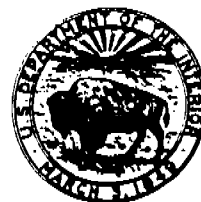


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

**ANNOTATED SELECTED REFERENCES ON
NATURAL RESOURCES INVESTIGATIONS,
COLLIER COUNTY, FLORIDA**

OPEN-FILE REPORT 81-1184

Prepared in cooperation with the
SOUTH FLORIDA WATER MANAGEMENT DISTRICT



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Tallahassee, Florida

1981



UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

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ANNOTATED SELECTED REFERENCES ON NATURAL RESOURCES

INVESTIGATIONS, COLLIER COUNTY, FLORIDA

By Leo J. Swayze

ABSTRACT

A data base for future natural resources investigations in Collier County was initiated by compiling a selected annotated bibliography. This report provides references and annotations for selected reports released between 1950 and 1978. The references are presented by subject material as follows: biologic, ecologic, geologic, geochemical, and hydrologic.

INTRODUCTION

This annotated bibliography was compiled by the U.S. Geological Survey in cooperation with the South Florida Water Management District to provide a data base to help plan future natural resources investigations in Collier County.

This report provides references and annotations for 131 selected reports released between 1950 and 1978. Publications for this bibliography were obtained through literature searches of WRSIC abstracts and libraries of the University of Miami, Florida International University, and the U.S. Geological Survey office in Miami. The references are presented by subject material as follows: biologic, ecologic, geologic, geochemical, and hydrologic.

In most cases WRSIC abstracts, author's abstracts, or author's introductions have been used in the annotations. When used, it is so noted at the end of the annotation. Reports not available to the author were not annotated. However, since it is likely that these reports contain pertinent data, references to them have been included in the bibliography.

Most reports with annotations and all consulting engineer reports are available for inspection at the U.S. Geological Survey in Miami. Data presented in reports by consulting firms and other agencies are not necessarily the views shared by the U.S. Geological Survey.

BIOLOGIC REFERENCES

Adams, C. A., Oesterling, M. J., Snedaker, S. C., and Seaman, W., 1973, The role of mangrove ecosystems: Quantitative dietary analysis for selected dominant fishes in the Ten Thousand Islands, Florida: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-40, 56 p.

"The stomach contents of 710 Bairdiella chrysura, 256 Cynoscion nebulosus, 479 Eucinostomus gula, 316 Lagodon rhomboides and 868 Anchoa mitchilli of the mangrove estuarine areas in south Florida's Ten Thousand Islands were analyzed gravimetrically. Otogeny of food habits, as percentage composition of food related to age and growth ("that is" size class), and milligrams food per kilogram fish body-weight, were determined. Analyses were made on specimens from Fahka Union Bay, an estuarine embayment receiving freshwater runoff from upland real estate developments, and Fahka-hatchee Bay, a relatively undisturbed area. The items eaten by these fishes show that variation in food type occurs among fish species and, to a lesser degree, among habitats. Data indicate that, for certain species, the intake of food material (milligrams food per kilogram fish weight) may be related to osmoregulatory adjustments for salinity differences between these two bays." (Quoted from authors' abs.)

Browder, J. A., 1976, Water, wetlands, and woodstorks in southwest Florida: [University of Florida Doctorial thesis], Gainesville, Florida, University of Florida, 406 p.

"Energy circuit models were used to study an oscillating ecosystem, the seasonally expanding and contracting wetlands of southwest Florida. Analog and digital computers were used to simulate the effects of the natural rainfall pattern and of drainage on seasonal expansion and contraction of water area, production and concentration of fish, and feeding and reproduction of the woodstork (Mycteria americana). Information for quantification of the models was obtained from aerial surveys of storks nesting at Corkscrew Swamp Sanctuary, quantitative sampling of fish and invertebrates in a pond and marsh, measurement of wetlands area on infrared aerial photographs, topographic field surveys, and a literature search and field observations on demographic parameters of populations ***." (Quoted from author's abs.)

Craighead, F. C., Sr., 1967, The mangrove belt of southern Florida including the Ten Thousand Islands, presented at a hearing of the Collier County Commissioner's meeting (April 7, 1976), (mimeographed).

Crowder, J. P., 1974, The freshwater fishes and fisheries of south Florida: Bureau of Sport Fisheries and Wildlife, Atlanta, Georgia, Ecological Report no. DI-SFEP-74-26, 29 p.

"Native species of fishes of Florida and adjacent waters are listed by family and their common and scientific names. Accumulated data may be incorporated into a systems model for the purpose of better defining the relationships of fishes to each other, to their habitats, and to the other animal life forms, including man, in South Florida. All of the important freshwater sport fishes of South Florida belong to the family Centrarchidae, the sunfishes. The largemouth bass sport fishery of the Everglades is intimately associated with and vitally dependent upon the canals. Lake Okeechobee, a major regional and national sport fishery resource, has recently been evaluated as in an early eutrophic condition. It supports the only important freshwater commercial fishery in the South Florida Ecological Study area. Recommendations are the current legal restrictions on fish harvest from Lake Okeechobee be substantially relaxed, and that a renewed effort be undertaken to reinstitute a commercial fishery for panfishes and other fishes, excepting largemouth black bass, having a market potential, as a method of nutrient removal. References of inventories, samples, and measurements of fish populations in South Florida are given." (Quoted from WRSIC abstract)

Dragovich, A., 1961, Relative abundance of plankton off Naples, Florida, and associated hydrographic data, 1956-57: U.S. Department of the Interior, Fish and Wildlife Service, Special Scientific Report, Fishery, no. 372, 41 p.

Dragovich, A., 1963, Hydrology and plankton of coastal waters at Naples, Florida: Quarterly Journal of the Florida Academy of Science, v. 26, p. 22-47.

Dragovich, A., Finncane, J. H., and May, B. Z., 1961, Counts of red tide organisms, Gymnodinium breve, and associated oceanographic data from Florida west coast, 1957-59: U.S. Department of the Interior, Fish and Wildlife Service, Special Scientific Report, Fishery, no. 369, 175 p.

Evink, G. L., 1973, The role of mangrove ecosystems: Biomass and diversity of benthic macroinvertebrates of Fahka Union and Fahkahatchee Bays, Florida: Department of the Interior, South Florida Environmental Project: Ecological Report no. DI-SFEP-74-42, 73 p.

"Quantitative samples were taken to establish biomass and diversity of benthic macroinvertebrates in the area of Fahka Union and Fahkahatchee Bays in south Florida. A series of 37 samples was completed during the period, February to December 1972. Major taxonomic groups collected were Crustacea, Mollusca, Polychaeta, and Echinodermata. Biomass of macrobenthos in Fahkahatchee Bay ranged from 3.1 to 6.1 g/m²; macrobenthos in Fahka Union Bay ranged from 4.0 to 6.4 g/m². Analysis of biomass data revealed no significant difference in biomass of the bays. Analysis of species occurring in the two bays showed that the bays have similar species with a small difference in species diversity." (Quoted from author's abs.)

Floherschütz, E. W., 1978, Dwarf cypress in the Big Cypress Swamp of southwestern Florida; [University of Florida M.S. thesis]: University of Florida, Gainesville, Florida.

"Two research sites differing slightly in elevation were monitored in dwarf cypress areas of the Big Cypress Swamp of southwestern Florida from December 1976 to December 1977.

"Biomasses were determined for the canopy species, shrub species, understory species, and the forest floor litter layer. Gross productivity of terrestrial vegetation at the various sites was measured with gas metabolism techniques.

"Insect diversity was determined for each season with numbers of individuals and diversity changing dramatically from 25 species/1,000 individuals in February to 138 species/1,000 individuals in May.

"Information gathered from the two study sites was used to confirm features that were important to a model of the dwarf cypress system.

"Main environmental factors influencing the dwarf cypress were rainfall, its contained nutrients, and solar insolation." (Quoted from author's abs.)

Hofstetter, R. H., and Alexander, T. R., 1971, Analysis of major plant communities at the Dade-Collier training and transition airport facility. In: University of Miami, Center for Urban Studies Final Report to Dade County Port Authority on Ecological Survey of the Dade-Collier training and transition airport facility, pt. II, May through September 15, 1970.

Horel, G., 1969, Lake Trafford progress report 1954-68: Florida Game and Freshwater Fish Commission, Tallahassee, Florida, 72 p.

"The haul seine period and selective poisoning experiments are briefly summarized. The results of sampling with a 1-acre and 0.85 acre block net and spot poison samples are summarized. These samples, taken prior to and following the attempted total poisoning, show the gizzard shad were exterminated in Lake Tafford. That and/or the improvement in the shoreline habitat was the cause for a much improved game fish population. Fish stocking did not improve the game fish population. The growth of vallisneria was largely the reason for the improvement, particularly in the black bass population. Chemical analysis taken and water guage readings are given." (Quoted from author's abs.)

Kushlan, J. A., 1973, Differential responses to drought in two species of *Fundulus*: *Copeia*, v. 4, p. 808-809.

This report discusses the behavioral responses of the golden topminnow (*F. chrysotus*) and the marsh killifish (*F. confluentus*) to lowering water levels in Big Cypress Swamp, Florida, during the spring drought of 1970. *F. chrysotus* became concentrated in the remaining pool of water, while *F. confluentus* massed along its periphery. The distinct responses of the two species may relate to differences in reproductive strategy.

Kushlan, J. A., 1974, Effects of a natural fish kill on the water quality, plankton, and fish population of a pond in the Big Cypress Swamp, Florida: *Transactions of the American Fisheries Society*, v. 103, no. 2, p. 235-243.

"A naturally occurring fish kill took place during the southern Florida dry season of 1970 when receding water levels forced aquatic organisms out of shallow swamps and into a small pond. Physiochemical parameters of water quality varied greatly from their usual range, as did the abundance of phytoplankton which reached a peak of 2,500,000,000 cells/liter. The fish kill had no effect on the long-term limnological characteristics of the pond, as water quality returned to normal range within two months and phytoplankton disappeared within 1 month after the fish kill. The species of fish in the pond showed a range of susceptibility to low oxygen concentration and other aspects of the fish kill. They were classified into three categories based upon their survival." (Quoted from author's abs.)

LaKela, O., and Craighead, F. C., 1965, Annotated checklist of the vascular plants of Collier, Dade, and Monroe County, Florida: Fairchild Tropical Garden and the University of Miami Press, Coral Gables, Florida, 95 p.

Lindall, W. N., Hull, J. R., Fable, W. A., and Collins, L. A., 1973, A survey of fishes and commercial invertebrates of the near-shore and estuarine zone between Cape Romano and Cape Sable, Florida: National Marine Fisheries Service, South Florida Environmental Project: Ecological Report no. DI-SFEP-74-44, 65 p.

"Fishes and commercial invertebrates of the near shore and estuarine zone between Cape Romano and Cape Sable, Florida were sampled quarterly (May 1971-February 1972) with beach seine and otter trawl. One-hundred fourteen species of fish (31,982 individuals) and 6 species of commercial invertebrates (2,864 individuals) were collected at 35 stations located in inland waters and to 10 miles in the Gulf of Mexico. Catches were decidedly higher at near shore and inland stations than at stations located 5 and 10 miles offshore. Twenty-four species of fish not listed in previous studies in the Everglades region were identified. A systematic account of all species is provided." (Quoted from authors' abs.)

Luer, C. A., 1964, Orchids of Fahkahatchee: Florida Orchidist, v. 7, no. 4, p. 191-195.

