and deepened. New ones were dug. Levees were thrown up, establishing a border of sorts between the Everglades and "flood-protected" urban and agricultural areas. Giant pumps were installed. The ancient trough of the Everglades was sectioned and impounded to create three shallow reservoirs, the Water Conservation Areas. The gates of those areas had to



Florida State Archives

Flood control district canal and pumping station, Everglades, circa 1960.

be opened to send water into the park. It took another act of Congress to guarantee the gates were opened and that Everglades National Park did get water.

As the population in southeast Florida doubled and pushed westward, another flaw of the new drainage system became evident. By continuously draining the coastal ridges through which they cut, the new canals lowered levels of fresh water underground by more than five feet. The result? Saltwater intruded into coastal well fields. A lot of money has been and will continue to be spent to correct the mistake and offset the loss of fresh water.

In an attempt to reconnect parts of the ecosystem that were hydrologically severed by the flood-control project and left out of the park, Congress in 1989 added 107,500 acres of the Northeast Shark River Slough and ordered modifications to send more water to the park. Previously, it had ordered the assembly of other parts of the ecosystem left out: the Big Cypress National Preserve, Biscayne National Park, the Keys National Marine Sanctuary, and acquisition of the 10,000 islands on the southwest coast. The State established John Pennekamp State Park and acquired the Fakahatchee Strand and Picayune State Forest.

Between 2000 and 2009, Florida and the South Florida Water Management District spent \$8.374 billion on restoration, aggressively buying land, creating and enlarging marshes to treat farm and urban runoff, and initiating restoration of the Biscayne Bay coastal wetlands on the east coast and the Picayune Strand (once known as Golden Gate Estates) on the southwest coast.



Photo by Mary Lou Norwood
Alligator amidst the pickerelweed at Shark Valley, Everglades National Park, 1980.

During the same period, the federal government spent \$2.337 billion. Congressional passage of the Water Resources Development Act of 2008, the first federal water-project authorization since 2000, portends dramatic increases in federal spending in the next few years and, with its precedential land purchases, Florida has banked \$1.5 billion in construction credits with the Corps. The Indian River Lagoon was included among restoration projects authorized. Utilizing “stimulus” money (American Recovery and Reinvestment Act), the Corps has already begun construction of a one-mile bridge on the Tamiami Trail (U.S. 41) to increase the flow of freshwater into Everglades National Park from Water Conservation Area Three. An additional four miles of bridge is in the offing as are major modifications to canals in the southern reaches of Miami-Dade County to restore much of the historic flow of water into Florida Bay through the Taylor Slough, which is near the main visitor entrance of Everglades National Park.

Increases in federal spending help offset the dramatic reduction to \$30 million for Everglades Restoration in the state’s 2011-2012 budget, from \$100 million in peak years, and new legislative caps on property-tax levies by the water-management districts. Currently the South Florida Water Management District, the state’s largest, levies some \$420 million in property taxes; the Legislature has capped its levy at \$285 million. The Everglades Coalition of 53 state and national environmental organizations is now pushing Congress to support President Obama’s



Photo by Dale M. McDonald
Queen Angel fish near French Reef at the John Pennekamp Coral Reef State Park, 1980.

request for \$168 million to maintain the comprehensive Everglades Restoration program in 2012.

Much of the state Legislature's ire stems from former Florida Gov. Charles Crist's announcement in June 2008 that the South Florida Water Management District would spend \$1.34 billion to buyout U.S. Sugar. The company's assets included 180,000 acres, some of which were to be swapped or traded to establish a flow-way between Lake Okeechobee and the Everglades. By the time the "game changing" deal closed in October 2010, however, the purchase had dwindled to \$197 million to buy 26,800 acres with a 10-year option to purchase the rest. The deal was bitterly contested by other sugar growers, drew national attention, and focused political attention on the state's five constitutionally independent water-management districts, which the Florida Legislature is now asserting it, rather than the governor, should control.

The most serious threat to the Kissimmee River-Lake Okeechobee-Everglades ecosystem as a whole, however, remains pollution. The need for more water to preserve and restore the environment is often offset by fears that the water available is too polluted to be of help. Whether found in farm or urban runoff, excess nutrients—largely phosphorus and nitrogen—arsenic and mercury contamination, traces of pesticides and pharmaceuticals, industrial solvents, and other chemicals pose serious problems in the environment. None are quickly or easily vanquished as has been demonstrated by the slow recovery of Lake Apopka, continuing decline of Lake Okeechobee, and widespread alarm over the cost of meeting the U.S. Environmental Protection Agency's proposed numerical standards issued for Florida water bodies.

The Comprehensive Everglades Restoration Plan identified 1.7 billion gallons a day of fresh water now being discharged into the Atlantic Ocean and Gulf of Mexico that could be re-

captured, stored, and used to meet environmental, urban, and agricultural needs. Required by longstanding state and federal law to "reserve water" for the environment, the South Florida Water Management District has set restrictions on agricultural water use and told urban utilities wanting to increase their water allocations to find "alternate sources." For most utilities that means treating salt water drawn from the Floridan Aquifer and reusing more wastewater. Both are more expensive than treating water from surface sources and shallow wells. As a result, urban-water users in South Florida have a vested economic interest in water conservation and the successful restoration of the Everglades to protect and maintain its water supply.

Despite restoration planning and efforts, Everglades National Park still ranks high on the lists of the nation's most endangered parks. A mere 10,000



Photo by Francis P. Johnson

Everglades National Park, 1964

to 20,000 egrets, ibises, and other wading birds remain of the 250,000 to 300,000 that whitened the skies 60 years ago. Invasive species of nonnative plants and animals—including Burmese pythons that have attracted national TV attention—present new threats. A vast “dead zone,” sustaining neither plant nor animal life, mars Florida Bay, which comprises one-third of the park.

Even so, visitors continue to explore and find much to marvel over at Everglades National Park, the adjacent Big Cypress National Preserve and Biscayne National Park; also further north, west of Delray Beach, the Arthur R. Marshall Loxahatchee National Wildlife Refuge and visitor center. State parks, recreation and wildlife conservation areas, and observation points abound in the region.

The main entrance to Everglades National Park is about 10 miles southwest of Florida City on State Road 9336. Newcomers should stop at the Main Visitors Center near the entrance. Camping facilities are

open, but the popular Flamingo Lodge and Restaurant were destroyed by Hurricanes Katrina and Wilma. The park also offers a 15-mile, two-hour tram tour into the heart of the Everglades from the Shark Valley Visitors Center, which is 30 miles west of Miami off the Tamiami Trail (U.S. 41). This tour includes a view from a 65-foot-high observation tower.

For more information about Everglades National Park, phone 305-242-7700 or write to P.O. Box 40001, Homestead, FL 33034-6733.

Information about all of the national parks in Florida can be found on the National Park Service’s website, <http://www.nps.gov/state/fl/index.htm?program=parks>; for national wildlife refuges check <http://www.fws.gov/refuges>.

Information about Florida’s state parks can be found at <http://www.floridastateparks.org> and about hunting, fishing, and wildlife viewing at <http://www.myFWC.com>.

NOTE: This essay was last updated for the 2011-2012 edition. For the most recent news on Everglades restoration, visit the Florida Department of Environmental Protection’s Everglades website at <http://www.dep.state.fl.us/everglades/news.htm>.

Scenic view of wet prairie land at Shark Valley, Everglades National Park, 1993.



Florida State Archives



Fish and Wildlife Conservation Commission

Henry P. Cabbage and Wendy Dial*



Natural wonders flourish throughout Florida's warm climate and abundant water. Recreational activities appeal to a wide spectrum of outdoors enthusiasts. Sportsmen, anglers, and nature lovers from all over the world find a wealth of resources here that no other place can match. Nature trails span the en-

tire state. Here in the Fishing Capital of the World, trophy-sized largemouth bass and other fish await anglers in Florida's fresh waters. Game is plentiful for hunters.

Rivers and lakes and coastline waters offer scenic and serene retreats for canoeists and kayakers. Two nationally recognized water trails give paddlers a chance to explore some of the wildest parts of Florida. From a half-day trip to multi-day adventures, the Apalachicola River Paddling Trail System guides paddlers through the vast swamps and estuary of the 65,000-acre Apalachicola River Wildlife and Environmental Area. In winter, paddlers may see bald eagles surveying their territories; summer visitors can view graceful swallow-tailed kites soaring overhead.

The seemingly endless salt marshes and cabbage-palm-dotted islands of the 105-mile Big Bend Saltwater Paddling Trail treat experienced open-water paddlers with views of wintering white pelicans and stately shorebirds. At times, paddlers feel they are skimming along the surface of a crystal-clear aquarium that is filled with waving meadows of sea grass and fascinating sea creatures. Campsites along the trails are placed every 10 miles for safety and to encourage paddlers to slow down and enjoy the history and wildlife of this unique part of Florida. Florida's waters offer thrills for boaters, water skiers, and personal watercraft riders.

Near-shore and offshore salt waters are alive with sea life for fishermen, and they are dotted with



Florida State Archives

Young boy with his catch, Everglades National Park.

**Henry P. Cabbage is a former FWC Information Director who originally authored this piece for the 1999-2000 edition of The Florida Handbook. Wendy Dial, FWC Deputy Director of Communications, updated the essay for the 2003-2004 Edition. Editorial staff have made minimal updates for the current edition.*



Photo by Gene Smith

Electrofishing in the Apalachicola River below the Woodruff Dam during a fish population study, 1968.

natural reefs and sunken ships to the delight of scuba divers. When officials sank the 888-foot aircraft carrier Oriskany in the Gulf of Mexico 24 miles south of Pensacola in 2006, they created the largest artificial reef in America. It's a popular spot for scuba divers and fishermen. The Florida Fish and Wildlife Conservation Commission (FWC) helped many partners sink the decommissioned 523-foot Vandenberg military ship in 2009 near Key West to create another artificial diving and fishing reef. This 140-foot deep reef is now part of the Florida Keys National Marine Sanctuary.

Pleasure cruisers, sailboaters, and sailboarders love Florida's emerald-green and cobalt-blue waters, too. Florida has 1 million registered boats. That's one boat for every 18 people who live here.

Wildlife watchers find hundreds of species, which include more than half the bird species that occur in North America along with hundreds of other creatures—some found nowhere else in the world. Floridians traditionally love their wildlife, and they rely on the FWC to practice sound management to protect the complex balance of nature that sustains all life here.

Approximately half of Florida's 18.5 million to 18.8 million residents participate in resource-related outdoor activities, and many nonresidents visit the state primarily to enjoy the natural resources. Fishing, boating, hunting, and wildlife viewing in Florida

contribute more than \$31 billion to the economy annually. FWC's Division of Law Enforcement's activities and services greatly enhance the ability of this industry to exist and thrive.

Seven commissioners are appointed by the Governor and confirmed by the Senate to serve 5-year terms. The state's voters, in a 1998 revision of the Florida Constitution, approved establishment of the commission and gave it authority to manage Florida's fish and wildlife.

Fish and Wildlife Research

The FWC's Fish and Wildlife Research Institute (FWRI) in St. Petersburg conducts research and provides information to improve management of Florida's fish and wildlife resources. The institute's work takes place in cooperation with other academic, nonprofit, and private research institutions. FWRI provides the technical expertise to meet the scientific needs of resource managers. Considering the diversity of natural resources and the magnitude of problems, the challenges are great.

