

Contents

List of Maps	xv
Foreword	xvii
Preface.....	xix
Acknowledgments.....	xxiii
Author and Contributors	xxv
Introductions	xxvii

SECTION I Background

Chapter 1 An Ecosystem Overview: What Is (or Are) the Everglades?	3
A Unique and Valuable Ecosystem	6
Terms and Definitions	7
South Florida Climate and Weather	10
The Historic Everglades Region.....	16
Origin and Evolution of the Everglades	18
Chapter 2 The Everglades in Space and Time	23
Florida, Geologic Time, and Plate Tectonics	23
Limestone and Aquifers	27
Emergence of Land on the Florida Platform: The Peninsula.....	29
Sea Level, Climate, and the Birth of the Everglades	31

SECTION II Environments of the Everglades Region

Chapter 3 Freshwater Marshes: Water, Weather, and Fire.....	37
Marsh Vegetation and Plant Communities.....	37
Sawgrass Marsh.....	40
Wet Prairies	41
Slough.....	43
Pond (Alligator Hole) and Creek	44
Water Levels in Everglades Peatlands.....	46
Water Quality	46
Periphyton: A Plant Community Atop Others	49
Marsh Soils.....	51
Weather and Fire	52
Ridge-and-Slough Landscape and Flow: The Cutting Edge of Everglades Science	54
Chapter 4 Tree Islands	61
Size and Location of Everglades Tree Islands	61
Kinds of Tree Islands: The Vernacular Names	62

Bayheads.....	62
Willows and Willow Heads.....	65
Cypress, Cypress Domes, and Cypress Heads.....	65
Tree Island Evolution.....	66
Pop-Up or Battery Tree Islands.....	66
Strand Tree Islands.....	68
Fixed Tree Islands.....	69
Other Processes.....	73
Tree Island Moats.....	74
Pond Apple (Custard Apple).....	74
Integrity of Tree Islands.....	75
Chapter 5 Tropical Hardwood Hammocks.....	77
The Hammock Environment.....	80
Tree Height.....	80
The Strangler Fig.....	80
Hammocks, Fire, and Succession.....	80
Unpleasant Aspects of Hammocks.....	81
Hammocks and Wildlife.....	83
Chapter 6 Pinelands.....	85
Pinelands and Fire.....	88
South Florida Pine Rockland and Endemic Species.....	88
Pinelands in South Florida Ecological History.....	90
Chapter 7 The Big Cypress Swamp.....	91
Conservation Units and Native American Lands.....	91
Surface Waters of the Big Cypress Region.....	94
Geology and Soils.....	95
Big Cypress Vegetation.....	97
Hammocks.....	97
Pinelands.....	97
Cypress Forests and Domes.....	99
Mixed Pine and Cypress Forest.....	100
Mixed Swamp Forest.....	100
Marl Prairies.....	102
Sloughs.....	102
Hydrology of Big Cypress Plant Communities.....	103
Integrity of the Big Cypress.....	104
Chapter 8 Mangrove Swamps.....	107
Kinds and Characteristics of Mangroves.....	107
Red Mangrove.....	108
Black Mangrove.....	110
White Mangrove, Buttonwood, and the Buttonwood Embankment.....	111
Mangrove Reproduction and Dispersal.....	112
Mangrove Swamp Soils and Soil Building.....	112

