

Contents

1	Wetland Functioning in a Changing World: Implications for Natural Resources Management	1
	J.T.A. VERHOEVEN, B. BELTMAN, D.F. WHIGHAM, R. BOBBINK	
1.1	Introduction	1
1.2	Clarity on Wetlands and Water Use	2
1.3	Wetlands and Environmental Flows	4
1.4	Wetlands and Water Quality	5
1.5	Biogeochemical Insights	6
1.6	Wetlands and River Fisheries	8
1.7	Wetlands and Climate Change	9
1.8	Further Developments in Wetland Science and its Applications	12
	References	12

Section I The Role of Wetlands for Integrated Water Resources Management: Putting Theory into Practice

2	Restoring Lateral Connections Between Rivers and Floodplains: Lessons from Rehabilitation Projects . . .	15
	H. COOPS, K. TOCKNER, C. AMOROS, T. HEIN, G. QUINN	
2.1	Introduction	15
2.2	Threatened Life at the Aquatic–Terrestrial Interface	16
2.3	Reconnecting Side-Channels Along the Rhône (France) . . .	18
2.4	Rehabilitation of Side-Channels of the River Danube (Austria)	21

2.5	'Environmental Flows' for Rehabilitating Floodplain Wetlands (Australia)	24
2.6	Lessons from Rehabilitation Projects	25
	References	30
3	Sustainable Agriculture and Wetlands	33
	F. RIJSBERMAN, S. DE SILVA	
3.1	Agriculture and Wetlands: Introduction	33
3.2	Water for Food, Water for Environment	35
3.2.1	"Ecosystems Produce the Water Used by Agriculture"	36
3.2.2	"Irrigated Agriculture Uses 70 % of the World's Water"	39
3.2.3	"Water Scarcity: Fact or Fiction?"	41
3.3	Producing More Rice With Less Water	43
3.4	Towards a Dialogue Among Agronomists and Environmentalists	44
3.4.1	Water, Food and Environment Issues in Attapeu Province, Lao PDR	47
3.5	Research on Sustainable Agriculture and Wetlands	48
3.6	Conclusions: Towards Sustainable Agriculture and Wetlands?	49
	References	50
4	Sustainable Water Management by Using Wetlands in Catchments with Intensive Land Use	53
	C. YIN, B. SHAN, Z. MAO	
4.1	Semi-Natural Wetlands Created by Humans Before the Industrial Age	53
4.2	Water Regulation by the Multipond Systems	55
4.2.1	Research Site Description	55
4.2.2	The Regulation Process for the Crop Water Supply by the Pond System	56
4.3	Other Ecological Functions of Ancient Semi-Natural Wetlands in a Modern Scientific Context	59
4.3.1	Sediment Retention Within the Watershed	60
4.3.2	Nutrient Retention and Recycling	61
4.3.3	Landscape Complexity and Biological Diversity	61
4.4	Wetlands and Human Activities in Harmony	62
4.5	Protection of Semi-Natural Wetlands Together with Natural Wetlands	63
	References	64

Section II Wetland Science for Environmental Management

5	Constructed Wetlands for Wastewater Treatment	69
	J. VYMAZAL, M. GREENWAY, K. TONDERSKI, H. BRIX, Ü. MANDER	
5.1	Introduction	69
5.2	Free Water Surface Constructed Wetlands	70
5.2.1	Free Water Surface Wetlands for Treatment of Wastewater and Non-Point Source Pollution in Sweden	72
5.2.2	The Role of Wetlands in Effluent Treatment and Potential Water Reuse in Subtropical and Arid Australia	75
5.3	Constructed Wetlands with Horizontal Sub-Surface Flow	79
5.4	Constructed Wetlands with Vertical Sub-Surface Flow	81
5.4.1	Danish Experience with Vertical Flow Constructed Wetlands	83
5.4.2	Constructed Wetlands with No Outflow	85
5.5	Hybrid Constructed Wetlands	86
5.6	Trace Gas Fluxes from Constructed Wetlands for Wastewater Treatment	89
5.7	Conclusion	91
	References	91
6	Tools for Wetland Ecosystem Resource Management in East Africa: Focus on the Lake Victoria Papyrus Wetlands	97
	S. LOISELLE, A. CÓZAR, A. VAN DAM, F. KANSIIME, P. KELDERMAN, M. SAUNDERS, S. SIMONIT	
6.1	Introduction	97
6.2	Wetlands and Inorganic Carbon Retention	99
6.3	Wetlands and Nutrient Retention	102
6.4	Wetlands and Eutrophication	106
6.5	Ecological Modelling	110
6.6	Discussion	117
6.7	Conclusion	118
	References	119
7	Predicting the Water Requirements of River Fisheries	123
	R.L. WELCOMME, C. BENE, C.A. BROWN, A. ARTHINGTON, P. DUGAN, J.M. KING, V. SUGUNAN	
7.1	Introduction	123
7.2	The Hydrological Regime and Fisheries in Rivers	124