Conservation Law Enforcement

The FWC's Division of Law Enforcement is unique in state government. No other state agency provides comparable patrol, response, and protection services. Its officers are among the most highly trained in any state agency.

The division patrols rural, wilderness, inshore, and offshore areas, and places where other law enforcement agencies do not routinely patrol. Its officers have the authority to enforce all laws of the state and are cross-deputized to enforce federal fisheries and wildlife laws. Division officers are often the sole law enforcement presence in many of the most rural and remote parts of the state. FWC officers have direct contact with approximately 1.4 million resource users each year.

In the normal course of performing their duties, FWC officers often encounter criminal activity unrelated to natural resources. With statewide law enforcement authority, they can address violations immediately, serving as a force multiplier for local jurisdictions. This capability enhances public safety statewide.

The division's motto, "Patrol, Protect, Preserve," reflects the daily duties of uniformed officers who carry out their responsibilities on more than 34 million acres of land; 12,000 miles of freshwater rivers, streams and canals; 3 million acres of lakes and ponds; 8,200 miles of coastline; and 15,983 square miles of offshore waters.

Florida's location, terrain, and population density make it vulnerable to disasters. The FWC is often the first responder to hurricane-impacted areas.

The FWC's Division of Law Enforcement plays an important role in Florida's waterways. In the course of enforcing freshwater and saltwater resource laws, officers conduct boating safety inspections. In 2007, more than 600 reportable accidents resulted in 426 injuries and 65 deaths. The FWC is a national leader in promoting boating accident prevention and works to reduce boating-related fatalities through enhanced enforcement and education about the importance of wearing life jackets.

The FWC forms partnerships with other agencies and lends its resources to recovery efforts. The agency has boats and off-road vehicles, and its officers have experience in search-and-rescue, land navigation, water survival, human interaction with wildlife, and first responder training. The division uses large vessels to enforce fishing regulations in state and federal ocean waters as far as 200 miles offshore.

The FWC's Aviation Section plays a vital role in the agency's efforts to enforce conservation and boating laws, protect rare species, and safeguard outdoor users. The canine teams assist in enforcement efforts with dogs specially trained for detecting wildlife and fish, recovering evidence, and tracking lost or missing people and wanted persons in remote areas. The Investigations Section monitors the commercial fish and wildlife trade. Plainclothes investigators conduct long-term investigations and perform surveillance activities in support of uniformed officers. The Internet Crimes Unit supplements other investigative measures by monitoring wildlife trade and other fishing and hunting activities via the Internet. The Special Operations Group of the division is specially trained to search for missing or wanted persons in the roughest and most remote areas of the state.

Florida's Wildlife

Much of Florida's economy revolves around the demand for opportunities to view wildlife in its natural habitat. Florida is a wildlife watcher's paradise, with more bird species and possibly more wildlife in general than any other state east of the Mississippi River. Florida's unique geographical position, between the temperate and tropical zones, provides conditions that enable a variety of wildlife to flourish here. Couple this with a geologic history of periodic flooding by the ocean and isolation from mainland North America, and the resulting conditions allowed the evolution of wild animal life found nowhere else on Earth.

Roughly 800,000 people per year visit Florida for the primary purpose of viewing wildlife, and nearly half the people who take vacations incorporate nature-based recreation into their plans. A growing number of resorts feature nature and wildlife viewing as their primary purpose for existence and are endeavoring to go "green."

The Great Florida Birding Trail is a 2,000-mile tour of prime sites for bird lovers to view Florida's bird species. Bald eagles, tiny hummingbirds, colorful painted buntings, beautiful roseate spoonbills, burrowing owls, and others—510 species in all—charm millions of bird watchers in a variety of habitats.

FWC officers enforce laws to protect more than 1,400 native species, of which 131 are state and federally listed as endangered, threatened, or a species of special concern.

Each year, hundreds of thousands of people from around the world visit Florida for a chance to see one of Florida's unique, imperiled species—the state's official marine mammal: the Florida manatee. Visitors look for these huge animals while visiting coastal waterways, parks with freshwater springs, power plant discharge canals, and facilities where workers care for injured manatees to be released back into the wild. Manatee education and visitor centers are near most of the warm-water sites where manatees gather during winter. Manatees have lived along Florida's coasts for thousands of years. The FWC has a state-wide manatee management plan, reviews permits for marinas and boat races, conducts research on mana-

tees' needs and habitats, promotes public awareness about the species and enforces boating speed restrictions—all to ensure manatees continue to thrive in Florida. A “Save the Manatee” specialty license plate provides money to support the FWC’s manatee research and protection programs.

Florida also hosts other marine imperiled species. Sea turtles—Kemp’s ridley, leatherback, green, hawksbill and loggerhead sea turtles—on average build 66,000 nests on Florida’s beaches between March and October. The FWC works with local governments to protect nesting areas through lighting ordinances to ensure beaches are dark during nesting and hatching seasons when artificial lights can confuse sea turtles as they try to find their way to the water. The agency encourages businesses to clear beach chairs and other items from beaches before dark so such things don’t block sea turtles on their way to and from the water. The FWC issues permits for sea turtle walks in which visitors get to see sea turtles during nesting seasons. A “Helping Sea Turtles Survive” specialty license plate helps pay for sea turtle protection.

Alligators live throughout the state and nest wherever swamps, rivers, or lakes provide suitable habitat. From a low level of abundance during the early 1960s, the alligator has made a strong recovery, even to the point of constituting a nuisance from time to time. The alligator is managed as a renewable resource. Tightly controlled recreational and commercial alligator harvests take place annually.

These reptiles grow about one foot per year in the wild. Females rarely grow longer than 9 feet, whereas males may grow much larger—upwards of 14 feet. In August 2012, Lane Stephens caught an alligator roughly 14 feet long using a baited line, a method only FWC trappers are allowed to use. The alligator’s head measured 23.75 inches—the largest ever officially measured—and was caught in Lake Talquin, near Tallahassee.

Females lay an average of 35 eggs during late spring to early summer in nests made of rotting vegetation, piled in a large mound. It takes about nine weeks for the eggs to hatch, kept warm by heat generated by the rotting vegetation. Whether the hatchlings will be males or females depends on the temperature of the eggs while they are in the nest. Females protect their nests from other animals that



Florida State Archives

Snooty the manatee having a healthy snack at South Florida Museum, Bradenton, 1976.

might eat their eggs before they hatch.

Baby alligators face many perils such as herons, snakes, raccoons, and other predators, including their own species. After the first couple of years, alligators have few effective enemies other than humans and other alligators.

Florida offers rare opportunities for cautious and respectful wildlife lovers to see imperiled species.

The American crocodile, for instance, is limited to the southern tip of Florida. It is similar to the alligator, but it has a much-more-pointed snout and lighter color. These reptiles normally live in saltwater or brackish water. They lay their eggs in holes they dig in the sand, much like sea turtles do. Males may reach a length of 15 feet. At one time, Florida’s crocodile population may have dipped to a mere 300 animals, but scientists believe the population is roughly 1,400 to 2,000 today, and that does not include hatchlings.

The Florida panther is the last of the big cats east of the Mississippi River, and it is among the most endangered species in North America. The remaining Florida panther population lives mostly in the remote Everglades, Big Cypress and Fakahatchee Strand regions of South Florida. At times, panthers have roamed far from their usual territories. Funds collected from the panther specialty license plate help support panther research.

The FWC classifies more than three dozen species of animals as endangered, including the American crocodile, Florida panther, Key deer, beach mice, and others. Efforts in Florida have resulted in some species such, as the bald eagle, being removed from the endangered species list, although wise management plans are in place to continue conservation of the species.

Florida Afield

Finding a place to hunt is no problem in most parts of Florida. In fact, Florida offers resident and visiting sportsmen one of the largest systems of public hunting lands in the country. The FWC administers hunting opportunities on more than 5.8 million acres of public land, spanning the state from the Everglades to the pine forests and oak hammocks in Florida's northern reaches. Hunting opportunities on these lands match the needs of a diverse group of hunters.

In addition, the FWC offers special-opportunity hunts on some areas where hunters pay a special fee if selected for a permit in areas with excellent game populations and low hunter densities. Special-opportunity hunts for white-tailed deer, wild hogs, turkey, and released quail are favorites among sportsmen. Another popular program is the Dove Club, which offers seasonal and daily permits to hunt on special-opportunity dove fields.

During some hunts, the commission limits the number of hunters on wildlife management areas by requiring sportsmen to possess no-cost quota permits, which they obtain through random drawings.

More than 176,000 people bought licenses to hunt in Florida during 2009-2010. Many other sportsmen are exempt from license requirements because of age, disability, or other factors. The money these individuals spend on hunting, and the taxes they pay on hunting equipment, have enabled Florida to maintain diverse hunting opportunities despite this state's huge increase in human population. These sportsmen

also provide funding for wildlife research, endangered species protection, and habitat improvements that benefit all wildlife—not just game animals.

Hunting opportunities for certain species on private lands are open throughout the year. For other game species, open seasons are restricted to certain time periods, and bag limits must be observed.

The most prized game animals in Florida include the white-tailed deer and both the Osceola and eastern wild turkeys.

With a growing deer herd, Florida offers hunters a daily bag limit of two. White-tailed deer occur throughout the state despite vanishing wildlife habitat. The overall deer population has responded to sound management and protective regulations. Deer

hunting opportunities begin in early August with an archery and crossbow hunting season in South Florida, and end with a muzzle loading gun season that continues into early March in Northwest Florida.

From mid-August through October, residents and nonresidents can take alligators on selected waters and counties through-

out the state and experience the thrill of testing their skills against the awesome reptiles that have inhabited the earth since dinosaur days. The FWC accepts alligator harvest permit applications for a random drawing, beginning in May. Applicants successful in the random drawing must purchase their permits by a specified deadline. Any permits not purchased by the deadline will be offered to the public on a first-come, first-served basis in June.

Other hunting seasons include bobwhite quail and gray squirrels from mid-October into March, and bobcats and otters, which are legal to take December through February.

Foxes may be chased but are protected from shooters. Wild hogs, rabbits, and furbearers are legal to take year-round on private property, and migratory game bird hunting seasons occur during fall and winter.

The gray squirrel is found chiefly in hardwood



Florida State Archives

Wild hog in South Florida, 1965.

forests and swamps. It is agile and generally lives among the branches and limbs of trees. Squirrels build nests from twigs and leaves in the branches of trees or may use tree cavities or abandoned woodpecker holes for rearing two litters of three to four young each year.

Wild turkey have both a fall and spring hunting season. The fall season varies within each of the four hunting zones but ends in January, and the spring season is during March and April. The bag limit for wild turkey is one per day and two per season. The Osceola or Florida subspecies only occurs within peninsular Florida, and as a result, is highly sought by sportsmen from all over the world. The eastern subspecies has the most widespread distribution of the five North American subspecies and occurs in portions of North Florida and across the Panhandle. Wild turkeys occur in all 67 counties in Florida. The wild turkey favors mature forests and open habitats within forested areas. Wild turkeys are particularly abundant in the mixed pasture, hammock swamp, cattle country of Central and South Florida and the mixed pine/hardwood forests of North Florida. Money from the sale of turkey permits and other licenses that contain turkey hunting privileges help fund management and research of the wild turkey resource.

Florida's wild or feral hogs are descendants of hog that were introduced to Florida by explorers and pioneers centuries ago. Since they are not native to Florida, wild hogs are legal for hunters to take year-round on private lands, with no size restrictions or bag limits. However, on wildlife management areas, season dates and other restrictions apply. Many farmers consider them nuisances because of the damage they cause to crops.

