WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM--Southern Florida

BACKGROUND

In 1991, the U.S. Geological Survey (USGS) began to implement a full-scale National Water-Quality Assessment (NAWQA) program. The three major objectives of the NAWQA program are to provide a consistent description of current water-quality conditions for a large part of the Nation's water resources, define long-term trends (or lack of trends) in water quality, and identify, describe, and explain the major factors that affect observed water-quality conditions and trends. These objectives will be met by conducting retrospective analyses of existing data; by establishing a nationwide, long-term monitoring network designed to assess existing water-quality conditions and provide a data base for trend analyses; and by conducting process-oriented studies designed to provide a better understanding of the relation between land- and water-use activities and water-quality conditions. The NAWQA program will provide an improved scientific basis for evaluating the effectiveness of water-quality management programs and practices.

The NAWQA program will be implemented through investigations of hydrologic systems in 60 study units that include parts of most major river basins and aquifer systems in the United States. Study units range in size from 1,200 to about 65,000 square miles and incorporate 60 to 70 percent of the Nation's water use and population served by public water supply. The Southern Florida study unit includes most of the southern half of the Florida peninsula and contains a major urban complex of more than 5 million people. The study unit was selected for inclusion in the program beginning in 1993.

DESCRIPTION OF THE SOUTHERN FLORIDA STUDY UNIT

The Southern Florida NAWQA study unit encompasses an area of about 19,500 square miles (fig. 1) and is the watershed of a large regional ecosystem that includes coastal waters between Charlotte Harbor on the Gulf of Mexico and the St. Lucie River on the Atlantic Ocean. The study unit includes the Kissimmee-Okeechobee-Everglades (KOE) watershed, a major freshwater source for the regional ecosystem. The KOE will be the focus of the Southern Florida NAWQA study.

The study unit includes all or parts of six physiographic regions: the Lake Wales Ridge, the Flatwoods, the Atlantic Coastal Ridge, the Everglades, the Big Cypress Swamp, and the Mangrove and Coastal Glades (fig. 1). The Lake Wales Ridge consists of well-drained sand hills that range in elevation from about 70 to 300 feet above sea level. The Flatwoods region is characterized by nearly level land that ranges in altitude from sea level to about 100 feet; by water levels that are usually near the land surface; and by pine forest interspersed with sloughs, swamps, lakes, and sluggish streams. The Atlantic Coastal Ridge is a relatively narrow, sandy ridge that extends along the Atlantic coast. The Everglades, Big Cypress Swamp, and Mangrove and Coastal Glades are flat, swampy areas that cover roughly the southern third of the study unit.

The climate in the study unit is subtropical and humid. Average annual temperature in the area is approximately 75 degrees Fahrenheit (°F). Freezing temperatures occur only occasionally.

Annual rainfall in the study unit averages about 53 inches--more than half of which occurs from June through September and is associated with thunderstorms and squalls. During the remainder of the year, rain is usually the result of large frontal systems and is broadly distributed rather than localized. The period October through May constitutes the dry season. Hurricanes sometimes bring severe weather conditions to the area.

The study unit which is predominantly underlain by shallow marine carbonate sediments to depths of about 20,000 feet, contains three major aquifer systems: the Floridan, the intermediate, and the surficial aquifer systems. The confined Floridan aquifer system is the principal source of water in the northern part of the study unit, but water from this aquifer system is too mineralized for most uses in the southern part of the study unit. The semiconfined intermediate aquifer system, which overlies the Floridan, serves as a confining unit for the Floridan and is a source of freshwater for public supply along the Gulf Coast. The surficial aquifer system includes the highly permeable Biscayne aquifer, which is the principal source of potable water for southeastern Florida and has been designated as a "sole-source" drinking water supply by the U.S. Environmental Protection Agency.