7.2.1	Fish Responses to River Flow	127
7.2.2	What River?	127
7.2.3	Linkages Between Hydrological Regime and Fish Catch . . .	132
7.3	The Social and Economic Role of River Fisheries	135
7.4	Methods for Estimation of Environmental Flow Requirements	137
7.5	Guidelines for the Selection and/or Development of Tools for Determining Environmental Flows for Rivers and Wetlands	138
7.5.1	Legislation, Policy, and Practice Supporting Environmental Flows Should Focus on People	138
7.5.2	There is a Need to Understand the Ecosystem First, Before the Impacts on People can be Predicted	139
7.5.3	There is No Such Thing as a Single Flow with a Single Flow Condition	140
7.5.4	Tradeoffs are an Integral Part of Decision-Making and Scenario Generation is Vital	140
7.5.5	The River Ecosystem and Its Flow Regime Must be Compart- mentalized to Provide the Required Scenario Information .	141
7.5.6	Present-Day Conditions Offer the Best Starting Point	143
7.5.7	Methods Should be Usable in Both Data-Rich and Data-Poor Situations	145
7.5.8	Uncertainty is a Reality – Adaptive Management is Crucial .	145
7.5.9	Implementation is Central to Promoting and Improving Environmental Flows	146
7.6	Discussion and Conclusion	146
	References	149
8	Water Management and Wise Use of Wetlands: Enhancing productivity	155
	R.L. WELCOMME, R.E. BRUMMET, P. DENNY, M.R. HASAN, R.C. KAGGWA, J. KIPKEMBOI, N.S. MATTSON, V.V. SUGUNAN, K.K. VASS	
8.1	Introduction	155
8.2	Trends in Capture Fisheries	157
8.2.1	Increasing Pressure – Decreasing Catch	157
8.2.2	Fisheries Management	158
8.3	Methods for the Enhancement of Inland Fisheries	158
8.3.1	Species Introductions	159
8.3.2	Stocking	159
8.3.3	Extensive Culture Methods	164

Contents	XI
8.4 Social and Economic Implications	174
8.5 Discussion	175
References	176

Section III Wetland Biogeochemistry

9	Hydrological Processes, Nutrient Flows and Patterns of Fens and Bogs	183
	W. BLEUTEN, W. BORREN, P.H. GLASER, T. TSUCHIHARA, E.D. LAPSHINA, M. MÄKILÄ, D. SIEGEL, H. JOOSTEN, M.J. WASSEN	
9.1	Introduction	183
9.2	Appearance of Pristine Fens and Bogs	184
9.2.1	General	184
9.2.2	Climate and Mire Vegetation of the Western Siberian Taiga .	185
9.3	Hydrology of Bogs: Examples from Canada, United States and Western Siberia	188
9.3.1	Aspects of Large-Scale Hydrology	188
9.3.2	Local Scale Hydrology of Bogs	189
9.3.3	Modeling a Western Siberian Bog	191
9.4	Fens: Analysis of a Large Pristine Fen in the River Ob Valley	194
9.4.1	General	194
9.4.2	Vegetation, Nutrients and Productivity	196
9.4.3	Hydrology and Modeling	196
9.4.4	Hydro-Ecological Integration	200
9.5	Discussion and Conclusion	201
	References	202
10	Ecological Aspects of Microbes and Microbial Communities Inhabiting the Rhizosphere of Wetland Plants	205
	P.L.E. BODELIER, P. FRENZEL, H. DRAKE, K. KÜSEL, T. HUREK, B. REINHOLD-HUREK, C. LOVELL, P. MEGONIGAL, B. SORRELL	
10.1	Introduction	205
10.2	The Microbial Habitat in the Wetland Rhizosphere	207
10.2.1	Root Structure and Function	208
10.2.2	Oxygen Distribution within Roots	208
10.2.3	Oxygen Concentrations and Fluxes in the Rhizosphere . . .	210