Raccoons and opossums also may be hunted throughout the year on private property. Hunters pursue these critters at night with dogs and lights, but they may use only single-shot .410-gauge shotguns or .22-caliber rimfire (other than .22-magnum) firearms. This type of hunting is mostly about the chase, and the firearms may not be loaded until the animal is treed or bayed. These animals, particularly raccoons, are quite at home in all types of habitats.

The cottontail rabbit is abundant throughout Florida except in marshy areas where swamp rabbits occur. On private lands, there is no closed season on rabbits, and licensed hunters may take a daily bag

limit of 12. Even with the continuous open season, there is little hunting pressure on rabbits.

Duck hunters take advantage of the early duck season in late September and the regular waterfowl and coot season that runs from late November through late January. Also, Florida offers Canada goose hunting in September, late November around Thanksgiving, and during December and January. Sportsmen also enjoy hunting snow geese and Ross' geese during fall and winter.



Photo by Lovett E. Williams

Wild turkey hen at Fisheating Creek, Glades County.

Wetland habitats, although greatly reduced by development, cover a vast expanse of Florida, and much of this habitat is open and available for public hunting. Large numbers of migratory ducks winter in Florida, particularly ring-necked ducks, scaup, teal, wood ducks, and wigeon. In addition, four species, the mottled duck (a.k.a. Florida duck), wood duck, black-bellied whistling duck, and fulvous whistling duck live in the state year-round. Easy access to hunting areas and a hunter success rate nearly twice the national average make Florida a great place to hunt ducks.

Mourning doves and white-winged doves are legal game during a three-phase season that begins in October and continues into January. Doves occur throughout the state during the entire year but are most abundant in the fall because of the arrival of migrants from the north. Flocks of doves are at-

tracted to harvested fields of corn, millet or peanuts. Hunting success varies yearly. Other migratory game birds include snipe, rails, common moorhens, and woodcocks.

For updated information, the FWC publishes the Florida Hunting Regulations handbook and other hunting publications annually and posts them on its website at <http://myFWC.com/Hunting>.

Marine Life

The beauty, diversity, and abundance of Florida's marine resources are major lures for new residents and visitors to this state. Consequently, 80 percent of Florida's population lives near the coast. From sunning on the beach and watching dolphins play in the waters near shore, to catching a large fish, the pleasures are many.

The rich diversity of Florida's marine environment is a result of its unique geography. There are 2,276 miles of tidal shoreline in Florida. State waters extend three nautical miles into the Atlantic Ocean on the East Coast and nine nautical miles (A nautical mile is about 800 feet longer than a 5,280-foot regular mile) into the Gulf of Mexico on the West Coast. Jutting south into a Caribbean-like environment, the coastline, southward from Cape Canaveral on the East Coast and Tampa Bay on the West Coast, is considered tropical to subtropical, and a wide range of marine plants and animals exist here in abundance that cannot be matched anywhere else in the United States. A major influence on the stability of the tropical marine resources of the area is the

warm ocean currents that flow from the Caribbean and bathe the coastline. The northern half of the state is considered warm-temperate, and its marine life is more typical of those found in the remainder of the eastern United States.

Thousands of species of plants and animals compose the marine environment in Florida. They range from marine mammals, such as manatees and dolphins, to coral reefs and the fishes that depend on reefs.

Living coral reefs and rocky limestone outcroppings are the two major types of natural reefs found in Florida. Coral reefs off the Florida Keys are spectacular and rival the Caribbean areas to the south. However, natural and manmade degradation is affecting these sensitive areas and great care is needed to preserve them. Rocky outcroppings are found all along the Florida coastline and are important to the productivity of our offshore waters. Both types of reefs are complex habitats for fish and other animals and plants, providing food and cover in an otherwise unfriendly environment.

Artificial reefs, constructed of ships, rubble, and other man-made materials, are becoming important habitats and fish attractors in the marine environment. Programs at the state, county, and local government level encourage artificial reef development in a coordinated and environmentally sound manner.

The estuarine environment is the most productive environment on Earth. Estuaries occur where fresh water meets and mixes with salty ocean waters. This includes bays, lagoons, and shallow, low-energy areas such as the Big Bend portion of the Gulf Coast. Important wetland habitats in the estuaries are mangroves, salt marshes, and sea grasses. Mangroves are subtropical trees that have adapted to grow in salt water. They cover 500,000 acres of southern Florida shoreline. Salt marshes are coastal wetlands rich in marine life that lives in low-energy areas in the zone between low and high tide. They occur all along Florida's coastline, often mixed with mangroves, and cover over 450,000 acres. Sea grasses are saltwater-adapted, flowering plants that grow below the tidal zone and cover about 2.2 million acres of submerged bottom. Sea grasses are a primary food for Florida manatees and sea turtles.

Estuaries absorb much of the residue from human activities, including storm water runoff and



Photo by Dale M. McDonald

Marbled grouper near French Reef at the John Pennekamp Coral Reef State Park, 1980.



Florida State Archives

Estuary with oyster bar, Cedar Key, 1978.

pollution. The plants in estuaries serve to filter the water. Their loss, through various types of development, can lead to serious problems for our marine resources.

When people alter the natural marine environment, changes are often permanent and damaging to the marine system. Natural events can have a similar impact, but often the resources recover from them or, in some manner, remain a working part of the marine ecosystem. Hurricanes and other storms can destroy mangroves, salt marshes, sea grasses, coral reefs, and oyster reefs through uprooting or burial, but sometimes recovery processes begin quickly. Winter freezes can kill thousands of acres of subtropical mangroves, but new plants start to grow back as soon as the weather warms.

Florida red tide is a natural occurrence resulting from dense concentrations, called blooms, of microscopic, plantlike organisms. The poisons produced by red tide can kill fish and cause human illness if they are in clams, oysters, and shellfish when people eat them. State health officials establish a ban on harvesting shellfish in affected areas whenever red tides occur.

Marine fishery resources are renewable, yet limited, and when limited resources are shared among various user groups, each individual must settle for

a smaller share. Effective management techniques are based on open and closed seasons, minimum and maximum size limits, bag limits, gear restrictions and other regulations that restrict users' access to the resource and limit harvests. Maintaining the information base to regulate in this manner is especially difficult in Florida because of the number of species sought and the fact that open marine systems have so many factors that influence marine life populations.

With such a diverse richness of natural resources and a variety of users, management of the resources is complex. This is compounded by rapid growth in Florida's human population and its impact on natural resources. Real-

izing that preservation and protection of the resources are important to a healthy ecosystem, Florida has developed numerous programs within various agencies to purchase and manage resources, protect them through regulations, and control growth that takes a toll on the health of natural resources.

Currently, Florida has 41 aquatic preserves, 37 that are marine or estuarine, covering more than 2 million acres. The goal of the Florida Aquatic Preserve Act of 1975 is to protect these sensitive areas from overuse by people. Florida also has three national estuarine research reserves—Rookery Bay, Guana-Tolomoto-Matanzas, and Apalachicola. Florida Keys National Marine Sanctuary covers 2,800 square nautical miles, 69 percent of it in state waters. It is the second largest marine sanctuary in the nation. Other areas within the marine environment are under consideration for special management.

Much work remains to retain or restore elements of Florida's natural systems and preserve its marine resources. The signs are clear that we are seriously stressing our marine resources. We have lost much of the natural habitat that supports life here, and we are using the resources more than ever before. Our marine resources are part of our natural heritage, and the FWC protects them for generations to come.

Saltwater Fishing

Florida has large commercial and recreational fishing industries. Florida ranks first in the nation in resident and non-resident saltwater anglers (more than 2 million of them). Recreational saltwater fishing has a \$5.4 billion annual impact on Florida's economy. The seafood processing industry is also significant, with sales of \$5.7 billion per year from commercial harvesters, processors, and dealers, wholesalers and their processors and retail.

It is important to realize these industries depend on the abundance and health of the species sought. Estuaries are major producers of fisheries products and serve as the nursery grounds for many of our fishery species. In fact, more than 70 percent of the commercially and recreationally caught species in Florida use estuaries during some stage of their life cycle. Estuaries provide juvenile fish with an abundant food supply and, just as importantly, protective cover in the various mangrove, sea grass, salt marsh and other habitats. Many of these fish grow up in estuaries but spend their adult life in deeper coastal waters. Shrimp, baitfish, red drum, mullet, and grouper are examples. Others, such as spotted seatrout, spend their entire life in estuaries. Species that do not directly use estuaries, such as sailfish and swordfish, depend on estuaries to produce their food.

For saltwater anglers, Florida offers opportuni-



Florida State Archives

Sunrise surf fishing in Daytona Beach, circa 1965.

ties in deep or shallow waters, off bridges and piers, from small boats and party boats, and by diving, wading, and surf-casting. The science behind managing saltwater resources requires regulations that vary in different areas of the state, and saltwater anglers should be thoroughly familiar with saltwater fishing regulations before taking to the water.

In 1983, following decades of increasing human population and decreasing coastal marine populations, Florida began scientific management of its valuable saltwater fisheries resources. The State established the Florida Marine Fisheries Commission, which later became part of the FWC. Many important commercial and recreational fisheries had not been managed properly, and many had never been managed at all. The State has since been able to provide significant protection for Florida's marine finfish and shellfish, using a science-based management approach.

Management of Florida's saltwater fisheries is extremely complex. Not only do managers have to take into account the individual characteristics of each fishery, including life history, biological behavior, habitat, and impacts of fishing pressure, but they also must contend with other state, interstate, federal, and international bodies involved in the management of saltwater species.

Today, most of Florida's coastal fisheries are under some form of management; however, the status of these fisheries varies greatly. Species that seem to be thriving, or at least stable, include Atlantic amberjack, Spanish mackerel, Atlantic and Gulf king mackerel, stone crabs, and spiny lobster. Species for which effective management is in place for recovery from overfishing include snook, striped mullet, red



Florida State Archives

Fishing boat "Ann H." near St. George Island, 1976.

drum, spotted seatrout, Nassau grouper, and Goliath grouper. Many important saltwater species are still overfished and require closer management, including red snapper, gag grouper, and sharks.

Resident and visiting anglers are able to enjoy world-class fishing for snook, tarpon, and sailfish in Florida waters, and fun-to-catch red drum and Spanish mackerel are found statewide. Thousands of divers of all ages enjoy pursuing delicious spiny lobster in South Florida and the Keys, and many families participate in the summer collection of tasty bay scallops in parts of Central and North Florida on the Gulf Coast.

Year-round, commercial fishermen supply huge quantities of fish, crabs, clams, lobster, and shrimp to dinner tables and restaurants worldwide.

The FWC will continue to monitor and fine-tune management of stable and recovering fisheries and to improve management of overfished species.

Saltwater fishermen find updates on regulations in the FWC's Florida Fishing Regulations, Saltwater Edition and on the agency's website, myFWC.com.

Freshwater Fishing

Opportunities to catch largemouth bass and other freshwater fish are everywhere in Florida. This state boasts 3 million acres of freshwater lakes and 12,000 miles of fishable rivers, streams, and canals. The FWC manages these fisheries for 1.2 million resident and nonresident anglers who spend 25.7 million days fishing in the state's inland waters each year.

No place in Florida is more than a 40-minute drive from a freshwater fishing spot (except the Keys), and the size restrictions and bag limits are among the most generous in the country for bream, crappie, catfish, and many others. Still, anglers continue to catch world-record fish here, and state records are impressive, too.