Lugo, A. E., Evink, G. L., Brinson, M. M., Broce, A., and Snedaker, S. C., 1973, The role of mangrove ecosystems: Diurnal rates of photosynthesis, respiration and transpiration in mangrove forests of south Florida: Department of the Interior, South Florida Environmental Project: Ecological Report no. DI-SFEP-74-36, 45 p.

"Measurements of CO₂ exchange and transpiration were made on the four south Florida mangrove-forest tree species Rhizophora mangle, Avicennia nitida, Laguncularia racemosa, Conocarpus erecta at Rookery Bay, Florida. Mangrove species were studied by compartment (trunks, prop roots, pneumatophores, seedlings, and shade and sun leaves) during two study periods: August 1971 and January-February 1972. R. mangle leaves had higher net daytime photosynthesis rates and lower nighttime respiration rates than A. nitida. Sun leaves had higher net daytime photosynthesis while shade leaves had higher nighttime respiration. Data obtained from the gas exchange studies suggest a metabolic basis for the zonation of the four mangrove species." (Quoted from authors' abs.)

Lugo, A. E., Sell, M., and Snedaker, S. C., 1973, The role of mangrove ecosystems: mangrove ecosystem analysis: Department of the Interior, South Florida Environmental Project: Ecological Report no. DI-SFEP-74-37, 60 p.

"A parameterized model of a mangrove ecosystem was simulated on an analog computer. The results suggest that: maximum live-biomass accumulation is hurricane limited; both in situ detrital accumulation and export are functions of tidal amplitude; gross photosynthesis is sensitive to terrestrial nutrient inputs and net production depends on the quantity of available nutrients; and, species zonation appears to be a function of nutrient availability as well as salinity gradients." (Quoted from authors' abs.)

Lugo, A. E., and Snedaker, S. C., 1973, The role of mangrove ecosystems: properties of a mangrove forest in south Florida: Department of the Interior, South Florida Environmental Project: Ecological Report no. DI-SFEP-74-34, 86 p.

"A suite of parameters describing the physical environment and the structure and function of a mangrove ecosystem was evaluated. The resulting data were evaluated in terms of the dynamic properties of the ecosystem with emphasis on auxillary energy sources, systems adaptations, and relationships with contiguous estuarine areas. Mangrove ecosystems are described as interface systems linking the terrestrial uplands with the coastal estuaries." (Quoted from authors' abs.)

McPherson, B. F., 1973, Vegetation map of southern parts of sub-areas A and C, Big Cypress Swamp, Florida: Tallahassee, Florida, U.S. Geological Survey Hydrologic Investigations Atlas HA-492, 1 sheet, 1 map.

This map showing vegetation of southern parts of Big Cypress Swamp, Florida was made with the aid of aerial photography in conjunction with ground surveys. The basic photography used was infrared black and white taken in December 1969 at 15,000 feet (1:30,000 scale). This photography was particularly useful in delineating areas of different water depths, which in turn, facilitated the separation of major plant associations such as deep water sloughs and marshes from relatively drier prairies. Higher elevation photography (1971) both black and white (24,000 feet) and color infrared (29,000 feet) was used to delineate large vegetal features, such as strands or coastal forests.

Various colors on the map show pine forest, hammock forest, cypress forest; mixed pine and cypress forest; mixed swamp forest; coastal forest, prairies; inland marshes, slough, and ponds; coastal marshes; and saltwater prairies or marshes. (From author's intro.)

Moore, S. A., 1974, Impact of pesticides on phytoplankton in Everglades estuaries: National Park Service, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-15, 92 p.

"Six-hour and 24-hour bioassays were conducted in place to determine in situ the effect of selected organochlorine compounds on natural communities of estuarine phytoplankton. The effect of organochlorine concentration observed was to reduce phytoplankton utilization of bicarbonate thereby also reducing photosynthetic production of organic material. Polychlorinated biphenyls (PCB's: Aroclor 1242 and Aroclor 1245) phytotoxicity occurred at PCB levels less than five micrograms PCB/L. P,p'-DDT phytotoxicity initiated at concentrations of 10 ug DDT/L. Phytotoxicity by dieldrin is inconclusive. No phytotoxicity was observed in one ecosystem. A typical dose-response toxicity was observed in a second ecosystem

and indicated apparent dieldrin toxicity at 15 ug dieldrin/L. Nanoplankton and netplankton difference in Aroclor 1242 sensitivity was observed. 10 ug/L and 25 ug/L PCB did not inhibit nanoplankton which contributed approximately 73% of the phytoplankton production. Netplankton production was inhibited by more than 50% in both the 10 ug/L and 25 ug/L PCB concentrations. Biochemical modes for organochlorine action are discussed in conjunction with difficulties in interpreting the effects of organochlorine compounds to phytoplankton. An objection to basing water-quality standards on organochlorine concentrations is raised." (Quoted from author's abs.)

National Marine Fisheries Service, 1973, Estuarine dependent marine fishes: Department of the Interior, South Florida ecological study, Appendix E, 105 p.

This report "*** provides information on the size and value of south Florida's commercial and sport fisheries and show their relationship to the estuarine environment. Brief summaries of the fishery and life history of each major estuarine-dependent species are provided. Also discussed are major environmental factors and their effect on fishery production. Included are freshwater runoff, water quality, vegetation, dredging and filling, and temperature. In so doing, attempts have been made to bring into overall focus the importance of the estuary as producer of fishery resources and to point out problems that require future research." (Quoted from author's intro.)

Pool, D. J., and Lugo, A. E., 1973, The role of mangrove ecosystems: Litter production in mangroves: Department of the Interior, South Florida Environmental Project, Ecological Report No. DI-SFEP-74-39, 36 p.

"Seventy 0.25 m² baskets were placed in three different types of mangrove forests in the Ten Thousand Islands and at one site at Rookery Bay, Naples, Florida. Results of litter basket collections and separations are reported by component and by species. Total litter fall ranged from a low of 1.4 g/m²/d (estimated 511 g/m²/year) to a high of 2.3 g/m²/day (estimated 840 g/m²/year). The total litter fall was composed of 75-85 percent leaves, 10-15 percent wood, and 4-5 percent miscellaneous (insect parts, grass, flowers, seeds, etc.) In 1972 the Rookery Bay site had the greatest daily rates of litter fall in the months of January, February, and March (2-5 g/m²/day) with total litter fall remaining stable during the remainder of the year. High rates of litter fall are associated with low temperature and seasonal storms." (Quoted from authors' abs.)

Provost, M. W., 1968, Florida estuaries and their protection: Florida State Board of Health, Entomology Research Center, Vero Beach, Florida, paper read at Southwest Florida Clearing House, May 16, 1968.

Riopelle, L. A., 1978, Melaleuca control at Corkscrew Swamp Sanctuary: Ecosystem Research Unit, National Audubon Society, Naples, Florida, 11 p.

This report describes the melaleuca control program at Corkscrew Swamp Sanctuary. The report presents two methods used for eradicating isolated melaleuca infestations and techniques employed to contain invasion where a seed source on neighboring property makes permanent elimination impossible.

Rodgers, D. P., and Crowder, J. P., 1974, Threatened wildlife of south Florida: Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-25, 34 p.

"The 34 endangered or otherwise threatened wildlife species, (as classified by the Department of the Interior), south Florida are identified and described. The listing includes 23 species or subspecies of birds, six of mammals, and three of reptiles. Eleven of these are found exclusively in Florida; several others are found only in Florida within the United States portion of their ranges. Thirteen are officially classified by the Secretary of the Interior as endangered species, entitled to protection under provisions of Federal endangered species legislations. Direct physical alteration or destruction of habitat (including drainage of wetlands), depredations by market hunters, and pesticides are identified as principal factors in population declines of the region's threatened species. Problems peculiar to each species are considered in detail. Recommendations are made for the protection and enhancement of surviving populations." (Quoted from authors' abs.)

Schemnitz, S. D., 1972, Populations of bear, panther, alligator, and deer in the Florida Everglades: Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-33, 26 p.

"The population status of the Florida black bear, white-tailed deer, and two endangered wildlife species, the American alligator and Florida panther, were studied in the Everglades Region of Florida. Questionnaires were distributed to field personnel of the Florida Game and Fresh Water Fish Commission and the Florida Department of Natural Resources to obtain information on population levels of bear and panther. Individuals who reported panthers were interviewed. Records of panther and bear at Everglades National Park were examined. Nocturnal and diurnal alligator counts along canals were made. Aerial deer counts, pre and post-hunting season sex ratio changes, and deer harvest information were used to estimate deer populations. Black bear and panther population estimates were 145 and 92, respectively. Most of these animals occur in Collier County. The estimated deer populations of the Everglades Region (four and one-half million acres) is about 20,000. The calculated 1971-72 legal deer harvest from the Everglades Wildlife

Management area (800,000 acres) was 900. With increased protection from poaching in recent years, alligator populations have increased despite the loss of more than one and one-half million acres of habitat. This habitat destruction is largely attributable to agricultural, residential, commercial, and industrial development." (Quoted from author's abs.)

Seaman, W., Adams, C. A., and Snedaker, S. C., 1973, The role of mangrove ecosystems: Biomass determinations in shallow estuaries--technique evaluation and preliminary data: Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-41, 23 p.

"A new type of portable drop net was developed and used to quantitatively harvest fishes from 16 m² sample areas in shallow estuaries. The technique is shown to be suitable for sedentary benthic and vegetation-inhabiting fishes, including eels, gobies, gerreids, syngathids, and juvenile pinfish, sciaenids, and flat fishes. The technique and preliminary results are evaluated and compared with reports in the literature describing techniques to estimate fish biomass." (Quoted from authors' abs.)

Snedaker, S. C., and Pool, D. J., 1973, The role of mangrove ecosystems: Mangrove forest types and biomass: Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-35, 13 p.

"Five physiognomic types of mangrove forests are identified on the basis of local topography, coastal position, and relationship to terrestrial runoff and tidal flushing. Estimates of biomass, by compartment, are reported for an overwash forest, fringe forest, riverine forest, a single-tree island and white mangroves (Laguncularia racemosa) colonizing dredge-spoil banks. Forest biomass (dry weight, above ground) ranges from 11 to 25 kgm⁻². Standing stock detritus contributes up to 39 percent of the total biomass and is related to storm damage." (Quoted from authors' abs.)

Steidinger, K. A., 1967, A key to the marine dinoflagellate genera of the west coast of Florida: Florida State Board of Conservation, Technical Service, no. 52, 44 p.

Steidinger, K. A., Davis, J. T., and Williams, J., 1967, Dinoflagellate studies on the inshore waters of the west coast of Florida: Florida State Board of Conservation, Professional Paper Service, no. 9, p. 4-47.

University of Miami, 1971, Everglades jetport faunal survey--Insects: Center for Urban Studies, final report to Dade County Port Authority on Ecological Survey of the Dade-Collier training and transition airport facility, pt. II, May 1 through September 15, 1970.

Webb, C., 1971, The spiders of the Dade-Collier jetport: University of Miami, Center for Urban Studies, final report to Dade County Port Authority on Ecological Survey of the Dade-Collier training and transition airport facility, Part II, May 1 through September 15, 1970.

ECOLOGIC REFERENCES

Albert Veri Associates, 1972, An analysis of density as it relates to the future environmental quality of Naples and coastal Collier County, Florida: Collier County Conservancy, 49 p.

This report evaluates "*** the effects of various population sizes and densities, and relate these as guidelines for testing in the study area. Based upon this analysis an optimum population is recommended for the 64,000-acre study region to be 170,000 persons. Limiting factors and resource constraints will vary from one region to another. For Naples the limiting factor is space, and for the remaining study area the factor is water ***." (Quoted from author's intro.)