10.3	Survival Strategies of Anaerobes in the Oxic Rhizosphere: Acetogens as an Example	210
10.4	Functional Diversity and Activity of Free-Living N ₂ -Fixing Bacteria	212
10.5	Microbial Community Stability in Response to Manipulation of the Vegetation	215
10.6	Wetland Roots as Hotspots of Microbial Iron-Cycling	220
10.6.1	Wetland Rhizosphere Ferrous Wheels: Introduction	220
10.6.2	Rhizosphere Fe(III) Reduction	221
10.6.3	Rhizosphere Fe(II) Oxidation	223
10.6.4	Rhizosphere Fe(II) Oxidation Scaled to Ecosystems	225
10.7	Methane-Processing Microbes in Wetland Rhizospheres	226
10.7.1	Italian (Vercelli) Rice Soil as a Model System	226
10.7.2	Microbes and Microbial Processes	226
10.7.3	The Controls	229
10.8	Summary and Prospects	229
	References	231
11	Linkages Between Microbial Community Composition and Biogeochemical Processes Across Scales	239
	A. OGRAM, S. BRIDGHAM, R. CORSTANJE, H. DRAKE, K. KÜSEL, A. MILLS, S. NEWMAN, K. PORTIER, R. WETZEL (deceased)	
11.1	Introduction	239
11.2	Microbial Controls on Decomposition	241
11.2.1	Decomposition of Plant Matter in Wetlands	241
11.2.2	Microbial Enzyme Activities as Indicators of Controls on Decomposition	243
11.3	Linking Decomposition with Microbial Community Composition	244
11.3.1	Anaerobic Carbon Cycle	244
11.3.2	Controls over CO ₂ :CH ₄ Ratios in Anaerobic Respiration in Wetlands	245
11.3.3	Sulfate and Iron Reduction as Important Routes for Mineralization in Fens	250
11.3.4	Linking Community Composition with Nutrient Status in Wetlands	252
11.3.5	Plant-Associated Microbial Communities Across Landscapes	255
11.4	Linking Microbial Community Structure and Function with Environmental Parameters	259
11.4.1	Case Study: a Northern Everglades Marsh System	261
	References	263

Section IV Wetlands and Climate Change Worldwide

12	Coastal Wetland Vulnerability to Relative Sea-Level Rise: Wetland Elevation Trends and Process Controls	271
	D.R. CAHOON, P.F. HENSEL, T. SPENCER, D.J. REED, K.L. MCKEE, N. SAINTILAN	
12.1	Introduction	271
12.2	Biotic Process Controls	273
12.2.1	Indirect Biotic Processes	274
12.2.2	Direct Biotic Processes	274
12.3	Hydrologic Process Controls	278
12.3.1	Surface Wetland Hydrology	279
12.3.2	Subsurface Wetland Hydrology	279
12.4	Findings from the SET Network	280
12.4.1	Data Analysis	280
12.4.2	The Salt Marsh SET Network	282
12.4.3	The Mangrove Forest SET Network	285
12.5	Further Considerations	287
	References	289
13	Connecting Arctic and Temperate Wetlands and Agricultural Landscapes: The Dynamics of Goose Populations in Response to Global Change	293
	R.L. JEFFERIES, R.H. DRENT, J.P. BAKKER	
13.1	Introduction	293
13.2	Links Between Modern Agriculture as a Food Source and the Increase in the Size of Arctic Goose Populations . .	296
13.3	Hunting Practices, Availability of Refuges, Agricultural Food Supplies and the Size of Goose Populations	297
13.3.1	Hunting Practices in Agricultural Landscapes and the Size of Goose Populations	298
13.3.2	The Synergistic Link Between Refuges and Agriculture: Effects on Wintering and Migrating Goose Populations . . .	299
13.3.3	The Direct and Indirect Effects of Weather Patterns and Climate Change on Wintering and Migrating Goose Populations	300
13.4	Habitat Changes in Response to Population Growth of Geese	303
13.4.1	Effects of the Geese on Temperate Salt-Marsh Vegetation . .	303
13.4.2	Effects of Geese on Arctic Coastal Vegetation	306

13.5	Anthropogenic Constraints on Population Growth	309
13.6	Conclusion	311
	References	312
14	Eurasian Mires of the Southern Taiga Belt: Modern Features and Response to Holocene Palaeoclimate	315
	T. MINAYEVA, W. BLEUTEN, A. SIRIN, E.D. LAPSHINA	
14.1	Introduction	315
14.2	Peatlands of the Southern Taiga Belt of Northern Eurasia . .	316
14.2.1	The Features of the Southern Taiga Bioclimate	316
14.2.2	Peatland Distribution and Main Types	317
14.2.3	Main Features of Peatland Development	317
14.2.4	Main Features of Climate During the Holocene	319
14.2.5	Peat Accumulation Dynamics	321
14.3	Mire Development and Peat Accumulation Dynamics in the Key Areas During the Holocene	322
14.3.1	Study Sites in European Russia	322
14.3.2	Study Sites in Western Siberia	325
14.3.3	Study Methods	326
14.3.4	Holocene Peat Dynamics	327
14.3.5	Peat and Carbon Accumulation Rates	332
14.4	Discussion and Conclusions	334
	References	338
	Subject Index	343



<http://www.springer.com/978-3-540-33186-5>

Wetlands and Natural Resource Management

Verhoeven, J.T.A.; Beltman, B.; Bobbink, R.; Whigham,
D.F. (Eds.)

2006, XXII, 354 p., Hardcover

ISBN: 978-3-540-33186-5