People can fish all day and night year round in Florida—the undisputable “Fishing Capital of the World”—so it is easy to understand why the average fisherman spends 17 days per year fishing. The U.S. Fish and Wildlife Service estimates that freshwater fishermen spend more than \$1.4 billion per year in pursuit of their sport, not including big-ticket items like bass boats. The total impact on Florida's econ-



Florida State Archives

Fishermen landing a big bass, Dead Lakes, 1968.

omy in 2011 was \$1.7 billion, and freshwater fishing supported 14,000 jobs.

Bass fishing in Florida is legendary among anglers from all over the world. Florida's largemouth bass are green in color, although this characteristic varies somewhat, depending on the color of the water where they live. They are easy to recognize because of the large mouth and the dark horizontal band from head to tail. “Bigmouths” are greedy fish that will attack a wide variety of prey, such as minnows, crawfish, frogs, small snakes, and insects. The bigger they are, the smarter and harder to catch they become.

Of the 1.2 million freshwater anglers in Florida, most focus on bass. Fishermen probably spend more money trying to catch largemouth bass than on any other freshwater game fish. In Florida alone, this species generates well over a billion dollars per year for the state's economy. Many of them purchase the “Go Fishing” largemouth bass tag for their vehicle or trailer, and the proceeds help support freshwater fisheries conservation throughout Florida.

Striped bass are at the southern extreme of their range in Florida and are classified as freshwater game fish here. Efforts are under way to restore the historic population of native Gulf Coast stripers, which is distinct from the Atlantic stock and handles Florida's

warm temperatures better. Most of the striped bass caught in Florida come from the major rivers in the northern part of the state and were stocked by FWC biologists.

Sunshine bass are a cross between white bass and striped bass and are popular game fish. Fisheries biologists produce and rear them in hatcheries and stock them in freshwater lakes and rivers. Sunshine bass do not spawn, so the supply must be replenished from time to time. These rapidly growing fish may reach a weight of several pounds during their first year. Usually, waters with an abundance of gizzard and threadfin shad are the best locations for sunshine bass stocking projects, since shad are the preferred food source for sunshines.

Peacock bass were introduced to South Florida waters from their native range in South America. After intensive research and consultation with other non-biased experts, this FWC stocking program led to an urban fishery that generated millions of dollars to the local economy and has been a source of funding for numerous guides and bait-and-tackle shops. (Although the cold snap of 2010 severely depleted populations, they are steadfastly recovering.)

Panfish (bluegill, redear sunfish, black crappie, and other abundant fish that delight the angler and provide a healthy meal) are in virtually every body of fresh water in Florida. They are fun to catch on cane poles with worms, crickets and such, but they also will take artificial lures.

Florida has an abundance of nongame fish, ranging from gar to minute minnows and darters. The most popular nongame species are catfish, which provide excellent table fare and are sought by recreational and commercial fishermen. Channel, white, blue, and flathead catfish, along with several spe-

cies of bullheads, are here in Florida. A new state record blue catfish was caught in 2008 on the Choc-tawhatchee River weighing 64 pounds, 5 ounces. Gar, catfish, and other nongame fish are popular with bow-fishermen as well as with hook-and-line anglers. Alligator gar are protected, however. Sterile triploid grass carp are stocked for vegetation control and must be released immediately and unharmed, the same as with alligator gar.

Regulations may be more or less restrictive in certain waters, so it is a good idea to check the regulations booklet or <http://myFWC.com/Fishing> before fishing in an unfamiliar area, but generally the bag limits are: 5 black bass (largemouth, Suwannee, spotted, and shoal basses individually or



Florida State Archives

Stringer of bass, Dead Lakes, 1952.

in total; only 1 may be longer than 22 inches, and the minimum size varies with location in the state); 20 striped bass, white bass, and sunshine bass (individually or in total); 50 panfish (bream, warmouth, and shadow bass individually or in total); 25 crappie; and 2 butterfly peacock bass, only one of which may be 17 inches or longer.

Summary

Fish and wildlife conservation is a complex matter in Florida. It's a constantly moving target as conditions change and development complicates efforts to manage the delicate system that sustains Florida's natural wealth.

However, the benefits of keeping our youth and adults connected with nature pay big dividends in terms of their health, quality of life, the economy, and the FWC's ability to ensure the safe and sustainable use of Florida's natural resources. That's why

the FWC launched its Youth Conservation Centers Network initiative to establish centers around the state to bring children back to nature. Partnerships

with individuals, organizations, and other agencies are making the FYCCN a reality. Fishing and hunting licenses and associated Federal Aid in Sportfish and Wildlife Restorations funds pay for much of these conservation efforts. In addition, along with youth fishing and hunting programs, donations collected wherever licenses are sold, enable the FWC to reach out to youths to teach them about conservation and offer them the benefits of an active outdoor life.

The wild creatures that share this state and its waters and wilderness areas offer wonderful recreational opportunities for the people who live here and those who visit Florida. That's a big part of Florida's charm.



Florida State Archives

Young boy holding a freshly caught catfish, 1972.



The Aliens Among Us

Exotic Plants

They are often green, even if they are not always little, and are not men. Although many alien flowers and trees have been brought into the United States by individuals, more than 300,000 plants were introduced by the United States Department of Agriculture between 1898 and 1967. Obviously, most of these species are benign, and many, such as citrus trees, beans, corn, and other vegetables are beneficial. But some agricultural, ornamental, industrial, and pharmaceutical introductions have become threats to fragile Florida habitats. In April 2000, the Nature Conservancy reported that Florida had 150 plants that exist nowhere else in the world and 570 species of plants at risk of extinction.

A four-category list of invasive species is published by the Exotic Pest Plant Council. Category I and II plants have either already displaced native species or probably will do so, and 92 percent of these two categories were purposely introduced.

Florida has up to 400 exotic animal species in the state (more than any other state in the continental U.S.), and, as of 2006, the state spent more than \$100 million annually for the removal of invasive, non-native species, including plants, animals, and farm pests. Another \$600 million was spent each year by the private sector.

The water hyacinth (*Eichhornia crassipes*) was brought home by a Jacksonville visitor to the Japanese Pavilion at the New Orleans exposition in the 1880s. By the early 1960s, more than 120,000 acres of Florida's waterways were clogged by the "pretty flower." In recent years, herbicides and biological



Photo by Lois Foley Steinmetz

Photographer Joe Steinmetz looking at water hyacinths from a canal along the Tamiami Trail, Everglades, circa 1955.

and mechanical removal have reduced the coverage.

Florida elodea (*Hydrilla verticillata*), called the fastest growing submerged aquatic plant in the world, was introduced in Dade County in 1959. Easily spread on the legs of water birds and the bottoms of boats, it now takes millions of dollars to control.

According to a Department of Environmental Protection Bureau of Invasive Plant Management report in 2004, water hyacinth, water lettuce, hydrilla, and eight other invasive plants infest 90 percent of Florida's public waters covering 17,700 acres. Funding was insufficient to control all aquatic weeds, and "plants like torpedo grass and wild taro were virtually unmanaged for decades. Consequently they spread throughout lake and river marshes and present substantial management challenges for many years to come." To compound the problem, "in 2003 a four

to five year drought ended and nearly 4,500 acres of floating tussocks formed as plants, peat and muck pulled loose from reflooded lake bottoms. The unprecedented speed and magnitude of the tussock formation combined with a \$4 million budget reduction left the Bureau financially unequipped to respond.”

The most successful battle has been the reduction of large mats of alligator weed that choked Everglades waterways. Biologists introduced a flea beetle and moth that eat it and have reduced the South American plant to scattered strands.

Hygrophila, first introduced as a decorative plant for aquariums, was identified in Miramar in 1979. It has spread to canals and lakes throughout Broward and Palm Beach Counties, as well as parts of Dade and Martin Counties. It is more brittle than hydrilla, roots easily, and can adapt from fresh to brackish water. In late 1995, experts agreed that it would take over as the No. 1 submerged weed in south Florida, and the only known way to control it is to stock the waters with grass carp, a fish from the Far East.

Kudzu, introduced from Japan in 1876 as a solution to soil erosion and a possible cattle food, is now known as “the plant that ate the South.”

Paper trees (*Melaleuca quinquenervia*) were estimated to occupy over 1.5 million Florida acres in 1995. The Australian native was introduced about 1886 as a way to dry up wet areas. Per acre, *Melaleuca* consume 2,100 gallons of water an hour. In 1936, seeds were scattered over the Everglades of Broward County from an airplane. Four years of effort, 1995-99, reduced Everglades *Melaleuca* population from 488 to 391 thousand acres. In 2006, it was estimated that the trees still occupied 620,000 acres of natural areas, ranches, farmlands, and yards in the state. *Melaleuca* forests threaten the drinking water supply of south Florida; the pollen can cause allergies and ruins the taste of honey when bees use it. The trees have wiped out native species like the pond apple, affected bird populations, and displaced Everglades animals, including bear and deer. Because of their resilience and resistance to fire, frost, drought, and flood, *Melaleuca* trees are difficult and expensive to destroy. A 2006 economic study by the University of Florida said it costs \$13 million a year just to keep the trees under control.

A half-inch-long gray beetle that helped to keep the *Melaleuca* under control in Australia was the first

hope for slowing the invasion. After being kept in a laboratory and tested for 11 years to be sure it would only eat *Melaleuca*, in 1997 the first groups of *mela-leuca* snout beetles were released at 10 sites. The insect spread and is now successfully established within *Melaleuca* populations throughout south Florida. A second insect, a sap-sucking psyllid, was released in November 2002 and has also become established. These two control agents have been observed to severely curtail flowering and new growth of *Melaleuca* within their ranges. In 2006, Allen Dray of the United States Department of Agriculture in Fort Lauderdale, could say “Overall we’re winning. We’re not at a point where we can declare victory yet, but we’re getting ahead of the game.”

Brazilian pepper (*Schinus terebinthifolius*), nicknamed “Florida holly,” became popular for its bright red berries beginning about 1950. Seeds spread by birds quickly grow into sprawling dense thickets that force out native species and kill undergrowth with shade. As a relative of poison ivy, Brazilian pepper can cause similar reactions on contact.



Photo by Dr. David E. LaHart

Brazilian peppertree in conservation area 2, Everglades, 1978.

Melaleuca and Brazilian pepper are only two of Florida’s well-known weeds, once covering more than 1 million acres of public conservation lands. The Florida Exotic Pest Plant Council lists 123 exotic plants found on public lands in Category I and II pest plants. Category I species are those known to have damaged natural areas, while Category II species are not yet implicated in direct damage to ecosystems. Funding has historically been insufficient to address every problem weed; therefore plants like



Florida State Archives

Australian pines along roadside near Homestead, 1932.

Japanese climbing fern and air potato have had an opportunity to expand their range over previous decades. Like *Melaleuca* in the mid-1990s, these and other plants are on the verge of overwhelming parks and forests across the state.

The Australian pine (*Casuarina* sp.), a seashore tree of Australia and the West Pacific, was brought to Florida in the late 1800s to provide shade and wind-break along the coast. Not a true pine, the leaves, which appear to be needles, form a thick mat that prevents the growth of native plants, and the tree's shallow root system interferes with nest sites of the American Crocodile and the Green Sea Turtle. After Hurricane Donna in 1960, Australian pines began to dominate areas of Everglades National Park, and it now infests south and central Florida.