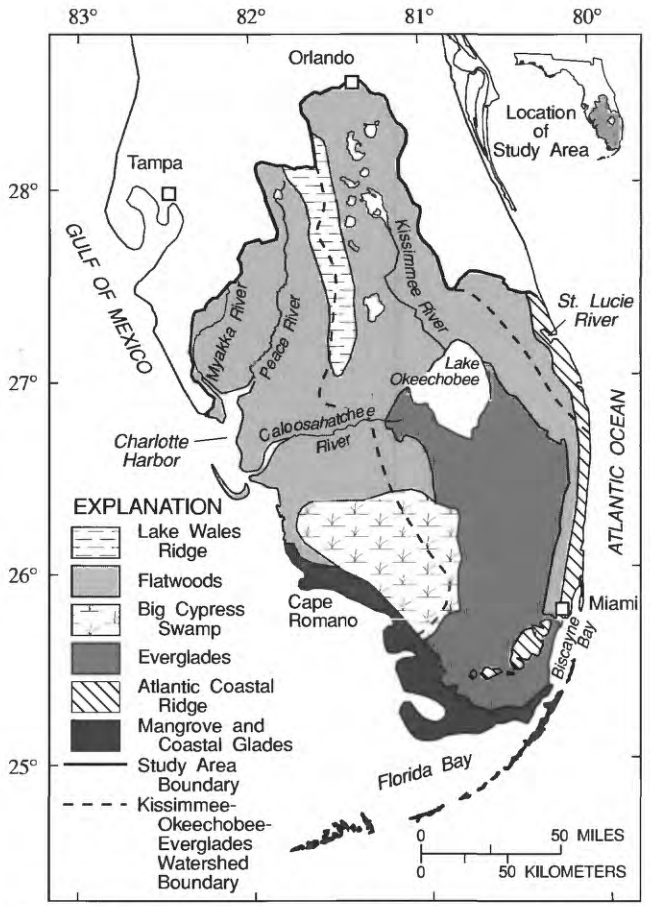

Figure 1. Physiographic regions, the Kissimmee-Okeechobee-Everglades watershed, and the southern Florida NAWQA study boundary.

Southern Florida is characterized by highly urbanized areas near the coast, by areas of intensive agricultural development in the northern Everglades, and by vast areas of rangeland and wetland throughout the area. Areas of native American lands are located in the central part of the study unit. The southern part of the study unit is largely in public ownership or under public control as parks, preserves, sanctuaries, conservation areas, and refuges (fig. 2) and contains most of the remaining Everglades and adjacent south Florida wetlands.

The environment of southern Florida has been greatly altered during the last 100 years. Early travelers to southern Florida encountered vast wetlands that virtually spanned the State south of Lake Okeechobee. The largest of these was the Everglades, a wetland of about 2.9 million acres of

predominantly peatland covered by tall sawgrass growing in shallow water. Associated plant communities included custard apple trees in swamps south of the lake, submerged and emergent aquatic vegetation in sloughs and wet prairies, tree islands, and mangrove trees in swamps bordering Florida Bay and the Gulf of Mexico. The Everglades was part of the larger KOE watershed, which extended from present-day Orlando to Florida Bay, roughly two-thirds the length of the Florida peninsula (fig. 2). The

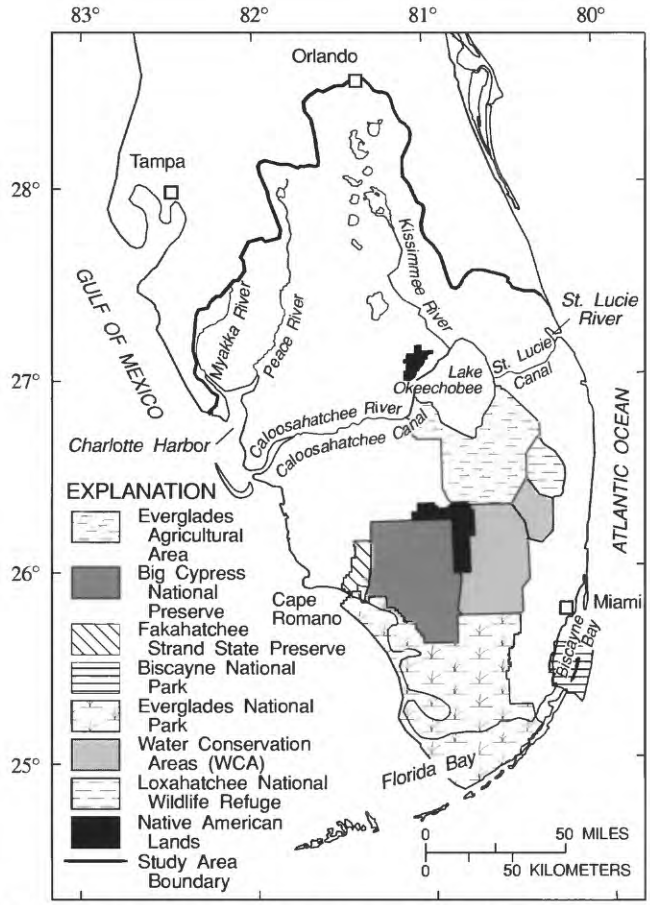

Figure 2. Parks, preserves, refuges, sanctuaries, Native American Lands, Everglades Agricultural area, and the southern Florida NAWQA study boundary.

Kissimmee River meandered through a region of lakes in a 2-mile-wide flood plain south to Lake Okeechobee, a shallow water body of 470,000 acres. When the lake was full, water sometimes overflowed the natural levee that formed the southern rim of the lake into the northern Everglades. Water in the Everglades moved slowly to the south by sheet flow in what was described as the "River of Grass" by Florida author and conservationist Marjory Stoneman Douglas. In normal rainfall years, most of the land was inundated during the rainy season, and during years of heavy rainfall, all but the highest tree islands were flooded. Seasonal flows from the Everglades into Florida Bay and the Gulf of Mexico supported highly productive coastal wetlands. During the dry season, water levels were generally near land surface, and during some years, extreme droughts lowered water levels well below the land surface and severe fires swept over the lands, burning vegetation and peat.

