

Preface

In the late 1960s, I worked as a graduate teaching assistant in plant ecology for the late Dr. John Henry Davis at the University of Florida. On one of our visits to the Everglades, he mentioned to me that he had been studying problems of the Everglades since the early 1930s, and that rapid growth in Florida, unless checked, was about to doom the Everglades. He hoped his vegetation survey of the Everglades and his vegetation map could someday be used to help restore the Everglades to some semblance of what it had been prior to the turn of the century. These long-forgotten discussions with Dr. Davis were rekindled when, during a wetland conference in Orlando, Florida in the late 1980s, I was asked what might be responsible for the reported massive invasion of cattails that had been noted during the past decade in the Everglades. Several hypotheses were presented at the meeting, including some preliminary data on the significant inputs of nutrients from agricultural lands and Lake Okeechobee to the north. The shifts in the hydrologic conditions and flow patterns of the existing Everglades were also mentioned.

Because of the extensive work on phosphorus and nutrient retention then being done at the Duke University Wetland Center, I was asked in early 1989 to do a preliminary survey and analysis of the ecological status of the Everglades. From this early work, carried out by Dr. Chris Craft and myself, it was apparent that the Everglades had undergone radical changes in both water flow and water quality since my early visits to the Everglades in the late 1960s. This led us to develop and focus our research on three key questions. (1) What are the effects of increased nutrient and water inputs on the native plant and animal communities? (2) What is the long-term nutrient storage capacity of the Everglades? (3) How can water management in the Everglades be improved to maintain the natural communities?

Our early studies showed that the multipurpose management objectives that had been maintained by the US Army Corps of Engineers, the South Florida Water Management District, and the State of Florida since the 1950s had resulted in major alterations in hydrologic and nutrient regimes throughout the Everglades. Moreover, the long-term ecological effects of the changes in hydroperiod and increased nutrient loadings during the past three decades have not been quantified under experimental conditions. While numerous reports on water monitoring and several excellent volumes on the Everglades regarding the ecological effects have been published

(Davis and Ogden 1994; Porter and Porter 2002), no detailed synthesis of long-term experimental work in the Everglades has been available.

Clearly, the restoration of the Everglades first requires a rigorous analysis of ecosystem structure and function to determine which factors and interaction of factors are responsible for the plant and animal community alterations reported for the Everglades. During a 14-year period (1989–2003), the faculty and students at the Duke University Wetland Center and its partner institutions conducted extensive experimental research on the effects of water, nutrients, and fire on the Everglades communities. This volume is a synthesis of the key findings and summary of the experiments conducted during this period by faculty and students at the Duke University Wetland Center and scientists from the University of Louisville, Michigan State University, Indiana University, University of Nevada Reno, SUNY Plattsburg of New York, Brigham Young University, Portland State University, the U.S. Forest Service, and the Hydrobotanical Institute, Czech Republic. Many thanks go to Lisa Blumenthal Rattray, my administrative assistant for nearly 10 years, for her tireless editing of our annual Everglades reports, the starting point for a lot of this book.

The data presented herein would not be possible without the thousands of analyses of soil, water, and plant samples carried out by the analytical technicians at the Duke University Wetland Center in Durham, NC. Key personnel include Paul Heine, lab manager, analytical chemist, and QA/QC specialist; Wes Willis, analytical chemist and QA/QC officer; and Julie Rice, analytical technician. At the Duke Florida lab, I would like to thank Dr. Panchabi Vaithiyanathan whose scientific insights into Everglades biogeochemistry along with his outstanding experimental designs for our field research were indispensable. Bob Johnson and Jeff Johnson are to be commended for their skilled lab management over the 14-year period, and key field technicians John Zahina, Kevin Nicholas, and Lea Karppi collected massive amounts of data under often very difficult field conditions. Dr. Mengchi Ho provided invaluable assistance with statistical analysis, database management, and many of the graphics found in this volume. Dr. Jan Stevenson provided invaluable early work on periphyton analysis from the dosing and gradient studies, and provided some unprocessed samples for our macroinvertebrate chapter. Species identifications for macroinvertebrates were verified by J. Epler (Coleoptera, Diptera, Ephemeroptera, Hemiptera, Trichoptera, Hydracarina), R. Maddocks (Ostracoda), M. Milligan (Decapoda, Hirudinea, Oligochaeta, other miscellaneous taxa), J. Daigle (Odonata), F. Thompson (Gastropoda), and M. Larsen (Cladocera, Copepoda). W. Loftus verified fish identifications of lake chubsucker, seminole killifish, and redbfin pickerel. Soil core work was aided by Molie Polk and Chad Gorham, and analyses for paleoecological research and microfossil extractions were performed by Daniel Jones with help from Rachel McCaskill, Jennifer Jensen, Laura Pyle, and Elizabeth Sklad. We are indebted to Claire Schelske, Jaye Cable, Bill Burnett, and Jason Lynch for help with radioisotope dating procedures and analyses. Thanks to David Higdon and Jackie Huvane for help with multivariate analyses, Eric Edlund for help and advice with Calpalyn, and Tom Pummer and the Radiology Department at Palms West Hospital in Loxahatchee, FL for X-rays of the soil cores.

We would like to thank Scott Struck (Indiana University) for the original design of the figures in Chap. 3. The study reported in Chapter 18 was supported by grant MSM 600 766 5801 from the Czech Republic Ministry of Education. Finally, to the dozens of graduate and undergraduate students who worked tirelessly on mountains of samples in the lab and entered data into spreadsheets for countless hours, I can say that your contributions to saving the Everglades were priceless.

Importantly, the work summarized in this volume covers both the structural responses and the functional responses of the Everglades ecosystem via experimental and gradient studies on microbial activity, algal responses, macroinvertebrate populations, macrophyte populations, and productivity in response to alterations to nutrients in soil and water, hydrologic changes, and fire. No studies were conducted to any degree on bird or fish populations.

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