Chinese tallow (*Sapium sebiferum*), nicknamed the "popcorn tree" because of its abundant ivory-colored seeds, was imported from East Asia in the early 1900s. Called the "Melaleuca of North Florida," Chinese tallow has spread into forests and wetlands. Possession with the intent to sell this plant is now illegal.

The tropical soda apple, a native of Brazil and Argentina, was discovered in Florida during the early 1980s. It now infests over a million acres of mainly pasture land in south Florida and is blamed for losses of more than \$10 million a year. The tropical soda apple usually grows 3 to 6 feet high and has thorned leaves and stems animals will not eat. The berries, which contain hundreds of seeds, are eaten and dispersed by animals.

The Burma reed (*Neyraudia reynaudiana*), which escaped from a USDA test garden in Coconut Grove in the 1920s, now threatens a rock formation known as Rockridge Pinelands, a swath of limestone that varies in width from 4 to 10 miles and stretches from North Miami south to Magnolia Hammock. The Burma reed reaches an average height of 10 feet within a year, shoots up five or more plumes, each producing 120,000 or so seeds, and casts them into the wind. It likes dry soil, thrives in sand, and embeds itself in porous rock and the spaces in piles of rock. Four endangered species unique to the Rockridge Pinelands are threatened by the reed.

Vines, at least two of which were brought to Florida for agricultural use, also threaten native plants and trees. Air potato was introduced as a possible food source about 1905, but neither humans nor animals eat the fruit. The state spent more than \$20,000 in 1998 to get rid of it by removing the vines and bulbs in sizes from pebbles to softballs. Along with the Japanese and old world climbing fern, these vines smother tree islands. They allow nothing to grow beneath them, prevent birds from nesting, reduce animal habitat, and provide a pathway for fire to get to the tree crown, which normally would not burn during ground fires.

Nearly \$108 million has been spent bringing 1.6 million acres of upland weeds under maintenance control since the inception of the Uplands Program in 1997.

Floridians must be vigilant. Remove invasive nonnative plants from landscaping and replace them with native plants. Use non-invasive exotic plant species. Boaters should clean boats and trailers every time they leave the water. Never empty an aquarium into the wild. Support legislation to control exotics and regulate their import. Volunteer to help eradicate nonnative plant populations in natural areas.

Exotic Animals

The walking catfish (*Clarias batrachus*) escaped from a Broward County fish farm in the mid-1960s. Within a decade they had spread throughout Broward County, Palm Beach County, and into Lake Okeechobee. By 1995, according to Paul Shaffland, director of the Florida Wildlife Commission's non-native research laboratory in Boca Raton, the flabby

gray native of Thailand was breeding in ponds over most of south Florida and had been reported in Orange County. After hurricanes and other periods of heavy rain, they move from pond to pond using their pectoral fins like crutches, wiggling their tails like propellers. They reproduce rapidly, crowd out native species, and have few enemies except large wading birds and the hot Florida sun.

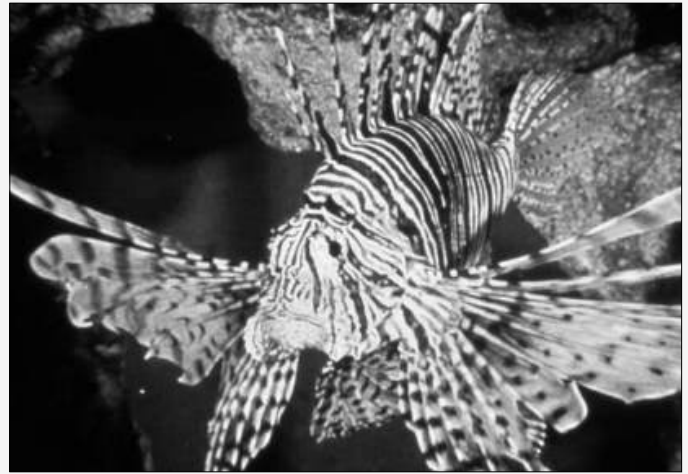
Flathead catfish, a native of the Mississippi River and its tributaries, were first reported in Florida in 1991. By 1995 this fish, which prefers live bait and can reach weights of 100 pounds, had been caught in the Apalachicola, Ochlockonee, and Escambia rivers. Although anglers may be pleased by the fight and taste of this odd-looking catfish, biologists fear for native fish.

In 2004, the population of the South American sailfin catfish in Lake Okeechobee exploded, threatening the safety of dikes and levees. These invaders can grow to over 2 feet long and have bony armor with saw-toothed barbs and spikes on side and back fins blamed for choking fish-eating birds. Of more concern to the U.S. Army Corps of Engineers are the sometimes 3-foot-long holes made by the fish in the area between Clewiston and Moore Haven. These burrows could collapse banks around the lake by causing the erosion of the interior walls. Commercial fishermen in the Clewiston area have seen the numbers of this fish, probably released from aquariums in the late 1960s, jump from a few a year to thousands of pounds. To help control future growth, fish wholesalers are being encouraged to sell them as food.

The tilapia was brought to the state to help control weed growth and because it was thought to be a good game fish. Unfortunately, the imported species was not the game fish type and soon threatened to completely take over waterways in south and central Florida.

The black acara (*Cichlasoma bimaculatum*) is another south Florida pest fish. It escaped a fish farm in the 1950s and has spread throughout much of the southeastern part of the state, including Everglades National Park and major canals.

Voracious, venomous lionfish were unknown in the Americas until the 1990s. Speculation says Hurricane Andrew (1992) may have washed them out of an aquarium or a capsized transport boat. In 2000, a diver saw two lionfish, at a depth of 140 feet, off the



Florida State Archives

Lionfish at the Marineland attraction near St. Augustine, 1980.

coast of North Carolina. Adult lionfish can lay hundreds of eggs every 55 days, year round. By 2002, they were in waters off Georgia, Florida, Bermuda, and the Bahamas. With no known predators, the lionfish's voracious appetite and poisonous sting threaten both the fishing and tourist industries. The invasion is being fought in at least three ways: early detection, trapping, and convincing the public that lionfish, said to have a delicate flavor, is not poisonous to eat.

Asian swamp eels, which can breathe air, pop out of the water, and slither on land like snakes, were first found in the continental U.S. in Fulton County, Georgia, north of Atlanta, about 1993, although they were probably there by or before 1990. Introduction is thought to have been through an aquarium release or fish farm escape or release. (The eels are a popular food in some parts of Asia and may have been released to establish a source.) Not a true eel, this fish was first found in Florida in canals in northern Miami and a drainage area near southern Tampa Bay in 1997. A third Florida location on the eastern edge of Everglades National Park was discovered in 2000. Tens of thousands of swamp eels are estimated to inhabit nearly 55 miles of the two south Florida canal systems. These usually olive-brown eels can grow to 3 feet or more, eat a lot of fish, crayfish, worms, and other water creatures, and could drive out or consume native species throughout the southeast.

Another Asian fish commonly known as a snakehead is an addition to Florida's list of reproducing exotic fish but, according to the Florida Fish and Wildlife Conservation Commission, it is too early to know what effect they will have on native species.

The Cuban Tree Frog (*Hyla septentrionalis*) was first reported in Key West in 1931. This species, generally four times larger than native tree frogs, has an outside coating that can make dogs and cats sick, and people who handle them and don't wash their hands can experience red and burning eyes. By the early 1970s, the frog had reached Palm Beach County and by the mid-1990s as far north as Brevard County. In the summer of 1998, wildfires drove them into residential neighborhoods in search of water. Summer rains allow them to reproduce in record numbers and invade Brevard County toilets, showers, and swimming pools.

The marine toad (*Bufo marinus*) has been wild in the Miami area since the 1950s. Accidental and deliberate releases between 1955 and 1964 of species from Surinam and Colombia led to the rapid spread of this large toad which secretes a poison that can be fatal if eaten by dogs, cats, or humans.

The cattle egret (*Bubulcus ibis*) brought bird watchers to Florida from all over the United States when it was first sighted here in the late 1940s. The species adapted readily and spread as far north as central Canada by 1961.

Escaped South American quaker parrots, or monk parakeets, short out transformers, costing power companies millions of dollars each year when they nest atop power poles.

The budgerigar (*Melopsittacus undulatus*), commonly called a parakeet, is probably the most widely domesticated of the parrot family. This Australian native, a favorite cage bird since the 1850s, has been established in the wild in Florida since the 1950s.

The canary-winged parakeet (*Brotogeris versicolurus*) was first identified as a wild bird near Miami in the late 1960s. By 1973, at least 15 nests and 2,000 birds had been counted in the area. In California they have been sighted eating the fruit of avocado trees, primrose, and rusty leaf figs as well as the buds of orange trees. Feeding on wild and cultivated fruit, berries, and seeds, they could become a serious agricultural problem here.

The nine-banded armadillo (*Dasypus novemcinctus*) was introduced into Florida several times between the early 1920s and 1936. Although blamed by hunters and farmers for game and crop losses, the examination of stomach contents indicates that 92 percent of their diet is comprised of insects, in-

cluding numerous agricultural pests. However, urban dwellers will still curse this armored invader for rooted-up lawns and gardens.

Coyotes, a western native, crossed the Mississippi River in the mid-1960s, conquered Florida's Panhandle in the 1980s, had been seen as far south as the Everglades by 1994, and have now been sighted in 66 of Florida's 67 counties. They eat almost anything, from grasshoppers and rodents to pets and species in between, including protected species like nesting birds and gopher tortoises, and sea turtle eggs. Rangers at St. Joseph Peninsula State Park found that coyotes had destroyed or damaged half of the turtle nests along 8 miles of Panhandle beach, going so far as to follow a female out of the water and wait for her to lay eggs. Cats that defend their territory, mistaking a coyote for a dog, end up as a meal. Coyotes are nearly impossible to eliminate. Extermination programs in the west that relied on poison bait also eliminated bears, foxes, eagles, and pets. Under severe hunting pressure coyotes respond by sharply increasing their birth rate, and although they are one of the most persecuted animals on earth, they are still here.

The nutria (*Myocaster coypu*), a native of South America, was imported in the 1920s to be bred for their fur. They resemble rats, 18 inches long and weighing 25 pounds. When owners found them unprofitable, many of the animals were released into the wild. Their numbers have rapidly increased, and they pose problems for farmers of root crops and some native species.



Florida State Archives

Group of nutria, 1957. The nutria was imported from South America and bred for its fur.

Rhesus monkeys have posed problems in two Florida locations: Silver Springs and two Florida keys. The Silver Springs monkeys, introduced by a boat ride operator in 1930, are now thought to carry

the herpes B virus. Early efforts to exterminate them caused a public uproar and are as yet an unresolved dilemma. In 1974, Charles River Laboratories, a subsidiary of Bausch and Lomb, released rhesus monkeys on Key Lois and Raccoon Key to breed them for sale to medical research laboratories. The monkeys roamed free and wreaked havoc on the stands of red mangroves. In 1992, an agreement between the state and Charles River Laboratories approved the continuation of the breeding program, but required that the monkey populations be reduced, that they be caged, and that the company begin restoring the destroyed mangroves. In late 1996, the Department of Environmental Protection filed a motion contending that Charles River Laboratories had failed to abide by the agreement, but preferred to settle rather than remove the operation from the keys. The monkeys were finally removed in December 1999, although rumor has it that a few may have escaped.