Alexander, T. R., and Crook, A. G., 1973, Recent and long-term vegetation changes and patterns in south Florida: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-08, 215 p.

"This preliminary report includes methods, ecological history and 10 completed samples of how data and maps for quadrats will be presented in the final report. Quadrats (sections) will number 100 and will be representative of the entire ecosystem. Vegetation change has been both major and minor. Agriculture, logging, and fire have had the greatest role, augmented by drainage. Examples are: the change from graminoid glade vegetation to a closed canopy of woody species on abandoned farmland, and the invasion of cypress forests by maple and pine. In the saltwater-freshwater ecotone, mangroves have invaded inland and freshwater species have been killed. For example, the cabbage palm population has been reduced. Coastal erosion has locally reduced mangrove forests. In the conservation areas, tree islands have been damaged by fire and flooding and even destroyed, and graminoid communities have adjusted to varying water depths. The latter are hard to document. Great changes in community structure have occurred where exotic plants have invaded and gone through a population explosion. Melaleuca, Schinus, and Casuarina are the greatest threat. No part of the study area is free from this threat to native communities. A bibliography is included." (Quoted from authors' abs.)

Big Cypress Conservation Act, Florida Laws 1973, Chapter 130, Sections 1, 2, Florida Statistic Section 380.055.

"The Big Cypress area of Florida has a significant impact upon environmental and natural resources both in the state and regionally. The area is one of critical state concern, as that term was employed in the Florida Environmental Land and Water Management Act of 1972. The area includes the Federal Big Cypress Freshwater Reserve, along with contiguous land and water areas ecologically linked with Everglades National Park, the estuarine fisheries of south Florida, and the freshwater aquifer of south Florida. The precise boundaries of the area are to be determined by hearings. The statute also provides spending of 40 million dollars for the acquisition of property in the area proposed as the Federal Big Cypress National Freshwater Reserve. Any land acquired is to be donated and conveyed to the Federal Government, when Congress authorizes the acquisition of the freshwater reserve. The Big Cypress Area is a water storage and recharge area, and is an integral part of the water management district of which the area is a part. The act authorizes the Governor and the Cabinet to exercise the power of eminent domain to acquire the necessary lands." (Quoted from WRSIC abs.)

Birnhak, B. I., and Crowder, J. P., 1974, An evaluation of the extent of vegetative habitat alteration in south Florida 1943-70: Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-22, 45 p.

"The extent of vegetative habitat alteration in seven south Florida counties was estimated. The acreage historically occupied by each of 13 vegetative habitat types was determined by planimetry of a base map prepared by J. H. Davis, Jr. in 1943. Land areas currently occupied by urban and agricultural development were identified from recent land use maps prepared by the Florida Coastal Coordinating Committee and the Florida Department of Transportation. The remaining amounts (in acres) of each type of habitat were determined by outlining upon the base map all acreage now converted to agricultural or urban usage, planimetrying the area of each habitat type lost to development, and subtracting the amount of lost habitat from that which was historically present. The data were arrayed in both county and regional summaries to show the total acreage and percentage of each vegetative habitat type lost to each form of development and the total remaining acreage of each. A "naive extrapolation" of past trends in land use was performed to show the astonishing rate at which wild lands are being developed in the region and to demonstrate the need for constraints on population growth and land use in order to conserve supportive natural systems." (Quoted from authors' abs.)

Bureau of Economic and Business Research, University of Florida, 1972, Projections of population, employment and income, selected Florida counties, 1975, 1980, 1990, 2000: Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-50, 34 p.

"This report contains projections of (1) population, by age and by sex; (2) employment, by specified categories; and (3) family income for selected Florida counties for the years, 1975, 1980, 1990, and 2000. Control data for total population and employment were derived from regional and county estimates made under the OBERS program, a joint program between the Office of Business Economics and the Economic Research Service. The value of the projections in this report is their usefulness as a series of baseline reference points.

"Supporting data for the Bureau of Outdoor Recreation's report entitled "An Analysis of Outdoor Recreation Resources, Impacts, and Potentials in South Florida," is prepared as part of the South Florida Ecological Study." (Quoted from author's abs.)

Bureau of Outdoor Recreation, Southeast Region, 1973, An analysis of outdoor recreation resources, impacts, and potentials in south Florida: U.S. Department of the Interior, South Florida Environmental Project: Ecological Report no. DI-SFEP-74-49, 120 p.

"This report describes briefly the 11 physiographic provinces of south Florida, relating to the recreational potentials and problems of the area.

"The socioeconomic climate in terms of projections of population, employment and income for target years and the relationship of these factors to outdoor recreation are analyzed for the study area.

"State, county and local recreation programs are noted, analyzing in-depth local recreation programs. This report identifies program functions and enabling legislation most likely to enhance or increase outdoor recreation opportunity where most people live in the urban environment.

"A complete inventory of public park and open space areas in south Florida at the various levels of government has been assembled. A recreation utilization system which denotes land classes and capacity standards was adopted in order to catalog inventory data. Totals indicate the amount of specified types of recreation facilities available for each county within the study area.

"A detailed analysis of study area resident recreation, participation rates, is given.

"This report reviews regionally significant natural resources remaining south of Lake Okeechobee, their recreational values, impacts, and actions needed to preserve them." (Quoted from author's abs.)

Canaday, A. C., 1971, Authority of cabinet to deny oil drilling permits, Florida Attorney General Reports, 071-183, July 6, 1971.

"Florida's Governor requested the legal opinion of the Florida Attorney General as to the authority of the Cabinet sitting as the head of the Department of Natural Resources to deny oil drilling permits in the Big Cypress Swamp on the basis of damage to the ecology resulting from the necessary development concomitant with drilling operations. The Governor also asked whether the Cabinet would approve such permits with restrictions promoting statutory purposes. The Attorney General concluded that the Department does have authority to deny an application to drill for oil and to promulgate standards for site preparation to guard against oil or saltwater pollution of freshwater. The statutory rule is that any denial of a drilling permit must be for just and lawful cause. In accordance with these rules, the Department would have authority to issue a permit with restrictions imposed to meet statutory standards. No statutory authority exists, however, for the denial of a drilling permit based solely upon a finding that drilling or site preparation would alter the sheet flow of water in that area. If State interests are damaged by such construction, other legal remedies must be utilized." (Quoted from WRSIC abs.)

Carter, M. R., and others, 1973, Ecosystems analysis of the Big Cypress Swamp and estuaries: Environmental Protection Agency, Ecological Report no. DI-SFEP-74-51, 375 p.

"A 2-year study was conducted to obtain biological and hydrological information on south Florida's land, water, wildlife and fisheries resources. Field investigations during 1971-72 intensively examined the details of biotic community interactions with hydrologic conditions of disturbed and relatively unaffected regions of the Big Cypress Swamp and contiguous tidal wetlands and estuaries. Study results demonstrate the total dependence of the south Florida ecosystem on the hydroperiod. Canal drainage of upland wetlands which include cypress swamps and wet-prairies effected a ten fold decrease in primary productivity. Drainage also effected a thinning of the forest canopy and induced a reduction in the rate of forest litter decomposition resulting in a buildup of litter as increased fuel for destructive wildfires." (Quoted from WRSIC abs.)

Clark, J., 1975, Rookery Bay and ecological constraints on coastal development: Conservation Foundation, Florida Environmental and Urban Issues, v. 11, no. 4, p. 9-13.

"The Conservation Foundation began a study of Collier County, Florida, in 1967 for publication of environment protection and economic welfare. The Rookery Bay area was chosen for in-depth study because it represented an ecosystem characteristic of the mangrove-estuarine environment of south Florida. The study suggests that all wetlands be preserved intact through an integrated program restricting water development by redirecting it to dry-land sites. Purchases of water-area parcels for public recreation and scenic purposes are also suggested. Other recommendations include primary and contingency standards allowing for a variety of environmentally compatible uses of privately owned water areas in a uniform program of water area management. Anticipated objections center around fears that the expected population growth cannot be accommodated, if development is limited to dry land areas. However, if the county encourages spot density concentration, this problem can be overcome." (Quoted from WRSIC abs.)

Clark, J., and Sarokwash, P. J., 1974, Rookery Bay land-use studies, environmental planning strategies for the development of a mangrove shoreline, study no. 9, principles of ecosystem management: Conservation Foundation, Washington, D.C., 17 p.

"The protection of estuarine ecosystems requires a comprehensive coastal zone management program with specific environmental controls set within this larger framework. Control elements must be derived from characteristics of the ecosystem involved and designed to achieve the best level of ecosystem function possible. The basic management unit must be a complete coastal ecosystem including both the coastal water basin and related adjacent shorelands. Within this unit, components of vital importance to certain species or to the functioning of the entire ecosystem must be classified as vital areas and protected from significant alteration and pollution. Coastal floodplain may be designated an area of environmental concern or conservation area, protected by stringent controls on development, or designated a buffer area to protect vital areas along a shoreline. Specific management practices required to minimize disturbance of the coastal environment include controls on development activities which affect water circulation, temperature, salinity, turbidity, oxygen, nutrient supply, levels of toxic substances, and vital areas. Ecosystem requirements and recommended management practices applicable to south Florida are discussed, as are certain types of vital areas of south Florida, the ecological functions they perform, and their major vulnerabilities to disturbance." (Quoted from WRSIC abs.)

Crowder, J. P., 1974, The effects of drainage and associated development in the Big Cypress Swamp: Bureau of Sport Fisheries and Wildlife, Atlanta, Georgia, Ecological Report no. DI-SFEP-74-21, 9 p.

"If the Big Cypress Swamp and the northwestern portion of the Everglades National Park are to be protected from damage or destruction, they must be assured of high quality water, adequate in quantity, and properly timed. Any proposals for draining or altering land within the Big Cypress, particularly within the central subarea C, should be scrutinized to anticipate and avert environmental damage. Nutrient overenrichment of waters from agricultural and urban areas is expected to reduce species diversity and ecosystem stability. Increases in water-borne pesticides are also expected to accompany development and could elevate levels above the present relatively low concentrations in water, soils, and animal tissues in the Big Cypress. Major alterations to surface water flows will disturb the critical periodicity of water delivery to estuarine zones, produce surface water depth fluctuations out of phase with the seasonally heavy feeding requirements of aquatic wading birds, and precipitate massive redistributions of dominant vegetative communities in favor of the less aquatic types. Drainage that causes a pulsing of freshwater flows to sea will intermittently reduce salinity to abnormally low levels in the estuarine zone, and will increase the transport of silt and chemical pollutants." (Quoted from WRSIC abs.)

Environmental Studies Board, 1970, Environmental problems in south Florida: 76 p.

"The study applies the methods of technology assessment to help solve an acute environmental problem in south Florida; considers environmental effects of building a jetport near Everglades Park and concludes the site could be so used with adequate safeguards which are detailed; recommends further study of impact of a commercial jetport at the site; and strongly suggests intensified research in effect of insect vectors from a tropical reservoir on public health." (Quoted from WRSIC abs.)

Feiss, C., McQuown, R., Roberts, P., and May, R., 1973, The demographic, political and administrative setting: Rookery Bay land-use studies, study no. 1, Conservation Foundation, Washington, D.C., 29 p.

"The social, political and managerial issues impacting a mangrove-estuarine area in Collier County, Florida, relating to the development of land-use strategies to protect the area's natural sanctuary, Rookery Bay, are discussed. Population, employment, land ownership, government, planning machinery, citizen activities, political climate and development pressures of the area as they affect on the sanctuary are examined. Several alternative approaches for the future of the sanctuary are offered, and recommendations are made for protective action." (Quoted from WRSIC abs.)