Drainage of the KOE watershed began in the early 1880's and continued through the 1960's. By the late 1920's, five canals connected Lake Okeechobee to the Atlantic Ocean. During the hurricanes of 1926 and 1928, Lake Okeechobee overflowed, killing thousands of people and destroying crops. In response to these disasters, a 38-foot high dike was constructed around the south shore of the lake, and canals were enlarged to improve drainage. In 1948, the State legislature established the Central and the Southern Florida Flood Control Project, which provided for construction of a complex water-management system that included canals, levees, pumps, and control structures. As part of this project, Lake Okeechobee and three water conservation areas (WCAs) were designated as reservoirs for flood protection during the wet season and for agricultural irrigation and recharge of ground water in urban well fields during the dry season. The northern Everglades were drained and designated the Everglades Agricultural Area (EAA). Approximately 50 percent of the historic Everglades had been eliminated by the early 1990's. The remaining 50 percent is preserved in WCA 1 (Loxahatchee Wildlife Refuge), WCA 2, WCA 3, and Everglades National Park. The Park was established in 1947 on 1.4 million acres in the southwestern end of the region.

Alterations of the KOE watershed by drainage and development has had severe environmental consequences. Approximately 40 percent of the water that originally flowed from Lake Okeechobee into the Everglades is now diverted directly to the Gulf of Mexico by the Caloosahatchee Canal and to the Atlantic Ocean by the St. Lucie Canal (fig. 2). Saltwater intrusion into freshwater aquifers has extended as far as 6 miles inland from the coast in some areas. Lowered water tables have resulted in oxidation of drained peats and damaging peat fires, which have lowered the land surface 3 to 6 feet in some agricultural areas. Using the WCAs as reservoirs has resulted in conditions that are often either too dry or too wet to maintain native plant and animal communities. Populations of woodstorks and other wading birds south of Lake Okeechobee have decreased by almost 95 percent from 1870 to 1973 as a direct result of hydrologic alterations. Drainage and land clearing have increased opportunities for exotic plants, such as melaleuca, to become established in dense stands that exclude native species.

WATER-QUALITY ISSUES

Agricultural, industrial, and urban areas are sources of water-quality degradation in southern Florida. Agricultural production involves the use of numerous chemicals, including fertilizers, insecticides, herbicides, and fungicides, that can leak into the ground water or nearby surface waters. The phosphate industry, located in the northwestern part of the study unit, is a potential source of contaminants, including organic chemicals, acids, nutrients, and sediment. In residential and urban areas, septic-tank drainfields are a source of nutrients and of potential bacterial contamination. Stormwater runoff from urban areas commonly carries heavy metals, nutrients, bacteria, viruses, and pesticides. Urban runoff and discharge of inadequately treated, nutrient-rich sewage effluent into canals have resulted in some canal waters becoming covered with algae and choked with aquatic weeds. Ground water in the highly urbanized Atlantic Coastal Ridge in the southeastern part of the study unit is highly vulnerable to contamination from surface sources because the highly permeable Biscayne aquifer allows rapid infiltration of surface waters.

Drainage and development of the KOE watershed has had adverse effects on water quality in the region. Water pumped into canals from agricultural lands can have high concentrations of nutrients, insecticides, herbicides, and fungicides. The high nutrient concentrations and loads entering Lake Okeechobee and the Everglades from farms and cattle lands have degraded water quality. Lakewide phosphorus concentrations have increased two and one-half times over the past 15 years and massive algal blooms have become more frequent and persistent. The increased nutrient loading to the northern Everglades is stressing the existing vegetative communities. Sawgrass, which is adapted to a low nutrient environment, is being replaced by cattails in the northern Everglades, particularly in WCA-2 where nutrient loading has been excessive. Drainage and development also could be implicated in the contamination of fish and wildlife by mercury. The Everglades constitutes the largest continuous area in Florida from which fish are banned from consumption because of mercury contamination. Florida Bay has undergone changes during the past 10 years that are unprecedented in the period of recorded observations. Seagrasses have died over large areas of the bay, algal blooms have increased in frequency and duration, and fisheries have declined. These changes have been attributed to a variety of causes, including altered freshwater and nutrient inflows from the watershed.

COMMUNICATION AND COORDINATION

Communication and coordination between U.S. Geological Survey personnel and other interested scientists and water-management organizations are important components of the NAWQA program. Each study-unit investigation will have a local liaison committee that consists of representatives from Federal, State, and local agencies; academia; and the private sector who have water-resources interests and responsibilities.
Information on report products and data collected as part of this NAWQA study can be obtained from:

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