The first documented breeding population in the United States of the African Gambian pouch rat was on Grassy Key in the Florida Keys, where it is rumored that one male and seven females were released in 1999. In 2006, \$40,000 was spent trying to exterminate hundreds of rats on Grassy and Crawl Keys. This omnivorous rat, which can grow as large as a raccoon, could be devastating to the Florida Keys' ecological system by eating bird eggs and competing for food with endangered species. An additional threat is that the rats carry the potentially fatal monkeypox virus. If Gambian rats escape to the mainland they could ravage America's winter vegetable crops, destroy tropical fruits, and possibly migrate as far as Georgia and Alabama.

Alien reptiles, some of which hitchhiked in cargo from Caribbean or Latin American countries and others imported as pets and then released, have established populations in southern Florida. By 2006, at least 44 species of exotic amphibians and reptiles were established and breeding in Florida. Lizards

such as brown anoles, bark anoles, Cuban knight and Puerto Rican crested anoles, South American brown gasilisks, curlytailed lizards, geckos, and iguanas (which can reach 5 feet in length) threaten both native species and human populations. Many homeowners find iguanas especially offensive since they eat decorative flowering plants and defecate everywhere. In 2003, on Key Biscayne alone, more than 1,000 were removed.

As early as 1995, health departments in 13 states reported strains of salmonella bacteria that had caused human deaths and were traced back to pet reptiles, especially iguanas. Ninety percent of reptiles carry some strain of bacteria. In 1996, the Centers for Disease Control began a campaign to encourage veterinarians and pet store owners to make buyers aware of the risk, but people continue to buy baby iguanas without

taking into account that within 2 or 3 years that baby will be 4 to 5 feet long and can live for more than 15 years. With no natural predators, by 2005 iguanas were breeding out of control in south Florida.

Large constrictors plague many south Florida neighborhoods. Since the mid-1990s, the escape of huge snakes has become a frequent occurrence that threatens small children, pets, and more than 20 native species. A 2-year-old girl was strangled in her crib by an escaped pet python in July 2009. As early as 2004, large unclaimed escaped snakes were euthanized if no owner claimed them. There is such overpopulation that zoos do not want them. In 2005, photos of a 13-foot Burmese python which had died after partially swallowing a 6-foot alligator were widely published, reducing the hope that alligators would control the constrictor population in the Everglades. In 2005, 95 Burmese pythons were captured in Everglades National Park. In 2008, 300 were removed from the Everglades. In August 2012, a Burmese python measuring 17 feet, 7 inches in length and weighing 164 pounds, and carrying 87 eggs, was found in the Everglades National Park.



Photo by Wallace Hughes

Anole lizard, 1964. The anole is one of at least 44 exotic reptiles and amphibians now living in Florida.



Photo by Donn Dughi

Senator Dempsey Barron, D-Panama City, holds a 5-foot boa constrictor in the state Senate during Tourism Day at the Capitol, 1983.

In July 2009, the Florida Fish and Wildlife Conservation Commission authorized the first group of snake handlers to hunt and kill nonnative constrictors in the Everglades. The campaign to prevent nine species of giant constrictors (including Burmese pythons, boa constrictors, and yellow anacondas) from extending their territory was expanded. Licensed game and alligator hunters on specific wildlife management areas in south Florida were allowed to take any “Reptile of Concern.”

The hope that the record cold weather in January 2010 (the coldest 12-day stretch since the 1940s) had wiped out a major portion of the constrictors was short lived. All it did was flatten the rising trend line in captures for the first time in a decade: 322 were captured in 2010, only a 10 percent drop from 2009. Hopes were raised again with the cold, dry winter of 2010-11, but 26 pythons were captured before the end of March 2011. United States Senator Bill

Nelson introduced a bill to prohibit the importation of pythons. The bill is opposed by breeders and pet shop owners and has not yet passed.

The Nile monitor threatens to annihilate populations of herons, terns, cormorants, burrowing owls, and the American crocodile by raiding nests for eggs, especially in the Cape Coral area of Florida’s southwest coast. The native of Africa’s Nile River region can grow up to 7 feet long.

In 1999, Asian green mussels, native to the Pacific and Indian Oceans, were found blocking underwater pipes in Tampa Bay. By 2002, they had spread south to Naples and were also found at Pensacola, St. Augustine, and Daytona Beach in native clam and oyster habitats. In Tampa Bay, some native oyster reefs have died off after being smothered by green mussels. Eradicating the mussels is unlikely because they reproduce so prolifically. Fortunately for most of the United States, green mussels are tropical mollusks and are killed by cold weather. They are edible in their native range, but in Florida green mussels mostly grow in waters that are either polluted or prone to harmful algal blooms.

The smallest aliens are in some ways the most costly. Federal control programs for exotic pests cost taxpayers \$137 billion in 2005. Insect pests like the Caribbean fruit fly, the South American citrus leaf miner, and the West Indian sugar cane weevil borer cause millions of dollars in damage annually. The state of Florida spends more than \$100 million annually controlling nonnative species. Another \$600 million is spent by the private sector.

In June of 1998, a new threat to American honeybees was found in St. Lucie County. Thought to be the first infestation in this country, it was later determined that the South African hive beetle had been found in South Carolina and Georgia in the mid-1990s. By 2002, the small hive beetle had been identified in 20 Florida counties and 28 other states. Already decimated by mites, which killed more than 95 percent of the wild colonies in America in the early 1990s, beekeepers now battle a beetle with a taste for honey, which affects the combs of stored honey and pollen. Bees flee their hives when leaked honey ferments, leaving a repellent on the combs. Fortunately, a pesticide developed for the Varroa mite has proven effective and was approved in 2002 for use against the small hive beetle.

Africanized honey bees have been in Florida since 2007. Their stings are no more potent than ordinary bee stings, but they are far more aggressive and attack in swarms. There have been few Florida reports of swarms attacking people, but on April 9, 2008, in rural northwestern Okeechobee County, a man died after being stung more than 100 times. Since 1990, there have been more than 17 fatalities in other states. Florida has had numerous deaths of livestock and domestic animals, but this was the first reported human fatality.

Early on (1980), the threat posed to Florida buildings by the Formosan termite was ignored because it was not “agricultural.” By 2000, it was known to be in Pensacola, Tallahassee, Crystal River, Tampa, Orlando, Jensen Beach, Jupiter, Palm Beach, Ft. Lauderdale, Hallandale, and Miami Beach. A single colony may contain several million termites (versus several hundred thousand for native species) that forage up to 300 feet in soil. Because of a colony’s size and foraging range, the presence of a Formosan colony poses a serious threat to nearby structures. The Formosan termite is persistent in finding small cracks in concrete which they enlarge and use as foraging routes, leading to the fallacy that they can penetrate solid concrete. Termites generally invade structures from the ground; however, the Formosan can form colonies that are not connected to ground, called aerial colonies. More than 25 percent of the infestations found in urban southeastern Florida are aerial colonies. Living plants, plaster, plastic, asphalt, and thin sheets of some soft metals (lead and copper) have been attacked by this termite. Once established, the Formosan has never been eradicated

from an area. In Florida, termites and wood decay cause 1 billion dollars plus in damage a year, more than one third of which is done by the Formosan termite.

The redbay ambrosia beetle, native to Southeast Asia, was first trapped near Port Wentworth, Georgia in 2002. In Florida, the mortality of redbay trees, called laurel wilt, was first reported in the spring of 2005 in northern Duval County. Redbay is important to wildlife as its fruit, seed, and/or foliage are eaten by songbirds, turkeys, quail, deer, black bear, and the larvae of the Palamedes swallowtail butterfly. Although the beetle spreads naturally at the rate of 20 or 30 miles a year, it can jump longer distances through the transport of firewood. By 2009, it was known that the beetle was also an efficient killer of avocado trees and had been found in Okeechobee County. The \$30-million-a-year avocado industry of southern Miami-Dade County is threatened, and scientists do not know how to protect the trees or how to stop the beetle/disease from spreading.

The brown marmorated stink bug probably got to the U.S. in the late 1990s by hitchhiking in container ships from Asia. They moved across the country and have been reported in 33 states, including Florida. In the summer of 2010, there was a major infestation of the brown, three-quarter-inch bugs in homes throughout the Mid-Atlantic. A research entomologist with the USDA in West Virginia reported that people in his area were finding thousands in their homes. Although they are a stinky nuisance for homeowners, they can be devastating to farmers. The bugs feed on a wide range of food crops, including sweet corn, grapes, berries, tomatoes, and peppers—all important crops for Florida agriculture. The National Institute of Food and Agriculture and the Agricultural Research Service are funding projects at universities and research centers to study how to control and combat stink bugs.

Who can determine the damage done by the Asian tiger mosquito? Probably imported from Japan in old tires, this mosquito was first discovered in Jacksonville in 1986 and has since spread throughout the state. Initially this insect’s eggs would not hatch unless the day length was at least 13.5 hours long. In south and central Florida, where the day length for much of the year is less than 13.5 hours, by rapid natural selection this mosquito eliminated the response

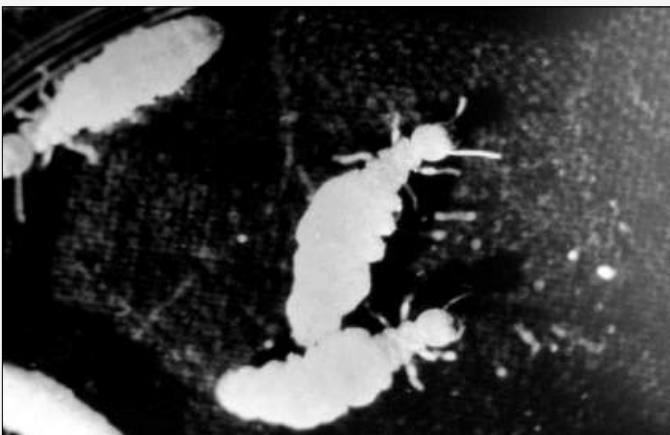


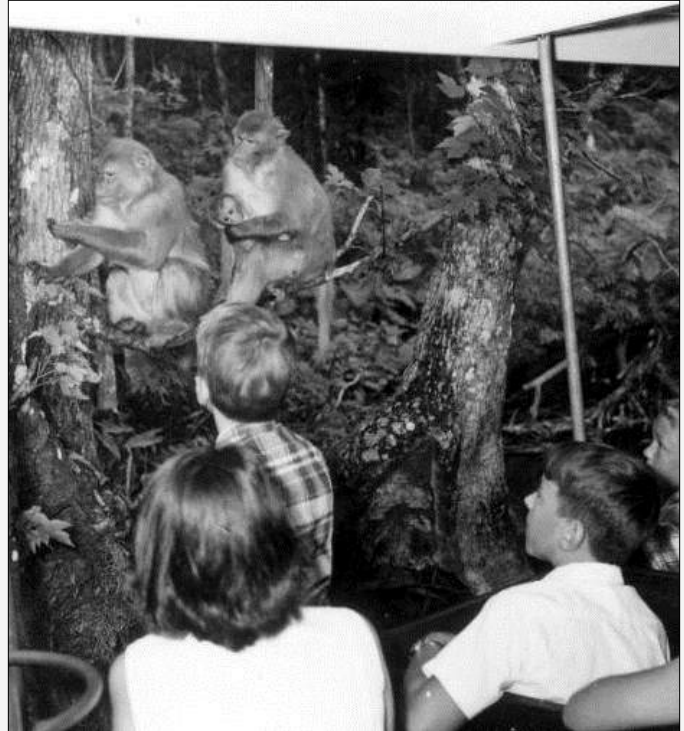
Photo by Donn Dughi

Formosa termite

to day length. The Asian tiger mosquito is linked to equine encephalitis, it breeds in any container where water is found, is a major vector for dengue fever and West Nile virus, is more aggressive than most mosquitoes, and inhibits outside daylight activities, as well as early morning and evening pursuits, of all Floridians.