Florida Bureau of Land Planning, 1973, Boundary and land development regulation recommendations for the Big Cypress Swamp area of critical state concern, 1 p.

"Under the 1973 Florida Big Cypress Conservation Act the Division of State Planning was directed to recommend a definitive boundary and land development regulations for the Big Cypress area of Florida to the administrative commission. Included in this summary of the project are a map and a legal description of this area as well as proposed land development regulations aimed at protecting the vital water resources within the Big Cypress critical area." (Quoted from WRSIC abs.)

Gore, Rick, 1976, Twilight hope for Big Cypress: National Geographic, August 1976, v. 150, no. 2, p. 251-273.

This article discusses the general history of the development of the Big Cypress National Freshwater Preserve and the ecological problems that have evolved.

Lemire, R. A., Davis, R. K., Hirsch, R. M., Zieman, J. C., and Hornberger, G. M., 1975, Rookery Bay land-use studies, environmental planning strategies for the development of a mangrove shoreline, study no. 10, Growth and land use, study no. 11, Economic implications of land development alternatives, study no. 12, A simulation modeling approach to the study of development alternatives, 58 p.

"Study no. 10 attempts to link the population growth that poses a threat to Rookery Bay to the future economic, social and ecological stability of Collier County. A brief statistical survey was conducted; and a strategy for advocacy participation in the local planning and regulatory processes is recommended as the most effective way to deal with development threats to Rookery Bay. Study no. 11 sets up a number of prototype housing developments appropriate to the southwest Florida market and the location and topography of the study area. Each prototype is examined for its profitability and for its effects on Rookery Bay, estimated as the residential value of the land after all costs except environment effects are estimated from total population, acreage of impervious surface, and similar parameters. In study no. 12 the simulation model was structured into four submodels: (1) land use; (2) watershed and hydrology; (3) estuarine hydrodynamics; and (4) estuarine ecology. The relationship of these sub-models to one another is discussed." (Quoted from WRSIC abs.)

Leopold, L. B., 1969, Environmental impact of the Big Cypress Swamp Jetport: U.S. Department of the Interior, U.S. Geological Survey, Washington, D.C., Special Report, 155 p.

This report assesses the "*** impact of Big Cypress Swamp Jetport and associated developments on the ecosystem--of which Everglades National Park is a part. The report is based upon the existing information known to local professionals who collectively possess broad experience in the south Florida environment. Three levels of jetport development are considered, the initial construction which is designed primarily for training, a possible intermediate level at which the jetport would be used for cargo, and finally a level of full development which would serve commercial transportation needs, relieving Miami International Airport of some of its expected pressures ***." (Quoted from author's intro.)

Mattiessen, P., 1967, The last great strand (corkscrew): Audubon, v. 69, no. 2, 64-71.

Mitchell, J. G., 1977, Big Cypress, tomorrow has arrived: Audubon, v. 79, no. 5, p. 20-31.

This is a general discussion of the Big Cypress Swamp and the efforts of the National Park Service to create the Big Cypress National Freshwater Preserve.

National Park Service, 1972, Proposed Big Cypress National Freshwater Reserve, Florida, 84 p.

"The proposed project involved acquisition of the 585,000 acres in Big Cypress Watershed in Collier, Monroe, and Dade Counties, Florida by the Federal Government. These areas are critical to the protection of freshwater resources of the Everglades National Park, estuarine regions, and cities of southwest Florida. The acquisition period would cover 10 years. The ecosystem of Big Cypress is described in detail. The project will have a favorable impact on the environment by controlling drainage and maintaining high water quality, quantity, and flow to park estuaries and preserving future water supplies for southwest Florida. Indian cultures in the area can continue in traditional surroundings. Unfavorable impacts are all economic including loss in taxes and development opportunities. Alternatives considered include taking no action to protect Big Cypress and the following alternative methods of protection: land use planning and zoning, joint local-federal control, control by trusteeship, Federal land use restrictions, and control by a public corporation. Appendixes contain lists of flowering plants and animals considered significant to the ecosystem." (Quoted from WRSIC abs.)

Nicholas, J. C., 1974, Land utilization in south Florida: A description of the historical development of urban and agricultural land use patterns: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-47, 230 p.

"This report consists of four studies designed to yield an overall view of the burgeoning growth of the south Florida region and the potential impact that these growth patterns might have for the Indian tribes residing in the region. The first report is "Land Utilization in South Florida: A Description of the Historical Development of Urban and Agricultural Land-Use Patterns." This was prepared to provide the historical perspective needed to project south Florida to the year 2000. The remaining three reports constitute a projection trilogy concerned with population, employment, and land use. Four population series were employed in these studies: (1) Office of Business Economics projections; (2) Jerome Pickard projection; (3) naive extrapolation; and (4) Florida Social Science Advisory Committee projection. The report "Population Projection for south Florida" details the various population series for the aggregate area and for the individual counties to the year 2000. The report "Employment Projections for south Florida" projected employment to the same data with alternative levels of employment projected based upon the four population series. In each of the reports the relevant area of south Florida is taken as being the counties of Broward, Charlotte, Collier, Dade, Glades, Hendry, Lee, Martin, and Palm Beach." (Quoted from author's abs.)

Odum, H. T., and others, 1974, Cypress wetlands for water management, recycling, and conservation: Annual report to Rockefeller Foundation and National Science Foundation, Center for Wetlands, University of Florida, Gainesville, Florida.

"This is the first annual report of progress on our project on Cypress Wetlands that started June of 1973 under auspices of the Rockefeller Foundation and the RANN Division of the National Science Foundation. The purpose of the work is to test and obtain practical guidelines for the use of Cypress Wetlands as water management areas, secondary sewage water receivers, and greenbelts for better and more economic fit of man and nature. To accomplish these aims, cypress domes are being studied in detail near Gainesville, Florida; some domes are natural controls, some receive treated sewage, and others receive hard ground water. An accidental forest fire in December 1973 swept through the experimental area producing conditions in the test areas characteristic of drained and burned areas that are a public concern in south Florida. With wastewater flow up to 5 inches per week, 2 experimental domes are beginning to yield information on swamp responses to alternatives of management, although pumping arrangements to others are still under construction. New data show important roles for the cypress dome ponds as regulators of regional water tables affecting productivity of forests, agriculture, and wild ecosystems: in such a role they may be effective in controlling microclimates and preventing fires and invasions of exotic species of trees ***." (Quoted from authors' abs.)

Odum, H. T., and others, 1975, Cypress wetlands for water management, recycling, and conservation: Second annual report to the National Science Foundation and the Rockefeller Foundation Center for Wetlands, University of Florida, Gainesville, Florida.

"This is the second annual report of the project testing feasibility of "Cypress Wetlands for Water Management, Waste Recycling, and Conservation" supported by the RANN Division of the National Science Foundation and the Rockefeller Foundation. Now in the third year, studies of water, nutrients, geological process, chemical cycles, microbes, vegetation, forestry, wildlife, economics, energetics, and systems are being made in several field tests. Comparisons are made with other swamp sites.

"This report summarizes the 14 phases of research and public interaction, the auxiliary projects that extend the studies to state and county-related problems through the Center for Wetlands, and the most pressing technical questions remaining. Several theses and dissertations are available as appendixes under separate cover. A proposal to complete the project has also been submitted to the Foundations ***." (Quoted from authors' abs.)

Tabb, D. C., and Iversen, E. S., 1971, A survey of the literature relating to the south Florida ecosystem (with pertinent references from outside the geographic boundaries of the subject area): Rosensteil School of Marine and Atmospheric Science, University of Miami, 205 p.

Tebeau, C. W., 1973, Post environment from historical sources: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-03, 66 p.

"In the year 1900 peninsular Florida south of Polk and Orange Counties was the home of only 43,344 people, just under eight percent of the state's total, and over a third of them lived in Key West. The region aptly described as one huge refuge for wildlife and plant life, was as yet largely unexploited and undisturbed. Though it had been explored, mapped, and described during the Second Seminole War, 1835-42, the reports were not generally known. The interior remained a mystery until it began to be "rediscovered" and widely reported about 1870 by hunters, naturalists, and surveyors who described what was there and what was happening to it. Gatherers of hides and feathers and sportsmen were killing ruthlessly. Settlers and developers were clearing and burning and draining and lowering the water table thereby altering the environment. Some species were disappearing and others were threatened. The Everglades National Park became a refuge for the surviving remnant, but man's activities threatened them even there." (Quoted from author's abs.)

U.S. Department of the Interior Report, 1969, Environmental Impact of the Big Cypress Swamp Jetport: 153 p.

"Development of the proposed Big Cypress Swamp Jetport, Florida and attendant facilities will lead to land drainage and development for agriculture, industry, housing, transportation, and services in the swamp which will destroy the south Florida ecosystem and Everglades National Park. Construction of each training strip will destroy about 400 acres of natural habitat. No significant problems are expected from the limited sewage, industrial wastes, or pesticides in the training phase. Air pollutants from engine exhausts will be substantial. There will be frequent high level noise intrusion on the wilderness character of the northern part of Everglades National Park and even more on the Big Cypress and Conservation Area no. 3. A severe bird strike may develop within the airport boundaries. With sufficient culverts provided through runways, ramps, roads, and other facilities, interference with overland flow will be negligible. The combination of bird strikes, pest insect problems, and incidence of small animals on runways will probably lead to drainage of at least part of the jetport property. Construction and imminent operation of the first training strip have elevated surrounding land prices and sales. Economic and social pressures for further development within and without the port property will mount rapidly. Land development and drainage will be accompanied by increased nutrients in the water, will alter the hydroperiod, and will promote eutrophication." (Quoted from WRSIC abs.)

U.S. House of Representatives, 92nd Congress, 2nd Session 1972, A bill to authorize the acquisition of the Big Cypress National Freshwater Reserve in the state of Florida and for other purposes, House Bill 13115, 7 p.

"The Big Cypress area is ecologically bound with the Everglades National Park. The continued viability of the Everglades, along with the existence of certain estuarine fisheries of south Florida, is directly dependent upon freshwater of adequate quality and quantity from the Big Cypress area. In order to protect the Big Cypress area from further development which would adversely affect its ecology; H.R. 13115 would establish the Big Cypress National freshwater reserve, consisting of not more than 540,000 acres of privately owned land. The bill would authorize the Secretary of the Interior to acquire by donation, purchase, transfer or exchange, lands, waters, and other interests within the boundaries of the proposed reserve. Owners of improved property acquired may, as a condition of acquisition, retain rights of use and occupancy for not more than 25 years, or in lieu thereof, for a term ending at the death of the owner or the death of his spouse, whichever is later. The bill would limit and control such activities as the exploration and extraction of gas, oil, and other minerals, hunting, fishing, and agriculture. However, the Miccosukee Indians and Seminole Indians may continue their usual use of the lands and waters within the reserve." (Quoted from WRSIC abstract).

U.S. House of Representatives, Big Cypress Preserve, Florida, Hearings-Subcommittee on National Parks Land Recreation-Committee on Interior and Insular Affairs, 92nd Congress, 2nd Session, February 15 and September 26, 1972, 180 p.