Oysters and Mangrove Swamps	112
Mangrove Swamps and Everglades Wildlife	113
Mangrove Swamps and Marine Fisheries	113
Legal Protection of Mangroves	116
Visiting a Mangrove Swamp	116
Chapter 9 Coastal Lowland Vegetation ... and Hurricanes!	117
Impacts of Hurricane Andrew on the Everglades	119
Hurricane Frequency and Environmental Impact in Southern Florida	119
Impacts of Hurricane Donna	120
The Hurricane Legacy: Coastal Lowland Vegetation	121
The White Zone—A Hurricane-Prone Landscape	121
Hurricanes and Glacial Cycles	124
Chapter 10 Estuarine and Coastal Marine Waters	125
Florida Bay: A Geologist's Classroom	125
Florida Bay as Part of Everglades Restoration	128
Historic Sea-Level Rise and Coastal Environments	130
Marine Transgression and the Future of Coastal Environments	134
Chapter 11 Lake Okeechobee and the Everglades Headwaters	137
The Lake Okeechobee Watershed	137
Lake Okeechobee's Discovery and Name	144
Origin of Lake Okeechobee and Its Basin	145
The Predrainage Lake	146
Beginnings of the Modern Lake: Hamilton Disston and the State of Florida	148
Federal Involvement: From the Okeechobee Waterway to the C&SF Project	150
Lake Okeechobee's Water Levels: Nature versus Regulation Schedules and the Hoover Dike	153
Vegetation and Wildlife	155
Littoral Zone	155
Pelagic Zone	157
Fishes	158
Other Wildlife	159
Water Quality	159
Summary and Conclusions	162
Elevation Surveys, NGVD, and NAVD	162
Chapter 12 Peripheral Ecosystems of the Everglades	165
The Caloosahatchee and Charlotte Harbor	165
The Caloosahatchee: Historic Condition	167
The Caloosahatchee: Modified Condition	168
Caloosahatchee Restoration	172
The St. Lucie River and Indian River Lagoon	173
The Watershed of the St. Lucie River and Southern Indian River Lagoon	175
Alterations of the St. Lucie River and Southern Indian River Lagoon Watershed	176
The St. Lucie River and Southern Indian River Lagoon Restoration Plan	179

The Loxahatchee Slough and the Loxahatchee River	179
Loxahatchee Slough	182
Loxahatchee River Northwest Fork: Environmental Impacts and Restoration... ..	185
The Lake Worth Lagoon	186
Biscayne Bay and Its Coastal Wetlands	187
Biscayne Bay's General Features	190
Predrainage Freshwater Inputs and Estuarine Values	191
Modern Biscayne Bay's Estuarine Decline	192
Biscayne Bay Coastal Wetlands and Everglades Restoration	195

SECTION III *The Flora and Fauna of Southern Florida*

Chapter 13 Origins of the Flora and Fauna	201
Tropical versus Subtropical	201
Elements of the Flora	202
Origin of the Tropical Flora	202
Trees	202
Palms	203
Epiphytes	204
Ferns	204
Bromeliads	204
Orchids	204
Marine Flora	205
Hurricanes and Dispersal	205
Proximity and Dispersal	206
Origin of the Temperate Flora	207
Trees	207
Marsh Vegetation	207
Origins of the Fauna	208
Chapter 14 Invertebrates	209
Marine and Estuarine Invertebrates	209
Freshwater Invertebrates	211
Florida Applesnail	211
Seminole and Mesa Rams-Horns	214
Crayfish	214
Riverine Grass Shrimp and Side-Swimmer Amphipod	215
Aquatic Insects	216
Terrestrial Invertebrates	217
Spiders	217
Scorpions	217
Insects	218
Florida Tree Snail	218
Importance of Invertebrates	219
Chapter 15 Freshwater Fishes	221
Primary Freshwater Fishes	221
Secondary Freshwater Fishes	223

Peripheral Freshwater Fishes.....	224
The Florida Gar.....	224
Introduced Fishes.....	225
Freshwater Fishes and the Food Chain.....	225
The Fisherman's Perspective.....	227
Chapter 16 Marine and Estuarine Fishes.....	229
Diversity of Marine and Estuarine Fishes.....	229
Game Fishes.....	230
Mullet.....	230
Threatened and Endangered Species.....	232
Importance of the Region's Marine and Estuarine Fishes.....	233
Chapter 17 Amphibians.....	235
Amphiuma and Sirens.....	235
Treefrogs and Toads.....	236
True Frogs.....	237
The Importance of Amphibians.....	238
Chapter 18 Reptiles.....	241
Reptiles of the Everglades Region.....	241
The American Alligator.....	246
Alligators and Other Crocodilians Compared.....	246
Size and Danger to Man.....	247
Alligators as Predators and as Prey.....	247
Alligator Distribution.....	247
Alligator Protection.....	247
The Alligator's Life Cycle.....	248
Alligator Holes and Their Importance.....	249
The American Crocodile.....	253
Chapter 19 Mammals.....	255
Land Mammals of the Everglades.....	256
The White-Tailed Deer.....	260
The Florida Panther.....	260
Marine Mammals.....	261
Chapter 20 Birds.....	263
Breeding Land Birds.....	264
Breeding Waterbirds.....	265
Feeding Behavior of Wading Birds.....	267
Wood Stork (WOST).....	269
White Ibis (WHIB).....	270
Glossy Ibis (GLIB).....	271
Roseate Spoonbill (ROSP).....	271
Great Blue Heron (GBHE).....	271
Great White Heron (GWHE).....	272

