

Contents

Prologue	1
 Part I: Herders and Reindeer: The Cultural and Socio-Economic Dynamics of Human-Animal Relations	
 Preface	5
The Reindeer: A Brief Natural History	7
References	9
 1 The Challenges of Modernity for Reindeer Management in Northernmost Europe	11
B.C. FORBES	
1.1 Introduction: The Research Setting	11
1.2 Semantics and Book Structure	14
1.3 Research Problems, Questions, Regions and Sites	15
1.4 Issues and Concerns	18
1.5 Challenges in Modern Reindeer Management	20
1.6 Conclusions: Outlook to Resolutions to Conflicts in Reindeer Management	22
References	23
 2 Dynamics in Human–Reindeer Relations: Reflections on Prehistoric, Historic and Contemporary Practices in Northernmost Europe	27
L. MÜLLER-WILLE, D. HEINRICH, V.-P. LEHTOLA, P. AIKIO, Y. KONSTANTINOV, and V. VLADIMIROVA	
2.1 Introduction: People and Reindeer in Northern Environments	27
2.2 Remarks on Prehistoric and Early Historic Dimensions of Human–Reindeer Relations	28

2.3	The Emergence of Sámi Practices in Reindeer Nomadism and Large-Scale Herding	31
2.4	Sámi Reindeer Herding in Crisis: Reflections on Practices in Sápmi, Finland	34
2.5	Human–Reindeer Relationships in the Post-Soviet Context: Kola Peninsula (Northwest Russia)	39
2.6	Conclusion: The Future of Human-Reindeer Relations and its Practices	41
	References	43

3	Development of Participatory Institutions for Reindeer Management in Finland: A Diagnosis of Deliberation, Knowledge Integration and Sustainability . .	47
	J. HUKKINEN, L. MÜLLER-WILLE, P. AIKIO, H. HEIKKINEN, O. JÄÄSKÖ, A. LAAKSO, H. MAGGA, S. NEVALAINEN, O. POKURI, K. RAITIO and N. WEST	
3.1	Introduction	47
3.2	Knowledge Integration: The Path from an Idea to a Policy Recommendation	50
3.2.1	Modes of Networking	51
3.2.2	Pioneer Networking	55
3.2.3	Translational Networking	58
3.2.4	Modular Networking	59
3.2.5	The Challenges of Knowledge Networking	60
3.3	Building on Cognitive Potential: Knowledge Networking as an Emergent Institution for Sustainability	61
3.4	Conclusion	66
	References	68

4	Comparison of Indigennus and Scientific Perceptions of Reindeer Management	73
	L. HEIKKILÄ	
4.1	Introduction: Research Questions, Approach, and Material .	73
4.2	Theoretical Background	75
4.3	The Environmental Management System and its Recognition of Tasks	78
4.4	Major Challenges in Management	80
4.5	Monitoring vs. Observing for Practical Purposes: Contrasting Discourses	84

4.6	The Integrative Challenges of Indigenous and Scientific Conceptions	87
4.7	Conclusions: Needed Dialogue Between Indigenous and Scientific Perceptions	89
	References	90

5	The Challenges and Dilemmas of Concession Reindeer Management in Sweden	95
	J.-L. JERNSLETTEN and H. BEACH	

5.1	Introduction	95
5.2	The Unexpected Field	98
5.3	The Reindeer System in Sweden	99
5.4	Early Legislation and Regulation	100
5.5	Current Legislation and Regulation	101
5.5.1	The Unique Tornedalen Case	101
5.5.2	Concession Reindeer Herding in Tornedalen Today	102
5.5.3	Distribution of Power	103
5.5.4	Concession for What?	104
5.6	A Small Scale System of Coexistence?	106
5.6.1	Winter Pasture Activities	107
5.6.2	Spring Migration	108
5.6.3	Summer Pasture and Calf Marking	109
5.7	Old System, New Challenges: The Future of the Concession System	110
5.8	Conclusions: ... but Some Conflicts Exist	113
	References	115

6	Changes in Property Regimes and Reindeer Herding Management in Post-Soviet Herding Collectives: The Case of the Municipality of Lovozero (Murmansk Region, Northwest Russia)	117
	Y. KONSTANTINOV and V. VLADIMIROVA	

6.1	Introduction: The Setting	117
6.2	A Brief Historical Survey of Land Reforms	118
6.2.1	“State Peasants”	119
6.2.2	Kolkhoz and Sovkhoz Building	120
6.2.3	Agrarian Reforms: Work History vs. Restitution	121
6.2.4	Herding Specifics	123
6.3	Coping Strategies	125

6.3.1	Agrarian Reforms as Power Tools	125
6.3.2	The “Tundra” Collective of Lovozero	126
6.3.3	Land Issues	127
6.3.4	SKhPK Structure	127
6.3.5	Administrative Management	128
6.3.6	Private Reindeer (<i>lichnye olen’i</i>)	129
6.4	Conclusions: An Apocalyptic Future for Reindeer Management?	131
	References	132