"H.R. 10410 would authorize the Secretary of the Interior to acquire certain lands within the Big Cypress Watershed in Florida; other bills would authorize the acquisition of the Big Cypress National Freshwater Reserve in Florida. The basic purpose of this field hearing was to hear testimony from people in the local area. Representatives of State and local agencies testified at this hearing with reference to these proposed bills. Upon passage, the Secretary of the Interior would be authorized to enter into an agreement with the state or local unit of government for the purposes of managing and administering the area. The use of the lands would be limited so as to assure the flow of freshwater into the Park. The use of motorized vehicles, mineral exploitation, grazing, and agricultural pursuits would be closely regulated. Hunting and trapping would continue subject to reasonable controls. The aim of the proposal is to protect the freshwater resources in Big Cypress Watershed and thereby protect the water quality, quantity and flow regimen to the northwest portion of Everglades National Park, as well as the estuarine regions and the water supplies of the cities and towns in southwest Florida." (Quoted from WRSIC abs.)

U.S. Senate, Big Cypress National Preserve (Part 2-Appendix), hearings on S.334, S.783, S.920, H.R. 10008-Subcommittee on Parks and Recreation--Committee on Interior and Insular Affairs, 93rd Congress, 2nd Session, March 21 and 22, 1974, 828 p.

"The proposed Big Cypress National Freshwater Reserve involves the acquisition over a 10-year period of 547,000 acres of lands in southwest Florida. Preservation of the watershed, its ecosystem, and water supplies of nearby cities is the aim of the proposal. The area is mainly aquatic and supports a diversity of rare plant and animal forms which are endangered by the draining, mining, and other development by the surrounding communities. Support for preservation of the area began when the city of Miami began construction of a jetport in the area. In addition to preserving the water supply, acquisition of the Big Cypress watershed will restore the ecosystem and enhance the change of survival of the 21 rare and endangered species living there. There are no expected adverse environmental effects of the proposal. If no action is taken, drainage and development projects will destroy the watershed. The other alternative is to use methods other than acquisition to preserve the area. Zoning measures appear inadequate because of the time required to approve and implement regulations by several levels of government. Creation of an environmental trust or public corporation for control of the area involves similar problems of coordination. Federal compensable land-use regulations have never

been adopted and would require Federal legislation. The short-term effect of the proposal prevents further exploration of the area's resources; the long-term effect insures preservation of the watershed. The only irretrievable commitment of land is that it is designated for recreational use. Supplemental studies include an earlier environmental impact statement by the Department of the Interior, and a hydrologic survey by the U.S. Geological Survey." (Quoted from WRSIC abs.)

Ward, Fred, 1972, The imperiled Everglades: National Geographic, January 1972, v. 141, no. 1, p. 1-27.

This article discusses the drainage of wetlands and the increased threat of forest fires.

GEOLOGIC REFERENCES

Florida Game and Freshwater Fish Commission, 1971, Statement on Big Cypress Swamp oil exploration, Statement to Governor Askew and Cabinet of the state of Florida, Tallahassee, Florida, May 17, 1971, 2 p. (mimeographed).

Leighty, R. G., 1964, Soil survey of Collier County, Florida: U.S. Department of Agriculture, Washington, D. C., and University of Florida, Florida Agricultural Experiment Station.

This report contains maps and descriptions of the various soils of Collier County and also correlates vegetation and soil types.

McPherson, B. F., 1974, The Big Cypress Swamp: Environments of south Florida, present and past: Miami Geological Society Memoir 2, p. 8-17.

"The Big Cypress Swamp differs from the adjacent Everglades in topography, soils, water quality, and vegetation. Because the swamp has relatively more high land, inundation and soil deposition are less extensive in the swamp than in the Everglades, soil in the swamp is usually a thin (less than 0.6 meters) layer of marl, sand, or mixtures of the two, or is absent where limestone crops out, whereas soil in the Everglades is usually deeper organic peat. Vegetation in the swamp is closely associated with topography, water inundation, and soils, and is more diverse and forested than it is in the Everglades." (Quoted from WRSIC abs.)

Phillips, O. P., 1964, Recent sedimentary record in mangrove swamps and rise in sea level over the southwestern coast of Florida
In: Marine Geology, Elsevier Publication Company, Amsterdam, Netherlands.

Puri, H. S., and Banks, J. E., 1959, Structural features of the Sunniland Oil Field, Collier County, Florida: Transactions- Gulf Coast Association of Geological Societies, v. IX, 1959, p. 121-23.

"Salient structural features of the Sunniland oil field are discussed and illustrated by structure maps drawn on the top of a sand in the Miocene, on top of the Crystal River Formation, the Avon Park Limestone, the Lake City Limestone, the Oldsmar unconformity, the Oldsmar anhydrite, the Cedar Keys Formation, the Cedar Keys anhydrite, the Upper Cretaceous, the Lower Cretaceous, near the top of the Fredericksburg, near the top of the Trinity, and on top of an anhydrite near the Sunniland producing zone. Isopach maps of the Cedar Keys Formation, the Upper Cretaceous, and the Lower Cretaceous (between the top of the Lower Cretaceous and the top of an anhydrite near the Sunniland producing zone) illustrate the lateral variations in thickness of these stratigraphic units ***." (Quoted from authors' abs.)

Scholl, D. W., 1963, Sedimentation in a modern coastal swamp, southwestern Florida: Bulletin of the American Association of Petroleum Geologists, v. 47, no. 8, p. 1581-1603.

Scholl, D. W., and Craighead, F. C., 1967, Recent geological history of the west coast of Florida; coastal mangrove swamps, and Florida Bay: Transactions - Gulf Coast Association Geological Societies, v. 17, p. 481.

GEOCHEMICAL REFERENCES

Horvath, G. J., 1973, The influence of Big Cypress land development in the distribution of heavy metals in Everglades estuaries: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-11, 156 p.

"The distribution, chemical fractionation, and flux rates of heavy metals were investigated in the Big Cypress Swamp and the Everglades National Park. The study area included canals draining developed land, and estuaries which receive runoff from both developed areas and natural wetlands. In the Barron River Canal, metals were present mainly in the dissolved ionic form, with the exception of iron and zinc which occurred mostly in the dissolved organically complexed and particulate fractions. Dissolved metal

concentrations in canals adjacent to actively cultivated fields were 2-6 times higher than those in canals draining uncultivated land. The degree of contamination was higher during the rainy season. The flux rates of heavy metals during high flow conditions were generally twice as high as during low flow. Iron had the highest flux rate under both flow conditions, followed by manganese, lead, cobalt and zinc. Dissolved iron concentrations decreased sharply over the salinity gradient, while the concentrations of other metals showed a net increase. Concentration levels of heavy metals in Chokoloskee Bay were 1.5 to 3 times higher than those present in other Everglades estuaries receiving natural drainage. The degree of enrichment increased during the wet season ***." (Quoted from author's abs.)

Mathis, J. M., 1974, Mangrove decomposition--A pathway for heavy metal enrichment in estuaries: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-13, 60 p.

"Red mangrove decomposition was studied as a natural pathway for heavy metal enrichment in estuaries of south Florida. Red mangrove leaves, major constituents of the highly organic suspended detritus of the estuaries, were analyzed in several decomposition stages for heavy metal concentration. Analysis revealed a 3 to 200-fold enrichment of iron, manganese, copper, and cadmium in the detritus compared to living leaves. This enrichment process is thought to be primarily due to adsorption, complexation, and concentration of dissolved metals by the mangrove detritus and its associated microbiota.

"Comparisons between the Barron River estuary, which receives its drainage from agriculturally developed areas, and the Shark and Broad River estuaries, which receive drainage from undeveloped areas, revealed a significantly higher concentration of copper and cadmium in Barron River leaves and a higher concentration of manganese, iron, and copper in Barron River detritus than in the leaves and detritus of the uncontaminated estuaries. This increase in heavy metal concentrations is probably due to the metal-containing pesticide and fertilizers applied to farmlands drained by the Barron River estuary." (Quoted from author's abs.)

Mattraw, H. C., 1973, Cation exchange capacity and exchangeable metals in soils and sediments of a south Florida watershed: U.S. Department of the Interior, South Florida Environmental Project, Ecological Report no. DI-SFEP-74-12, 80 p.

"A study of exchangeable metal behavior was designed and tested for a disrupted Big Cypress Watershed in south Florida. Essential considerations included isolation of a hydraulic equivalent fine fraction of soils and sediments and in situ measurements of sediment pH and Eh. Measurements of cation exchange capacity (CEC) and exchangeable manganese, iron, cobalt, copper, zinc, cadmium and lead for four identifiable environments were compared with field data and laboratory measurements of pH, amount of fine material, and organic content to elucidate control mechanisms on exchangeable metal content. Kruskal-Wallis analysis of variance on CEC normalized estuarine sediments indicated a cultural enrichment of exchangeable cobalt, copper, zinc and lead in Chokoloskee Bay." (Quoted from author's abs.)

HYDROLOGIC REFERENCES

Armbruster, J. T., 1972, Land use in the Big Cypress area, southern Florida: Florida Bureau of Geology Map Series no. 50, 1 sheet, 1 map.

"This one sheet atlas describes land use of the Big Cypress physiographic province in southern Florida, southwest of Lake Okeechobee. It is a hydrologic unit of 2,450 square miles of flat swampy area that merges into a coastal-marsh and estuarine environment. The Big Cypress has been divided into 3 subareas. The subareas have reasonably distinct internal drainage determined largely by topographic configuration and manmade drainage. These manmade water-control measures generally establish patterns for urbanization. Development of the Big Cypress started in 1926 with the building of the Barron River Canal. It continued in 1928 with the excavation of the Tamiami Canal. The canals were the sources of fill for State Road 29 and U.S. Highway 41, respectively. In all 49 bridges distribute flow to the west part of Everglades National Park along the 37-mile reach of the Tamiami Canal between 40-mile Bend and State Road 29. The Turner River Canal was completed during the late 1950's and served as the source of fill for State Road 840A. Initially, land use along most of these canals was primarily agricultural. Later, small residential areas appeared. The most significant development has been residential land use." (Quoted from WRSIC abs.)

Benson, M. A., and Gardner, R. A., 1974, The 1971 drought in south Florida and its effect on the hydrologic system: Tallahassee, Florida, U.S. Geological Survey Water-Resources Investigations 12-74, 46 p.

"The 1971 dry season rainfall in south Florida was low enough that the public media and concerned public officials unanimously characterized the event as a severe drought.

"Rainfall overall in south Florida during the 1970 wet season and the 1970-71 dry season was less than 85 percent of normal, as was the 1971 wet season on the heavily populated southeast coast of Florida. Rainfall during the dry season ranged from 20 to 63 percent of normal and recurrence intervals for dry season rainfall of this magnitude ranged from 100 years to several hundred years.

"Canal flow and ground-water levels reflected the drought conditions but in most cases did not set record lows. No permanent undesirable effects occurred as a result of the drought." (Quoted from authors' abs.)

Black and Associates, Inc., 1959, Suggested water supply policy for the Board of County Commissioners, Collier County, Florida: Engineering Report Job no. 349-59-R; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The purpose of this interim report is to present the results of a study of the water resources of Collier County and how they may be best developed for the overall benefit of the citizens of Collier County. The report includes a study of land use, population density, and water-supply requirements for the principal residential districts and sets forth a long range plan for providing a safe and potable supply of water to those areas. It presents the fundamental requirements and the criteria for sound water conservation practices to develop, protect, and make maximum use of those water resources ***." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1963, Water system improvements for city of Naples, Naples, Florida: Engineering report Project no. 305-63-R; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"This report presents the results of an engineering study of the water supply, treatment, pumping, and transmission requirements of the city of Naples water system as affected by the anticipated growth of the city. The report summarizes the findings of earlier reports and contains the results of a recent investigation as to raw water supply and service area requirements. It established a master plan for the water system to meet the projected requirements and sets forth a stage construction program to fulfill that end ***." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1965, Engineering report to the Board of County Commissioners, Collier County, Florida on the proposed Collier County salinity line in the vicinity of Henderson Creek: Project no. 349-65-R; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The purpose of this engineering report is to present the results of an engineering study relative to the establishment of the proposed Collier County salinity line in the vicinity of Henderson Creek is presented in this report.