For more information about Florida's invasive species, visit the Florida Fish and Wildlife Conservation Commission website at <http://www.myfwc.com/wildlifehabitats/>.

Delighted children on the Jungle Cruise at Silver Springs feed members of a tribe of Rhesus monkeys that forage along the river bank, Ocala. Native to an area between northern India and southern China, a population of Rhesus monkeys were released by a tour boat operator named Captain Tooey to enhance his jungle cruise in the 1930s.



Florida State Archives



Florida Forests



The forests of Florida are one of our great natural resources, ranking with water and sunshine in meeting the highly diverse demands placed on them by millions of individual residents and visitors.

Trees and forests are valued for basic goods such as food and wood fiber, but they also deliver other important “public services” such as air and water purification, flood and climate regulation, biodiversity, wildlife habitat, and scenic landscapes to name just a few. Maintaining the health of Florida’s forests is vital to human health and livelihood.

Florida, with about 35 million acres of land, has 16 million acres classed as timberland. An esti-

mated 654,500 tons of wood grow on this land, and the gross volume is increasing, though not always in usable form.

The Florida Forest Service of the Department of Agriculture and Consumer Services, in cooperation with the U.S. Forest Service, conducts an annual inventory of all forested lands in the state. The inventory is designed to give forest resource managers a better idea of the future supply and demand for our natural resources. Approximately 65 percent of Florida’s timberland is in the hands of nonindustrial private owners. About 6 percent of Florida’s forest is owned by industrial forestry operations, and the remaining 29 percent is under government ownership.

Increasing demands on the land, as well as fragmentation due to diverse ownership and development, will determine the future of Florida’s forest production.



Photo by Robert M. Overton

View looking up at trees at the Corkscrew Swamp Sanctuary in Collier County, 1992. Acquired by the National Audubon Society in 1954, the Corkscrew Swamp Sanctuary contains the largest remaining stand of old growth Bald Cypress forest in North America.

The Florida Forest Service

The Florida Forest Service provides statewide fire protection for woodlands and rural structures and assistance with firefighting to municipal and volunteer fire departments. It assists and advises landowners in a wide variety of forestry matters and aids urban populations and governments in establishing, maintaining, and expanding the urban forests that provide invaluable benefits to urban environments. The Service operates throughout the state and is administered by the Director, Florida Forest Service, 3125 Conner Boulevard C 19, Tallahassee, Florida 32399-1650. There are eight administrative districts under district managers and seven forestry centers under center managers.

State and National Forests

The Florida Forest Service operates 35 state forests that total 1,058,784 acres and cooperates with other agencies in managing other state and public lands throughout Florida.

Many recreational opportunities are provided in the state forests. Most state forests are used for hiking, mountain bike riding, horseback riding, picnicking, camping, boating, fishing, and hunting.

The Florida Forest Service also manages between 6 and 8 million dollars worth of timber, other forest products, and recreational uses revenue annually. Timber harvesting plans are based on the health and sustainability of the forest and the value of timber products. Many endangered wildlife and rare plant species find protection in state forests.

The Florida Center for Wildfire & Forest Resources Management Training is located in the Withlacoochee State Forest. It was created to provide training in the practices of prescribed fire, wildfire protection, and forest resource management.

Information about the center is available <http://www.freshfromflorida.com/Divisions-Offices/>; or by phone at (352) 797-4173.

The U.S. Forest Service operates three national forests in Florida, which, like the state forests, are managed to supply multiple benefits to varied interests. The Apalachicola, Osceola, and Ocala National Forests total over 1,167,000 acres. All offer extensive opportunities for outdoor recreation with improved facilities and natural environments suitable for almost every kind of forest-oriented recreation.

Management goals for the national forests include sustained yield of wood, forage, wildlife, and water quality. The three forests are administered by the Forest Supervisor, National Forests in Florida, 325 John Knox Road, Suite F-100, Tallahassee, Florida 32303.

Reforestation

Organized reforestation has been underway in Florida since 1928. It began with the establishment of the Florida Forestry Service, which later merged

with the Department of Agriculture and Consumer Services as the Division of Forestry in 1969. In 2011, the Florida Forest Service name was reinstated. It took nearly 30 years to plant the first 1 billion seedlings. Since then about 1 billion have been planted every 10 years, with the 7 billionth tree planted in 2011.

Florida's industrial and private landowners plant more than 40 million seedlings each year on over 55,000 acres. Florida is among the leading states in reforestation. The Florida Forest Service's Andrews Nursery in Chiefland produces approximately 6 million bare root and 6 million containerized seedlings each year. The remaining seedlings planted come from private nurseries.

The bulk of trees planted in Florida are southern pines, which include longleaf pine, slash pine, and loblolly pine. The annual slash pine planting amounts to about 34 million seedlings covering 50,000 acres. Annual loblolly pine plantings are approximately 18 million seedlings on more than 31,000 acres.

Longleaf pine was the dominant pine in the southeast; however, due to poor planting practices and conversion to other land uses, the longleaf pine habitat has been reduced significantly. In Florida, the planting of longleaf pine increased dramatically starting in the 1990's on both public and private lands. Improvement in seedling quality of bare root longleaf seedlings, along with the emergence of containerized longleaf seedlings, has greatly increased the



Photo by Charles Barron

Planted pines. Osceola National Forest, Olustee, 1953.



Photo by Joseph Janney Steinmetz

View of the National Container Corporation mill near the railroad tracks in Jacksonville, circa 1955. The National Container Corporation was founded in 1938 by Harry Ginsberg. By 1956, when it was purchased by Owens-Illinois, Inc., it was the nation's third largest box company.

survival and popularity of this native tree. Longleaf pine is the most insect, fire, and disease resistant pine in Florida and grows well on dry to moist flatwood sites. The Florida Forest Service's Andrews Nursery has increased containerized longleaf production by nearly 5 million since 2000. Other pine species produced and planted in Florida include Ocala sand pine, Choctawhatchee sand pine, and south Florida slash pine.

Economics of Forestry

Florida's nearly 16 million acres of timberlands supported economic activities which generated \$14.7 billion in total output impacts in 2010 (IMPLAN, 2012). This was almost the same output level as in 2009, and 12% more than in 2008 at the lowest point in the recent economic recession. Forestry and forest products manufacturing generated \$7.11 billion annually in total value-added impacts and contributed 89,993 in total job impacts to the state economy (Hodges and others, 2012). The forest products manufacturing sector contributed the largest share of this economic activity with \$5.99 billion and 72,783 jobs.

Forestry and timber tract management generated 948 million dollars and 13,510 jobs, and com-

mercial logging generated 172 million dollars and 3,700 jobs.

Forestry and forest products manufacturing is the third largest agriculture and natural resource-based economic sector in Florida behind environmental horticulture, which holds first place, and fruit and vegetable farming and processing, which holds second place, based on value-added and employment impacts.

Florida is home to 59 primary wood-using mills including: 32 sawmills, 7 mulch plants, 6 pulp/paper mills, 3 chip mills, 3 post mills, 2 plywood mills, 2 pole mills, and 1 each of pellet, strand board, veneer, and dedicated firewood production facilities (Florida Forest Service ongoing survey data). A 100-megawatt biomass-fueled power plant is being constructed near Gainesville, which is the only significant new development in the woody biomass energy arena.

Within forest products manufacturing, leading sectors in terms of value-added and employment impacts in 2010 were: paper mills (1.37 billion dollars, 16,014 jobs); paperboard container manufacturing (1.01 billion dollars, 12,826 jobs); sanitary paper products manufacturing (938 million dollars, 8,170 jobs); paperboard mills (817 million dollars, 9,450 jobs); pulp mills (685 million dollars, 8,263 jobs); and stationary product manufacturing (279 million dollars, 3,572 jobs). Other sectors with significant value-added impacts were: coated and laminated paper packaging paper and plastic film manufacturing (166 million dollars); engineered wood member and truss manufacturing (141 million dollars); sawmills and wood preservation (126 million dollars); and wood window and door manufacturing (125 million dollars) (Hodges and others, 2012).

Landowner Assistance

Approximately 65 percent of the commercial timberland acreage in Florida is owned or controlled by several hundred thousand private nonindustrial forest (PNIF) landowners. Many of these PNIF properties are less than 20 acres in size, and landowner objectives vary from recreation or solitude to wildlife or timber production. It has been estimated that less than 10 percent of these landowners have a management plan for their property. The Florida Forest Service administers the Forest Stewardship Program,

which enables forest landowners to work with county foresters, consulting foresters, and other resource professionals in developing a multiple-resource management plan for their property. Since the program's beginning in 1990, 3,020 Florida landowners have worked with a professional forester to develop and implement their Forest Stewardship plans, which combined cover nearly 885,000 acres.

In 1941, the Florida Forest Service began providing technical assistance to PNIF landowners. In order for private forests to remain a productive and viable part of the larger forest ecosystem, landowners need access to technical forestry assistance and guidance from a professional forester. The objective is to help landowners ensure sustained productivity and responsible management of their forest land and to optimize public benefits.

Productive viable forests can be passed on from one generation to the next and benefit Floridians for years to come.

Florida's Champion Tree Program

The Champion Tree Program was created by the American Forests organization in 1940 to recognize the largest known tree of each species in the United States. American Forests publishes their "National Register of Big Trees" every 2 years.

All native and recognized non-invasive naturalized tree species are eligible for nomination. The 2012 edition of the register lists 111 national champions and co-champions from Florida, far and away the most of any state. A significant portion of those champions are located south of Lake Okeechobee, because those species need a climate with little or no frost in which to thrive.

Sources: Florida Department of Agriculture and Consumer Services; IMPLAN software and Florida region data for 2010 (MIG, Inc.) Compiled by Alan W. Hodges, University of Florida, March 12, 2012; and Hodges, A.W.; Rahmani, M.; Stevens, T.J. 2012. "Economic Contributions of Agriculture, Natural Resources, and Related Industries in Florida for 2010." EDIS document FE906, University of Florida. Available at <http://edis.ifas.ufl.edu>.



Florida State Archives

George Moseley demonstrates how to operate a mechanical tree planter to plant seedlings, Taylor County, 1947. This mechanical tree planter, designed by Mr. Moseley, could plant 10,000 seedlings a day at 40 percent less cost than with a hand dibble.

Florida began keeping its own register in 1975 to recognize the largest tree of each species within the state. In addition to the national champions, the Florida register also contains 104 Florida champions and co-champions, as well as a number of emeritus champions and potential challengers. The Florida register can now be viewed online in an interactive format, where the user can query trees by species, size, and location.

The largest National Champion tree in Florida is a native Florida Shortleaf Fig, or Wild Banyan, located in Monroe County. The tree is 444 inches in circumference, stands 48 feet tall, and carries a crown spread of 76 feet. The largest tree listed in the Florida Champion Tree register is a nonnative Cluster Fig in Broward County. It measures 649 inches in circumference, 102 feet in height, and its crown spans 95 feet.



National Forests in Florida

A magnificent variety of experiences are possible in Florida National Forests, where diverse ecosystems stand as islands surrounded by ancient seas of time. Finding these experiences is as easy as finding the National Forests on your Florida map.