Tricolored Heron (TRHE)	273
Reddish Egret (REEG)	274
Great Egret (GREG)	274
Snowy Egret (SNEG)	275
Little Blue Heron (LBHE)	276
Green Heron (GRHE)	276
Black-Crowned Night-Heron (BCNH) and Yellow-Crowned Night-Heron (YCNH)	277
Wading-Bird Rookeries	278
Threatened and Endangered Birds	279
Snail Kite	279
Cape Sable Seaside Sparrow (CSSS)	281
A Contest of Beauty	282
Chapter 21 Synthesis: Ecological Relationships, Processes, and Models for the Everglades	287
Succession	287
Everglades Peatland Succession	287
Food Chains and Food Webs	290
Everglades Food Web	292
Lake Okeechobee Food Web	293
Mangrove Swamp Food Web	295
Conceptual Ecological Models	295
Hydrologic Modeling	300
EDEN: The Everglades Depth Estimating Network	303
An Example Hydrologic Model Application: L-31N Seepage Barrier	303
Ecological Models: Putting Food Chains, Landscapes, and Hydrology Together	306
Small Fishes Example and Trophic Implications	309
 SECTION IV Environmental Impacts	
Chapter 22 Humans and the Everglades	315
Native Americans and the Everglades	315
Paleo-Indians	316
Archaic Period	318
Formative Period	318
Seminole and Miccosukee Tribes	320
Overview of Native American Impacts	321
Hydrology, Land Use, and the C&SF Project	321
Everglades Features of the C&SF Project	324
Everglades National Park and the C&SF Project	328
Modifications to the C&SF Project	328
The Development of South Florida	331
Agriculture and the C&SF Project	331
The Everglades Agricultural Area	331
South Miami-Dade Agricultural Area	333
Rock Mining and Land Development	335
Coastal Waters	336

Ecological Effects of Altered Hydrology on the Everglades: A Summary.....	338
Everglades Water Quality Issues.....	338
Phosphorus	339
Sulfur and Mercury	340
Sulfate and Sulfide in the Everglades	341
Mercury and Methylmercury.....	341
Sulfate, Sulfide, and the Methylmercury Connection	344
Sulfide Toxicity.....	344
Sulfate Regulation	347
Changes in Wildlife.....	347
Wading Birds.....	348
The Alligator	349
Specimen Collecting.....	350
Introduced Exotic Species	352
Plants.....	353
Melaleuca.....	353
Brazilian Pepper	356
Old World Climbing Fern.....	357
Animals	357
Invertebrates	358
Fishes	358
Reptiles and Amphibians.....	359
Birds.....	360
Mammals and the House Cat Dilemma	360
Controlling the Introduction of Plants and Animals.....	360
Off-Road Vehicles	361
Solving Deterioration: Everglades Restoration	362
The Everglades Forever Act and Everglades Construction Project.....	364
Modified Water Deliveries, "Mod Waters"	365
Comprehensive Everglades Restoration Plan (CERP).....	368
Everglades Expedited Projects (Formerly "Acceler8")	371
The Central Everglades Planning Project (CEPP).....	372
Restoration and the Endangered Species Act.....	374
Restoration versus Climate Change and Rising Sea Level	375
The Economics of Everglades Restoration.....	376
What Lies in the Future?	377
References.....	383
Index.....	421