"This study included review of all available data relative to ground and surface water conditions, inventory of existing wells, analysis of water samples, and determination of general piezometric conditions of water-bearing aquifers throughout the area ***." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1966, Proposed well code for Collier County, Florida: Engineering Report Project no. 349-66-R; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The scope of this report is to propose a code, including Rules and Regulations, to protect the ground-water resources of Collier County, Florida. Special emphasis is placed on preventing any possible intermixing of ground waters of different quality which may result from drilling, use, poor maintenance, or abandonment of wells in Collier County.

"The proposed code does not cover public health aspects which the Legislature has delegated to the Florida State Board of Health under Chapter 170C, sanitary code of Florida ***." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1966, Engineering report for water system improvement for the city of Naples, Naples Florida: Engineering Report Project no. 305-66-R-1; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The purpose of this report is to present the results of an engineering study of the sources of supply, and the treatment, pumping, transmission, and distribution requirements of the city of Naples water system as affected by the anticipated growth of the City.

"Projections of water requirements for a period ending in 1985 have been made from an analysis of records on number of water users and their water consumption.

"Present water works facilities are described and supply, treatment, and pumping capacities indicated. A comparison of present capacities with projected requirements, leads to the development of a rational improvement program.

"An evaluation is made of the present and potential sources of water supply. Findings on this subject from earlier reports and results of recent investigations are summarized. Potential sources are described including estimates of perennial yield and expected water quality. A program is established for orderly development of new sources, and to monitor and protect the quality of those now used ***." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1969, Collier County, Florida,
Comprehensive area plan for water and sewer development:
Project no. 449-68-52; available for inspection at U.S.
Geological Survey, Water Resources Division, Miami, Florida.

"The purpose of this report is to present a comprehensive area-wide plan for the development of water and sewer facilities in all rural areas within the boundaries of Collier County, Florida. This includes all of the communities considered to have a growth potential.

"The plan comprises background basic studies to permit an understanding of the general conditions of the area, a study of the water and sewerage needs, and plans for development of these facilities ***." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1970, Future water supply studies for the city of Naples, Naples, Florida: Engineering Report
Project no. 305-69-51; available for inspection at U.S.
Geological Survey, Water Resources Division, Miami, Florida.

"This report presents a master plan for development of the future water supply for the greater Naples area. Existing water supply and treatment facilities are described, as well as present service requirements. Anticipated future requirements are determined after consideration of conditions affecting growth. A comprehensive analysis of possible surface and ground water sources of supply is presented, including water quality and physical characteristics of existing wells, drainage canals and limestone pits. Results of additional drilling and testing conducted during this study are included. Following evaluation of all possible sources, the location of the future water supply is presented along with a plan for its orderly development." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1973, Water management study, Water Management District no. 6, Collier County, Florida:
Project no. 449-71-51; available for inspection at U.S.
Geological Survey, Water Resources Division, Miami, Florida.

"The purpose of this report is to present a comprehensive water management plan to accomodate future urban development projects and provide relief for previously developed projects within the study area while maintaining a quality environment for the protection of natural resources. The study incorporates the disciplines of engineering, land planning, and environmental science into a water management plan which provides the precautions necessary to protect and preserve the hydrology and ecology of the area while permitting optimum land use within the district. One of the basic purposes of the proposed plan is to prevent overenrichment and other water pollution problems, where they occur, rather than passing them downstream." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1974, Hydrologic study of the GAC Canal network, Collier County, Florida: Engineering Report Project no. 449-73-53; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The primary objective of the present study is evaluation of the existing GAC canal system, covering both engineering and environmental aspects. In addition, actions which may be taken by the county to improve flood protection and lessen environmental stress are outlined and their costs are estimated.

"The engineering evaluation includes a discussion of the general surface and ground-water hydrology of the study area, and estimates of present and future flood flows within the drainage network. A hydraulic analysis is also presented which quantifies the capacity of the existing system." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1974, Master plan for Water Management District no. 6, Collier County, Florida: Project no. 449-71-51; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The report presents a proposed plan for development within the District that will protect coastal wetlands from traditional decline in water quality associated with urban runoff as well as from changes in tributary flow patterns and characteristics. In particular, the plan will protect Rookery Bay Wildlife Sanctuary and ensure its continued preservation as a valuable natural ecosystem. The plan incorporates several innovative features that will permit high quality urban development in harmony with the environment." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1975, Specifications for the city of Naples well field, Naples, Florida, "Drilling and Completing Two (2) Recharge Wells": Project no. 305-75-01; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

These specifications provide for the furnishing of all materials, equipment, transportation, tools, labor, and all other services necessary for the prosecution and completion of the work of drilling and completing two (2) recharge wells for the city of Naples well field, Naples, Collier County, Florida.

Black, Crow, and Eidsness, Inc., 1975, Master plan, Water Management District no. 7 including the Cocohatchee and Gordon River Basins, Collier County, Florida: Project no. 449-71-52; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The report presents results of investigations conducted to evaluate environmental conditions, within the study area, and their interrelationship with the water resources of the District. These investigations include hydrologic studies, water quality sampling, estuarial salinity and mixing studies, and vegetation and land-use mapping. The resulting data were utilized to develop a plan for management of water resources consistent with both development and environmental objectives." (Quoted from author's intro.)

Black, Crow, and Eidsness, Inc., 1977, Water and wastewater studies for the city of Naples, Naples, Florida: Engineering Report; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The purpose of this report is to bring to date the pertinent data relevant to the growth and development of the city of Naples water and wastewater systems; and to provide projections and recommended programs to assist the City Council, for the city of Naples, to continue to provide an orderly growth of the utilities.

"The report presents a history of the development of the present water and wastewater facilities and an evaluation of the present facilities in terms of their adequacy of capacity and projected rate of growth. The report includes recommendations for the immediate expansion of the systems, along with a suggested development schedule to provide continuity in the continued development of these facilities.

"A fiscal section has been included in the report to provide construction costs, operating expenses, required depth service projections, and projections of required revenues to establish the fiscal soundness of the proposed programs." (Quoted from author's intro.)

Boggess, D. H., 1968, Water supply problems in southwest Florida: Tallahassee, Florida, U.S. Geological Survey open-file report FL-68003, 27 p.

"*** This discussion is generally restricted to the water-supply problems that affect large segments of the urban and potential urban areas. Southwest Florida, as referred to herein, includes the five counties--Charlotte, Collier, Glades, Hendry, and Lee--adjacent to the lower west coast of Florida. Four of the counties--Charlotte, Collier, Hendry, and Lee--are among the 15 counties in Florida with the most rapid population increase for period 1960-64. In the past 15 years, the population of this 5-county area has increased by more than 300 percent. The more densely populated areas are along the coastal margins and tidal waterways." (Quoted from author's intro.)

Deju, R. A., and Miller, W. L., 1971, Geohydrology of Collier County, Florida: Southeastern Geology, v. 16, no. 1, p. 67-78.

"Southwestern Collier County, Florida, is undergoing growth in population with consequent increases in their water demand. Although rainfall is abundant, losses due to evapotranspiration and oceanic discharge are equally large. The subsurface geology of the two main aquifers underlying the area is discussed. Well logs, drillers logs are the main tool for understanding the subsurface geology of this low, poorly drained, flat plain. The shallow aquifer is composed entirely of permeable limestones in the Tamiami Formation. The deeper Floridan aquifer is artesian and contains two basic parts, an upper one yielding freshwater (Hawthorn Formation) a lower part yielding saltwater (Tampa Formation). The two layers of the Floridan aquifer are separated by an aquiclude. Directions of flow, water quality and future potential of all these hydrologic units are also examined." (Quoted from WRSIC abs.)

Dragovich, A., Kelly, J. A., and Goodell, H. G., 1968, Hydrological and biological characteristics of Florida's west coast tributaries: U.S. Department of the Interior, Fish and Wildlife Service, Special Scientific Report, Fisheries, no. 455, 40 p.

Finney, A. R., 1963, Report of availability of potable water for Marco Island Collier County: Deltona Corporation, Miami, Florida, 19 p.

The population in Collier County increased rapidly during the 1950-1960 decade, rising from 6,488 to 15,753 for an increase of 243 percent during this period. With the rapid growth, additional quantities of potable water were needed, and in some areas of the county the growth was impeded due to the lack of water or limited data on the availability of water. One such area falling in this category was Marco Island. This report documents the search and testing of a possible well field with potable water.

Freiberger, H. J., 1972, Streamflow variation and distribution in the Big Cypress watershed during wet and dry periods: Florida Bureau of Geology Map Series no. 45.

"A part of the water needs of Everglades National Park and the Lower Gulf Coast communities is fulfilled by water that drains from the Big Cypress Watershed. This map report shows the magnitudes, direction, and distribution of surface-water flows through the Watershed during periods of high and low flows. The Big Cypress Watershed in southwestern Florida encompasses an area of about 2,450 square miles, most of which lies in Collier County. Streamflow throughout the Watershed was determined from discharge measurements made at about 250 sites during November 18-20, 1969, in a period of high flow and on March 9, 1971, in a period of low flow. During November 18-20, 1969, the total flow through the outlets along Everglades Parkway between the Levee 28 Interceptor Canal and Naples was 1,603 cubic feet per second. This flow was distributed through canals and over land. On March 9, 1971 the flow through Everglades Parkway between the same two points was 40 cubic feet per second. There was no over land sheet flow through the outlets along this 50-mile stretch of Everglades Parkway. The flow was divided between just two canals, 29 cubic feet per second in Barron River Canal and 11 cubic feet per second in the Turner River Canal." (Quoted from WRSIC abs.)

Freiberger, H. J., 1972, Nutrient survey of surface waters in southern Florida during a wet and a dry season, September 1970 and March 1971: Tallahassee, Florida, U.S. Geological Survey open-file report FL-72008, 29 p.

"A mass nutrient survey of southern Florida surface waters was made in September 1970, during a period of generally high water, and again in March 1971, during a period of low water. Water samples were analyzed by automated chemical techniques for total ortho plus acid-hydrolyzable phosphorus ($P-PO_4$), ammonia nitrogen (NH_3-N), nitrite nitrogen (NO_2-N), and nitrate nitrogen (NO_3-N)." (Quoted from author's abs.)

Gee and Jenson, 1970, Report covering review of water management systems of GAC Properties in Collier and Lee Counties, Florida: Prepared for GAC Properties, Inc; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"GAC Properties Inc. requested preparation of this report on September 10, 1970 stating that the engineers should determine how they could best follow the suggestions and recommendations set forth in reports from the Department of the Interior. This report should include but not be limited to the following: (a) a method of maintaining sheet flow and required quantities of water into the Fahkahatchee Strand, (b) determine if there is any pollution problem resulting from canal construction, (c) recommendations as to advanced levels of waste treatment, including nutrient removal to be used in GAC Properties Inc. developments in order to protect the waters discharging into the Fahkahatchee Strand and Fahka Union Bay, (d) set up a program and method of plugging flowing wells on the GAC property in order to protect the water quality in the Floridan aquifer, (e) investigate the possibility of obtaining a Government grant to treat canal waters prior to their release into the Fahkahatchee Strand or the Fahka Union Bay, so that the waters will have the necessary qualities to protect the ecosystem of the Big Cypress Swamp." (Quoted from authors' intro.)