The Apalachicola National Forest (1936)

There are 571,088 acres in the Apalachicola National Forest, the largest in Florida. Portions of the forest, in wet lowlands, abound with cypress, oak, and magnolias. Stands of slash and longleaf pines cover the sand hills and flat woods. Rivers and streams provide a steady freshwater flow to some of the most productive coastal bays and estuaries known.



Photo by Dr. David E. LaHart

Barred owl in Apalachicola National Forest, Wakulla County, 1978.

The Apalachicola National Forest hosts the world's largest population of red-cockaded woodpeckers.

Fort Gadsden Historic Site, east of the Apalachicola River, is a short distance from State Road 65 and the town of Sumatra, where one of the first settlements in North America of free African Americans was formed.

Leon Sinks Geological Area is an unusual geological formation in the Woodville Karst Plain. Sinkholes, swales, caverns, natural bridges, circular depressions, and water table ponds are all features of karst and the Leon Sinks area has them all, plus a disappearing stream. Nearly six miles of well-maintained trails will take you to these sites, just seven miles south of Tallahassee, along U.S. 319.

Munson Hills Off-Road Bicycle Trail offers a scenic and challenging ride through some of the most rolling terrain in the forest.

The most highly developed campgrounds in the forest are Hitchcock, Camel Lake, and Wright Lake Recreation Areas where campers can swim, picnic, and boat.

Osceola National Forest (1931)

There are nearly 200,000 acres of woodlands, swamps, lake, and beach in the Osceola National Forest.

Each February 20th the Olustee Battlefield Historic Site is host to thousands of Confederate and Union soldier re-enactors, sutlers, and camp followers from all over the nation. They recreate the battle where North met South and left the bodies of over

Cannon in front of Memorial at Olostee Battlefield Historic State Park, Olostee, 1976.



Photo by Bob Murphy

2,800 men scattered beneath the pines in Florida's largest Civil War battle.

Olostee Beach is a day-use area for fishing, picnicking, hiking, swimming, and waterskiing.

Ocean Pond Campground is the most highly developed, with lakeshore and other camping sites. Swimming, picnicking, and boating opportunities are available there.

Four interconnected horse trails traverse over 50 miles of the forest and provide an opportunity to ride through open pine flat woods and wet, scenic bays. The trails originate at West Tower where there is a camping area with horse stalls in addition to other facilities.

Hunting is a popular activity in the Osceola National Forest. General gun season runs from mid-November to early January and during that time all camping is restricted to designated hunt camps and Ocean Pond Campground. Nine hunt camps are open all year round.

Ocala National Forest (1908)

Encompassing roughly 383,000 acres north of Orlando, this is one of Central Florida's last remaining traces of forested land. The Ocala National Forest is the oldest national forest east

of the Mississippi and contains the largest forest of sand pines in the world. The sand pine is the only tree capable of growing to a usable timber size in this forest's dry, sandy soil.

At Silver Glen Springs Recreation Area, the Lake George Trail begins a two mile journey traversing the shoreline of the lake and ends at a scenic location overlooking a rustic pier and boathouse. A wide variety of wildlife, plants, and trees can be seen along the trail.

Alexander Springs Recreation Area, where 80 million gallons of water per day gush from the spring at a year-round temperature of 72 degrees is at the north end of the Paisley Woods Bicycle Trail. The trail, developed by the Lake County Bicycle and Pedestrian Program and Florida Free-Wheelers, Inc., in cooperation with the Forest, is 22 miles long, but shorter loops can be accessed at the halfway point.

Campers looking for swimming and picnicking should go to Salt, Alexander, and Juniper Springs.

National Forests Information

For more information, contact the ranger districts below, or visit the United States Department of Agriculture Forest Service website at <http://www.fs.usda.gov/main/florida/home>.



Photo by Joseph Janney Steinmetz

Visitors at the swimming area of Juniper Springs, Ocala National Forest, circa 1960.

Apalachicola National Forest:

Apalachicola Ranger District
11152 NW State Route 20
Bristol, FL 32321
(850) 643-2282

Wakulla Ranger District
57 Taff Drive
Crawfordville, FL 32327
(850) 926-3561

Ocala National Forest:

Lake George Ranger District
17147 East State Road 40
Silver Springs, FL 34488
(352) 625-2520

Seminole Ranger District
40929 State Road 19
Umatilla, FL 32784
(352) 669-3153

Osceola National Forest:

Osceola Ranger District
24874 US Highway 90
Olstee, FL 32072
(386) 752-2577



Florida State Archives

Old mill and water wheel at Juniper Springs in the Ocala National Forest.

Sources: *USDA Forest Service website:* <http://www.fs.usda.gov/florida>; and “The Sunshine Connection Volume II”, *produced by the USDA Forest Service, 1998.*

(Updated January 2013)



Florida's Natural Playgrounds

State Parks

The Florida Department of Environmental Protection's Division of Recreation and Parks manages the Florida state park system, consisting of 171 units encompassing nearly 800,000 acres of land and water, including 100 miles of sandy white beaches and more than 1,600 miles of multiuse trails. It celebrated 75 years of service in 2010.

Florida State Parks were recognized with the National Gold Medal Award for Excellence in Recreation Management from the National Recreation and Parks Association in 2005. Florida also received the Gold Medal in 1999. This award is especially significant because it marks the first time a state park system received the recognition twice.

Thanks to Florida's nationally recognized land acquisition programs, these state parks offer resource-based recreation in some of Florida's finest, most authentic natural areas ... the Real Florida (SM). Among the diverse properties managed by the Florida Division of Recreation and Parks are state parks and state trails, historic sites and museums, preserves and reserves, beaches and recreation areas, botanical sites and gardens, geological and archaeological areas, and a wildlife park. From swimming and diving in rivers and springs, to basking in the Florida sun at a beautiful beach, to birding and fishing or hiking and riding on natural scenic trails, Florida's state parks offer year-round outdoor activities for all ages. Battle reenactments and Native American festivals celebrate Florida's history, while art shows, museums, and lighthouses offer a window into Florida's cultural heritage.



Florida State Archives

St. George Island State Park

The nation's best state parks and trails have joined forces. The Florida Park Service of the Division of Recreation and Parks manages the 110-mile Marjorie Harris Carr Cross Florida Greenway and eight other state trails. Now a part of the Division of Recreation and Parks, the award-winning Office of Greenways and Trails works to establish a connected network of greenways and trails throughout Florida for the purposes of recreation, conservation, and alternative transportation and is responsible for implementing the Florida Greenways and Trails System Plan and providing support for and facilitating priority and opportunity land and water trail projects. With more than 5,000 miles of paved and unpaved trails, including the Florida National Scenic Trail, Florida offers year-round access to trails for hiking, biking, horseback riding, running, in-line skating, wildlife viewing, and more. Thousands of miles of inland paddling trails and the 1500-mile Florida Cir-



Florida State Archives

Footbridge at Mike Roess Gold Head Branch State Park, Keystone Heights.

cumnavigational Saltwater Paddling Trail also make Florida a watery paradise for canoeing and kayaking. Greenways and trails are important to Florida's communities because they attract tourists, improve quality of life, increase property values, stimulate business development, and provide health recreation and alternative transportation.

Florida's award-winning state parks have inspired residents and visitors with recreation opportunities and scenic beauty that helps to strengthen families, educate children, expand local economies, and foster community pride. The popularity of Florida's state parks is reflected in the attendance of nearly 25 million visitors in fiscal year 2011-2012. Florida's state park system also makes a significant contribution to Florida's economy with an annual statewide economic impact of more than \$1.6 billion and generation of more than 23,000 jobs.

The Florida Park Service has received national recognition for an extensive program of state park partnerships. There are 84 citizen support organizations, including the statewide Friends of Florida State Parks, Inc.

For online information about Florida State Parks, visit www.FloridaStateParks.org. To order a free park guide, call (850) 245-2157 or write the Department of Environmental Protection, Division of Recreation and Parks, 3900 Commonwealth Boulevard MS 535, Tallahassee FL, 32399-3000. Follow @FLStateParks on Facebook, Twitter, and Pinterest.

Coastal and Aquatic Managed Areas

Coral reefs. Salt marshes. Estuaries. Mangroves. Sea grasses. Much of Florida's distinctive character lies in the beauty of its 4.2 million acres of bays, rivers, nearshore waters, and nearly 56,000 acres of coastal uplands. Three National Estuarine Research Reserves, a National Marine Sanctuary, the Florida Coral Program, and 41 aquatic preserves provide protection for submerged lands and areas for research, recreation, and education. The northern portion of the Florida Reef Tract supports reef-related industries such as diving and tourism, and adds \$6.4 billion a year to

the Florida economy. Florida's Aquatic Preserves, a program of the Office of Coastal and Aquatic Managed Areas, accounts for more than half of the water features found in our state parks. Seagrass management in the preserves is a key economic driver for Florida as seagrass forms the basis of fisheries. More than 90% of all commercially and recreationally important fish and shellfish spend a portion of their life cycle in seagrass beds. In 2011 alone, seagrass communities in the state of Florida supported an estimated harvest of \$70.3 million for the top five seagrass-dependent, commercial species of fish and shellfish. Water quality programs around the state help to ensure that our beaches are clean and our seafood is healthy. Florida takes great pride in its coastlines and strives to protect coastal lands and waters while providing environmentally compatible public access. To



Florida State Archives

Sand dunes at Grayton Beach State Park, 1977.

learn more about these varied and fascinating meetings of the land and sea, contact the Florida Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas at (850) 245-2094 or visit www.dep.state.fl.us/coastal.

State Lands

The Division of State Lands acquires and administers land and serves as staff to the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida, on behalf of the citizens of Florida. The Division of State Lands performs various functions. It evaluates the quality of both conservation and non-conservation land the state might acquire, assesses its fair market value, conducts site visits to determine if the condition of the land the state owns is acceptable, grants permission for easements, arranges leases of state lands and waterways, maps and surveys state lands, and researches historical titles to state lands. The Division of State Lands has oversight of more than 12 million acres, including approximately 3 million acres of inland lakes, rivers, and coastal bays; 6 million acres of territorial waters; and 3.5 million acres of uplands. Included are more than 7,700 lakes and 4,510 islands, 10 acres or more in size. Most of these lands are managed for conservation purposes. The tasks assigned to the Division of State Lands range from purchasing thousands of acres of land and ensuring their appropriate management to defending the boundaries of public ownership in court.

One of the most important tasks of the Division of State Lands is overseeing the distribution of money from the 10-year, \$3 billion Florida Forever land

acquisition and preservation program. The Florida Forever Program was extended for an additional 10 years by the 2008 Florida Legislature and expanded in scope. Money from bond sales for Florida Forever buys land for state parks, forests, wildlife areas, greenways and trails, and cultural sites. A share of the money is distributed to the state's five Water Management Districts to protect and restore the state's water resources. The Florida Communities Trust uses its share of Florida Forever funds to acquire community-based parks and open space to further outdoor recreation and natural resource protection needs as identified in local government comprehensive plans. The 2008 program expansion included protection of working agricultural lands and working waterfronts. While the economic downturn has resulted in reduced funding provided for the Florida Forever program since 2008, the program continues to help preserve Florida's natural and recreational resources. All protected lands acquired by the state have their roots in the work done by the Division of State Lands of the Department of Environmental Protection.

To learn more about Florida's land, contact the Florida Department of Environmental Protection, Division of State Lands, at (850) 245-2118 or visit www.dep.state.fl.us/lands.



Florida State Archives

Paddle boats and canoes at Hillsborough River State Park, Thonotosassa.