

Contents

List of contributors

xiii

1	Peatland habitats	1
1.1	Wetlands, peatlands, and mires	2
1.2	Peatland habitats along wetness and chemical gradients	5
1.3	Origin of groundwater and trophic classes	6
1.4	The main ecosystems: marsh, swamp, fen, bog	7
1.5	Environmental gradients as a basis for a finer classification	13
1.6	Peatland classifications	17
2	Diversity of life in peatlands	21
2.1	Fungi and microorganisms	21
2.2	Protozoa	27
2.3	Microalgae	28
2.4	Lichens	29
2.5	Plants	30
2.6	Animals	38
3	Adaptations to the peatland habitat	48
	WITH CONTRIBUTIONS FROM BAPTISTE REGNERY	
3.1	Plant adaptations to flooding and anoxic conditions	48
3.2	Plant adaptations to low nutrient availability	53
3.3	The perfect peatland plant	60
3.4	Adaptations in animals	63
4	<i>Sphagnum</i>—the builder of boreal peatlands	65
4.1	Morphology	65
4.2	Capillarity and water-holding capacity	68
4.3	Chemical adaptations	71
4.4	Nutrient conservation	73
4.5	<i>Sphagnum</i> life cycle	74
4.6	Diversity of <i>Sphagnum</i>	75

4.7	<i>Sphagnum</i> as an environmental indicator	76
4.8	Biological interactions in <i>Sphagnum</i>	78
4.9	Dispersal and colonization	81
4.10	Dynamics and persistence in <i>Sphagnum</i> assemblages	83
5	Peat and organic soil	85
5.1	Sedentation versus sedimentation	86
5.2	Organic versus mineral matter content	87
5.3	Sampling the peat profile	88
5.4	Botanical composition	90
5.5	Degree of decomposition	92
5.6	Physical properties	95
5.7	Electrochemical and chemical properties	98
5.8	Interrelationships of peat properties	105
5.9	Organic soils (histosols)	107
6	The peat archives	109
6.1	Peat fossils	109
6.2	Other environmental indicators	116
6.3	The problem of dating profiles	118
6.4	The Blytt–Sernander scheme	121
6.5	Pleistocene peatlands	125
6.6	Wetland archaeology	125
7	Peatland succession and development	127
7.1	Peatland succession	127
7.2	Successional pathways	128
7.3	Processes of peatland formation	130
7.4	Ombrotrophication	140
7.5	Detailed sequences of peatland development	143
8	Peatland hydrology	148
8.1	Water quantity	148
8.2	Acrotelm and catotelm	155
8.3	Water balance	157
8.4	Peatlands as regulators of water flow	164
8.5	Water quality	166
8.6	Variation in water chemistry along the bog–rich fen gradient	172

9	Nutrients, light, and temperature	175
9.1	Nutrients	175
9.2	Light	189
9.3	Temperature and other climatic factors	192
10	Hydrological systems, hydromorphology, and peatland patterns	199
10.1	Hydrological systems	199
10.2	Hydromorphologic classification	206
10.3	The formation of peatland patterns	226
11	Peatlands around the world	230
11.1	Areas of peatland	230
11.2	Peatland areas used for agriculture, forestry, and peat harvesting	233
11.3	A brief global survey	234
11.4	Peatlands in Tierra del Fuego DMITRI MAUQUOY AND KEITH D. BENNETT	236
11.5	Restiad bogs in New Zealand BEVERLEY R. CLARKSON AND BRUCE D. CLARKSON	241
11.6	Tropical peatlands in south-east Asia ALJOSJA HOOIJER	248
12	Productivity and peat accumulation	254
12.1	Biomass and productivity	254
12.2	Decomposition	259
12.3	Carbon flow in peatlands	264
12.4	Peat accumulation and its limits	266
13	Management, conservation, and restoration of peatlands	274
13.1	Historical development of peatland use	275
13.2	Agriculture on peatland	276
13.3	Forestry on peatland	278
13.4	Peat extraction	281
13.5	Peatland conservation	284
13.6	Restoration, reclamation, and after-use	287
13.7	Peatland societies and organizations	294

14	Peatlands and climate change	296
14.1	Carbon pools in peatlands	297
14.2	Greenhouse gases and radiative forcing	298
14.3	Methods to study environmental changes in peatland	299
14.4	Current carbon balance in peatlands	301
14.5	Effects of climate change on peatlands	302
14.6	Effects of drainage for forestry and agriculture	310
14.7	Peat harvest	312
14.8	Effects of climate change in permafrost regions	313
14.9	Conclusions	314
	 Glossary	 317
	References	321
	Index	369