Gorelick, S., 1975, Southwest Florida regional hydrogeology and water supply: New College Environmental Studies Program.

"Data related to southwest Florida's ground-water resources and water supply have been organized and assembled. Geologic history and the existing framework for the hydrogeologic system are briefly reviewed. Patterns of ground-water quality and the serious problem of saltwater intrusion are analyzed. Regional water use is displayed, illustrating the relative uses of ground water for agricultural, industrial, and public supplies. Particular aspects of the ground-water framework and its uses are described county-by-county over the southwest Florida region." (Quoted from author's intro.)

Hyde, L. W., 1965, Chronological bibliography of principal published ground-water reports in Florida: Florida Geological Survey, Tallahassee, Florida, 18 p.

Klein, Howard, 1954, Ground-water resources of the Naples area, Collier County, Florida: Florida Geological Survey Report of Investigations 11, 64 p.

A general report on the geology and ground-water resources of the Naples area. Fresh ground-water supplies are obtained from the shallow aquifers. The upper aquifer contains water under water-table conditions and underlies the surface to a depth of 30 to 55 feet. The lower aquifer contains water under artesian conditions and extends from about 50 to 80 feet below sea level. Includes results of three pumping tests and 18 chemical analyses.

Klein, Howard, 1972, The shallow aquifer of southwest Florida:
Bureau of Geology Map Series no. 53.

This report describes the pertinent hydrologic aspects of the shallow aquifer determined from data collected during 1 year of investigation in the central part of the Big Cypress Swamp and from data collected during several years in perimeter areas of the Big Cypress Swamp.

Klein, Howard, Schneider, W. J., McPherson, B. F., and Buchanan, T. J., 1970, Some hydrologic and biologic aspects of the Big Cypress Swamp drainage area, southern Florida: Tallahassee, Florida, U.S. Geological Survey open-file report FL-70003, 94 p.

"This report shows the importance of the Big Cypress in maintaining an adequate water supply for (1) Everglades National Park. (2) expanding population of southwestern Florida, and (3) adjacent estuaries which constitute nurseries for fish, some of which are commercially important. Hydrological information defining the boundaries of Big Cypress Swamp and its subregions on which Everglades National Park depends for its water supply will assist in predicting effects of alternative land uses within Big Cypress Swamp on the ecology of the Everglades National Park." (Quoted from WRSIC abs.)

Little, J. A., Schneider, R. F., and Carroll, B. J., 1970, A synoptic survey of limnological characteristics of the Big Cypress Swamp, Florida: U.S. Department of the Interior, Federal Water Quality Administration, Southeast Water Laboratory, Technical Service Program, Athens, Georgia, 212 p.

"A 1-month synoptic study of the limnological characteristics of the Big Cypress Swamp, Florida, was conducted in March 1970. This study was undertaken by the Federal Water Quality Administration to insure that as much information as possible would be available on water quality to serve as background for this agency's participation in a larger effort by U.S. Department of the Interior agencies to develop recommendations on the need to maintain special protection areas in the Swamp ***." (Quoted from authors' intro.)

McCoy, H. J., 1962, Ground-water resources of Collier County, Florida: Florida Geological Survey Report Investigations 31, 82 p.

"Since 1950 the population of the coastal areas of Collier County, Florida has increased rapidly. With this increase has come the need for additional quantities of potable water. Recognizing this, the Collier County Board of Commissioners, in cooperation with the city of Naples, requested the U.S. Geological Survey to investigate the ground-water resources of the county. Such an investigation was begun in November 1959 by the Geological Survey in cooperation with Collier County. An appreciable part of the data was obtained during a continuing cooperative program begun in 1951 with the city of Naples.

"The investigation included the following phases: (1) assembling and evaluating existing basic data; (2) obtaining data related to the availability and movement of ground water; (3) determining the hydrologic and geologic characteristics of the subsurface materials; (4) determining the chemical quality of ground water; and (5) preparing a report of the results of the investigation ***." (Quoted from author's intro.)

McCoy, H. J., 1967, Ground water in the Immokalee area, Collier County, Florida: Florida Geological Survey Information Circular no. 51, 31 p.

"Potable ground water in the Immokalee area is available at depths ranging from about 20 to 300 feet below the land surface. The materials comprising this subsurface section are primarily quartz sand, marl, shells, and consolidated to semiconsolidated limestone. Although vertical and horizontal ground-water movement is retarded by marl layers, the section is essentially a single unconfined aquifer.

"The principal chemical constituents of the ground water are calcium and bicarbonate. The most objectionable constituents are iron and hydrogen sulfide which occur in small amounts and both of which can be removed easily and inexpensively.

"The shallow coarse sand and gravel beds west and northwest of Immokalee contain the best quality of ground water in the area and appear to be the most feasible source for municipal supplies. A deep limestone section in Immokalee and a shallow limestone section to the east could be developed for increased future demands. However, detailed studies regarding size, shape, and hydraulic characteristics of the major producing zones are needed to determine the overall ground-water potential of the system." (Quoted from author's abs.)

McCoy, H. J., 1972, Hydrology of western Collier County, Florida: Tallahassee, Florida, Florida Bureau of Geology Report of Investigations no. 63, 32 p.

"Western Collier County, Florida, has large freshwater supply potential because of its 54 inches of rainfall annually and its manmade surface flow system, hydraulically connected to a shallow permeable aquifer. However, water problems exist because the rainfall is not evenly distributed throughout the year, causing a threat of saltwater intrusion in the Naples well field during prolonged dry seasons. Contamination of existing and future groundwater supplies by man-related activities including urbanization is of concern. The controlled surface-water flow system and the distribution of weirs allow for water control without an excessive lowering of ground-water levels. The system also has the potential for recharging the coastal section of the shallow aquifer during the dry seasons. Variable water quality and inadequate flows during the dry season precludes the use of the surface-water flow system as a direct source of municipal water." (Quoted from WRSIC abs.)

McCoy, H. J., 1973, Summary of hydrologic conditions in Collier County, Florida, 1972: Tallahassee, Florida, U.S. Geological Survey open-file report FL-73022, 118 p.

"This report is a continuation of annual summaries of hydrologic conditions in Collier County, Florida, which began in 1968. Streamflow and water-level fluctuations are graphed for the 1972 year (October 1971 to September 1972). Water-quality data are presented in table, graph, and diagram form for their period of record. Changes in hydrologic conditions are monitored by a data-collection network throughout the county and in the urbanized Naples area. The countywide network consists of 5 streamflow gaging stations, 16 wells equipped with continuous water-level recorders, 19 wells sampled semiannually for chloride analyses, and 13 surface-water sites sampled semiannually for nutrient analyses. The Naples network consists of 1 streamflow gaging station, 3 wells equipped with continuous water-level recorders, about 75 wells sampled and/or measured semiannually and 4 surface-water sites sampled quarterly for extensive analyses of chemical, physical, and bacteriological parameters." (Quoted from WRSIC abs.)

McCoy, H. J., 1974, Summary of hydrologic conditions in Collier County, Florida, 1973: Tallahassee, Florida, U.S. Geological Survey open-file report FL-74030, 99 p.

This report is another in a series of annual summaries of hydrologic conditions in Collier County, Florida which began in 1968. Streamflow and water levels are graphed from October 1972 to September 1973. Water quality data is also presented in various forms for their periods of record. The data collection system is countywide and in the urbanized Naples area.

McCoy, H. J., 1975, Summary of hydrologic conditions in Collier County, Florida, 1974: Tallahassee, Florida, U.S. Geological Survey open-file report FL-75007, 103 p.

McElroy, W., and Alvarez, K. C., 1975, Initial report on the augmentation of surficial flow through the Fahkahatchee Strand, Collier County, Florida: Water Resources Report no. 2, Florida Department of Environmental Regulation, 5 p.

This report discusses the public ownership of the Fahkahatchee Strand from 1913.

McPherson, B. F., 1969, Preliminary determinations of hydrobiological and chemical conditions in the vicinity of the proposed jetport and other airports in south Florida, April 1969: Tallahassee, Florida, U.S. Geological Survey open-file report FL-69004, 42 p.

**** Individuals and groups have expressed concern over the possible hazards posed by the jetport for Everglades National Park and the surrounding environment of south Florida. One concern is the effect this facility might have on the water quality and flow in south Florida ***.

"At the request of the Dade County Port Authority and the National Park Service, the Geological Survey undertook to obtain the background information on hydrobiological conditions in the south Florida area prior to and immediately following the first scheduled training flights set for December 1969. Twenty-two stations were selected to be sampled at three times prior to December 1969; that is, April, July, and October-November. Three of the stations were at canals near existing commercial airports. The three stations near existing airports, Miami International, Homestead Air Force Base, and Opa-Locka were selected as representative of conditions prevailing under full-scale commercial operations.

"This report gives the results of the first set of sampling which was done in April 1969. Surface water was sampled at all stations except number 16, where ground water was taken from an observation well." (Quoted from author's intro.)

McPherson, B. F., 1970, Preliminary determinations of hydrobiological and chemical conditions in the vicinity of the proposed jetport and other airports in south Florida: Tallahassee, Florida, U.S. Geological Survey open-file report FL-70004, 31 p.

This report gives the results from the samples collected as above in July 1969.

McPherson, B. F., 1971, Water quality at the Dade-Collier training and transition airport, Miami International Airport, and Cottonmouth Camp--Everglades National Park, Florida, November 1969: Tallahassee, Florida, U.S. Geological Survey open-file report FL-70011, 29 p.

"Water quality was determined at three areas in south Florida in November 1969 to portray conditions at a commercial jetport (Miami International Airport) and in a natural environment (Cottonmouth Camp in Everglades National Park) and a transitional environment (Dade-Collier Training and Transition Airport). Water in canals near Miami International Airport generally contained higher concentrations of nitrogen, phosphorus, organic carbon, trace elements and heavy metals, and lower concentrations of dissolved oxygen than waters at the Training and Transition Airport and at Cottonmouth Camp. Concentrations of chromium, lead, and oil in surface water at Miami International Airport exceeded the limits established in 1969 by the Federal Water Quality Administration for interstate waters of Florida; concentrations were below these limits in the other areas. Sediment at Miami International Airport was heavily coated with oil and grease (23 percent) at station 5, and contained a relatively high concentration of 85.2 micrograms per kilogram (ug/kg) of the DDT family (DDT, DDE, DDD) at station 1. Sediment at other stations in the three areas contained less than 3.0 percent oil and grease and less than 4.2 ug/kg of the DDT family. Nutrient concentrations in sediment were highest at a natural pond near Cottonmouth Camp (station 11) and lowest in a newly excavated borrow pit (station 9) at the Training and Transition Airport." (Quoted from author's abs.)

Miller, R. A., and Benson, M. A., 1976, Hydrologic effects of storms of June 24-28, 1974, in Lee and Collier Counties, Florida: Tallahassee, Florida, Water Resources Investigations 57-75, 30 p.

"The storms of June 24-28, 1974, in Lee and Collier Counties, Florida, produced widespread flooding, beach erosion, and utility failures. Recurrence intervals of the rainfall at Fort Myers are less than 5 years for durations under 6 hours, and less than 10 years for durations under 2 days. Recurrence intervals for peak ground water elevations in Lee and Collier Counties as a result of the storm are less than 5 years, as are the recurrence intervals for both stage and discharge in streams." (Quoted from WRSIC abs.)

Miller, W. L., 1973, Hydrologic resources of the Everglades city area, Collier County; Florida: [Wright State University, M.S. Thesis]; Department of Geology, Wright State University, Dayton, Ohio, 60 p.

"In the last two decades, much of coastal Florida has experienced rapid development and population growth. Associated with this growth, increased demands for water have been met with rapidly devised water systems which have depleted ground-water resources and intensified saltwater intrusion. Detailed study and development plans for the hydrologic resources of coastal areas are necessary prior to development.

"The Everglades City area in southwestern Collier County is the developing coastal area for which this investigation of hydrologic resources and development plan has been prepared. The area is bounded to the east by Monroe Station and Florida Road 94, to the west by Road 29, to the north by a line 1 mile north of U.S. Route 41, and to the south by Everglades National Park. The hydrologic resources of north and central Collier County control those in the area and must be investigated to produce a coordinated and comprehensive water development plan ***." (Quoted from author's abs.)

Miller, W. L., 1975, Nutrient concentrations of surface waters in southern Florida, September 1970 to April 1975: Tallahassee, Florida, U.S. Geological Survey open-file report 75010, 44 p.

"Inorganic nitrogen and phosphorus in the surface waters of southern Florida were measured synoptically by the U.S. Geological Survey during wet (June-October) and dry (November-May) seasons nine times between September 1970 and April 1975. The number of sites sampled ranged between 175 in 1970 and 500 in 1975, with a total of 2,367 samples collected and analyzed since the inception of the program. Samples were collected from canals, rivers, lakes, coastal bays, marshes, and swamps. The data are shown on a series of maps which indicate the locations of sampling sites and the nutrient concentrations. Each nutrient species is shown separately on maps prepared using data collected during the surveys. The analytical data are presented with no discussion of variation in concentration of the several parameters in either space or time. No statistical analysis has been given the data, nor has the significance of given nutrient concentration been cited. The accumulated data of nine nutrient surveys is presented to facilitate storage of and reference to the data." (Quoted from author's abs.)

Morrow, B. W., and Stevens, J. A., 1971, Hydrologic effects of the proposed Gordon River Canal, Naples, Florida: Collier County Conservancy.

This report discusses the hydrologic effects of building the Gordon Canal. It compares existing hydrologic conditions with projected hydrologic conditions, if the canal was built. Any possible benefits derived from drainage of a portion of the Gordon River basin must be compared to the deterioration of the water supply system, increased saltwater intrusion, and probable damage to the environment.

Parker, G. G., Ferguson, G. E., Love, S. K., and others, 1955, Water resources of southeastern Florida, with special reference to the geology and ground water of the Miami area: U.S. Geological Survey Water Supply Paper 1255, 965 p.

A detailed report on the geology and hydrology of southeastern Florida is provided. The report presents basic geologic, hydrologic, hydraulic, and chemical data. It includes discussion of climate, ground water, surface water, saltwater encroachment, water quality, and contains many chemical analyses.

Post, Buckley, Schuh, and Jernigan, Inc., 1977, Collier County Master Water Plan: Engineering report, 135 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"This study provides a master plan for the development of countywide water resources and facilities in an orderly and efficient manner through the study area consisting of western Collier County. This plan is consistent with the existing and projected county land-use plans.

"The recommended plan has been selected based on its compatibility with long-term county water resources, existing and programmed water treatment and distribution facilities, economic investment, political attitudes, and environmental requirements ***." (Quoted from author's intro.)

Sherwood, C. B., and Klein, Howard, 1961, Ground-water resources of northwestern Collier County, Florida: Florida Geological Survey Information Circular 29, 44 p.

"This investigation was made to provide hydrologic information for use in development of safe water supplies and water-control plans for northwestern Collier County. Previous development in this area has been limited to a narrow coastal ridge between the Big Cypress Swamp and the Gulf of Mexico ***." (Quoted from authors' abs.)

Smally-Wellford and Nalven, 1961, Preliminary study, water management in north Naples and east Naples area, county of Collier, Florida: Engineering Report, 41 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"This preliminary study relates to the rapidly growing urban areas outside the corporate limits of the city of Naples. Although intensive analysis has been applied, decisions as to alternatives will have to follow and lead to preparation of final plans before construction could be undertaken. The purpose of this report is to assist the Board of County Commissioners in making decisions and in charting the sequence of future improvements ***." (Quoted from authors' intro.)

Smally-Wellford and Nalven, 1962, Report on storm drainage in the Immokalee urban area, Collier County, Florida: Engineering Report, 25 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"This study relates to the unincorporated Immokalee urban area. Although intensive analysis has been applied, decisions as to alternatives will be necessary, leading to the preparation of final plans for construction. The purpose of this report is to assist the Board of County Commissioners in making such decisions and in charting the sequence of future improvements ***." (Quoted from authors' intro.)

Smally-Wellford and Nalven, 1962, Engineering report, Exploratory drainage study of eastern Collier County, 21 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"This exploratory study is limited to a general review of the drainage and flood control features of eastern Collier County. Available data has been assembled consisting of topographic maps, soil maps, aerial photographs, geological reports, and other material from Federal, State and local sources ***." (Quoted from authors' intro.)

Smally-Wellford and Nalven, 1962, Proposed drainage and road improvements in southeastern Collier County, Florida: Engineering Report, 43 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The essential purpose of this study is to determine the engineering feasibility and approximate construction costs for basic flood routing, drainage and graded roads in southeastern Collier County, sufficient to permit all year use of the area. Aspects related to this purpose have been included, because a broad background picture is essential for an intelligent approach to the complex problems of modifying a huge wilderness area for the uses of people without creating unduly adverse effects ***." (Quoted from authors' intro.)

Smally-Wellford and Nalven, 1963, Water management in western Collier County and a proposed Water Conservation District: Engineering Report, 68 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

This report studies the feasibility of the creation of a 30 square mile water conservation district in western Collier County. It also prepares a Master Flood Routing Plan for Western Collier County.

Swayze, L. J., and McPherson, B. F., 1977, The effect of the Faka Union Canal system on water levels in the Fakahatchee Strand, Collier County, Florida: Tallahassee, Florida, U.S. Geological Survey Water-Resources Investigations 77-61, 19 p.

"The Faka Union Canal system, constructed in the western Big Cypress Swamp in the early 1970's, lies about 3.5 miles west of the centerline of the Fakahatchee Strand, a forested water course which the State of Florida has designated as an area of critical state concern to conserve natural resources. Between 1970 and 1975 the canal system annually discharged to the Gulf of Mexico from 143,200 to 275,600 acre-feet freshwater. Discharge lowered ground-water levels as much as 4 feet near the eastern canal and created a water-level gradient that indicates water flowed from the Fakahatchee Strand west toward the canal during most of the year. In June 1975, water from early summer rains was impounded in the eastern canal upstream of the control structure at Janes Scenic Drive, and as water levels rose in this reach, water flowed from the canal into the aquifer and around the control structure. The annual low-water level in the center of the Fakahatchee Strand declined from nearly 3 feet above mean sea level in 1972 to 1 foot above mean sea level in 1974." (Quoted from authors' abs.)

Tri-County Engineering, Inc. (Craven-Thompson, Inc.), 1971, Engineering report for water control project in north Naples, Florida: TCE project no. 2844 for Collier Development Corporation, 22 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"This report presents an account of the design for a water control project in north Naples, Collier County, Florida and on lands owned by Collier Development Corporation.

"The outfall for this area involves the old drainage and borrow ditch originally constructed by the Seaboard Air Line Railroad when it built its railroad grade in the years 1925 and 26, approximately 46 years ago. The railroad has been abandoned for many years and the grade is now used for a Florida Power & Light Company Transmission Line ***.

"The design details are incorporated in the report and the details of alignment, profiles and cross-sections, and the locations of the self-actuating water control structures are shown ***." (Quoted from author's intro.)

Tri-County Engineering, Inc. (Craven-Thompson, Inc.), 1971, Offset drainage canal for Pine Ridge second extension Collier County, Florida: TCE project no. 2844 for Collier Development Corporation, 21 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

"The report presents an account of the design for the Pine Ridge Offsite Drainage Canal undertaken by TRI-COUNTY ENGINEERING, INC., to drain Pine Ridge Second Extension area located within Collier County and owned by Collier Development Corporation. At present the area is partially developed and measures approximately 1,000 acres. However, the design calculations are based on the assumption of a fully developed area ***.

"The design details are incorporated in the report and the details of alignment, profiles and cross-sections are shown on a drawing plate." (Quoted from author's intro.)

Unklesbay, A. G., Heath, R. C., and Peek, H. M., 1959, Bibliography and index of articles relating to ground-water resources of Florida: Florida Geological Survey Special Publication no. 4, 104 p.

Wilson, Miller, Barton, Soil and Peek, Inc., 1975, Naples Bath and Tennis Club lake monitoring study: Engineering Report, 8 p; available for inspection at U.S. Geological Survey, Water Resources Division, Miami, Florida.

This report discusses a lake surveillance monitoring program which includes physical, chemical, and biological parameters.

Wimberly, E. T., 1973, Reconnaissance of water quality in the vicinity of Sunniland Oil Field, Collier County, Florida, 1971-72: Tallahassee, Florida, U.S. Geological Survey Water-Resources Investigations 35-73, 10 p.

*** Anticipation of oil exploration in the Big Cypress area aroused concern over the effects a producing field would have on the quality of surface water in the area. The Florida Department of Natural Resources requested the U.S. Geological Survey to determine whether there have been any such effects. The 29-year old Sunniland Oil Field was chosen for this preliminary evaluation. A second phase of the investigation was to monitor the effects of

building roads, drilling operations and other exploratory activities related to development of an oil field, on the quality of surface water in the areas of proposed exploration. This report presents the results of the first phase." (Quoted from author's intro.)

Wimberly, E. T., 1974, Quality of surface water in the vicinity of oil exploration sites, Big Cypress area, south Florida: Tallahassee, Florida, U.S. Geological Survey open-file report FL-74012, 26 p.

"Exploration for oil in the Big Cypress area of south Florida caused concern that this activity might change the quality of surface water in the vicinity of the drilling sites. Samples of surface water were collected near the proposed exploration sites before oil drilling activities commenced in order to assemble background water quality data. After the drilling sites were actually in use, the surface water was again sampled to determine whether the exploration activities had caused any water-quality changes. At site 4, concentration of June 1973 was about 445 times higher than that of August 1971; at site 5, concentration of June 1973 was about 15 times higher than that of August 1971 and July 1972; at site 8, concentration of June 1973 was about 8 times higher than that of August 1971. The October 1973 sampling showed that chloride concentrations at all sites were at background level." (Quoted from WRSIC abs.)

Wimberly, E. T., 1975, Satellite relay and processing of hydrologic data in south Florida: Tallahassee, Florida, U.S. Geological Survey Water-Resources Investigations 12-75, 19 p.

"A data collection system (DCS), using the Landsat satellite (Landsat-1) as a data relay platform, has been tested in south Florida. The purpose of DCS is to transmit water data to the user in near real time, even from remote areas. The flow of data is from data-collection platforms at field sites via Landsat-1 satellite to the National Processing Facility at Goddard Space Flight Center to the Miami office of the U.S. Geological Survey to data users. The process requires only a few hours, and current data are provided to water-management agencies in several different forms. Thousands of square miles of south Florida are inundated many months of the year when the only practical access is by airboat or helicopter. The need for near-real-time data becomes imperative during times of crisis, such as a hurricane, because rapid evaluation of the situation and operational decisions are mandatory. In October 1972 a DCS began transmitting to the U.S. Geological Survey office in Miami, water-level and rainfall information from gaging stations in the water-conservation areas, Everglades National Park, and Big Cypress Swamp. The time for this transmittal is about 45 minutes." (Quoted from WRSIC abs.)