Part II: Reindeer Herding – Effects on Soils, Soil Biota and Vegetation

Preface	137
References	139

7	Defining the Quality of Reindeer Pastures: The Perspectives of Sámi Reindeer Herders	141
	H. KITTI, N. GUNSLAY and B.C. FORBES	
7.1	Introduction	141
7.2	Reindeer Herding	143
7.3	Theoretical background	144
7.4	Study Sites	146
7.4.1	Näkkälä Reindeer Herding District	146
7.4.2	Sirkas Sámi Village	147
7.5	Methods	147
7.6	Results	148
7.6.1	Factors Affecting the Quality of the Pastures	148
7.6.1.1	Biological	148
7.6.1.2	Geographical Factors	150
7.6.1.3	Climatic Factors	151
7.6.1.4	Socioeconomic Factors	152
7.6.2	Management and Economic Questions	154
7.6.3	Interactions Among the Different Factors	155
7.7	Scientific Knowledge and Practitioners’ Knowledge	155
7.8	Discussion and Conclusions	158
	References	160

8	Very High Resolution Remote Sensing Data in Reindeer Pasture Inventory in Northern Fennoscandia	167
	T. KUMPULA	
8.1	Introduction	167
8.1.1	Aims of the Research	168
8.2	Research Area	169
8.3	Material	170
8.3.1	Field Data	170
8.3.2	Remote Sensing and GIS Data	170
8.4	Methods	172
8.4.1	Lichens as Indicators of Grazing and Trampling Intensities	172
8.4.2	Digital Image Processing and Accuracy Assessment	172
8.5	Results	174
8.5.1	Classification of Reindeer Pasture Types	174
8.5.1.1	Winter Pastures	174
8.5.1.2	Summer Pastures	176
8.5.1.3	Other Classes	176
8.5.2	Accuracy Assessment	178
8.5.3	Reindeer Lichen Biomass on Winter Pasture Types	180
8.6	Discussion	181
8.6.1	IKONOS-2 Image Classification and Accuracy	181
8.6.2	Grazing and Trampling Intensities in the Jauristunturit	182
8.6.3	Very High Resolution Remote Sensing Data in Reindeer Pasture Inventory	183
8.7	Conclusions	183
	References	184
9	Vegetation: Structure, Cover and Biomass of Subarctic Tundra Wetlands Used as Summer Pastures	187
	H. KITTH and B.C. FORBES	
9.1	Introduction	187
9.2	Study Site and Methods	188
9.2.1	Plant composition	191
9.2.2	Biomass	191
9.2.3	Data analysis	191
9.3	Results	192
9.4	Discussion	194
	References	195

10	The Chemical Response of Reindeer Summer Pasture Plants in a Subarctic Peatland to Ultraviolet (UV) Radiation	199
	P. SOPPELA, M. TURUNEN, B.C. FORBES, P. AIKIO, H. MAGGA, M.-L. SUTINEN, K. LAKKALA and C. UHLIG	
10.1	Introduction	199
10.2	Material and Methods	202
10.2.1	Study Site	202
10.2.2	UV Filtration Experiment	202
10.2.3	Sampling and Analyses	205
10.3	Results	206
10.3.1	Weather and Irradiance Conditions	206
10.3.2	Content of Soluble Phenolics in Different Plant Species . . .	207
10.3.3	Content of Nitrogen and Fibers in Different Plant Species .	208
10.3.4	Digestibility of Different Plant Species	209
10.4	Discussion	210
10.5	Conclusions	212
	References	213
11	Consequences of Grazing on Soil Physical and Mechanical Properties in Forest and Tundra Environments	217
	S. PETH and R. HORN	
11.1	Introduction	217
11.2	Study Areas and Sampling Sites	217
11.3	Materials and Methods	222
11.3.1	Assessment of Soil Structure and Pore Functioning	222
11.3.2	Assessment of Soil Stability	223
11.3.3	Assessment of Heat and Water Flow	223
11.4	Results	224
11.4.1	Changes in Soil Structure and Conductivity Functions . . .	224
11.4.2	Stress-Strain Relationships of the Investigated Soils	230
11.4.2.1	Stability of Soil Structure	230
11.4.2.2	Soil Deformation Under Cyclic Loading	232
11.4.3	Changes in Microclimate and Moisture Regime	234
11.4.3.1	Exchange of Heat Between Atmosphere and Pedosphere . .	234
11.4.3.2	Exchange of Water between Atmosphere and Pedosphere . .	237
11.5	Discussion	238
11.5.1	Changes in Soil Structure and Functioning as a Result of Mechanical Loading	238

11.5.2	Changes in Soil Thermal Regime as a Result of Changing Lichen Cover	239
11.6	Conclusion	241
	References	241
 12	 Changes in Organic Horizon Soil Properties Due to Reindeer Herding and Changing Management	 245
	C. UHLIG and A. ZINK	
12.1	Introduction	245
12.2	Materials and Methods	247
12.2.1	Selection of Study Area	247
12.2.2	The concept of Degradation/Succession Stages	248
12.2.3	Soil Description, Sampling, and Analysis	250
12.2.4	Statistical Analysis	252
12.3	Results	252
12.4	Discussion	257
12.4.1	Quantitative Changes	257
12.4.2	Erosion	258
12.4.3	Microbial Activity	258
12.4.4	Qualitative Changes	259
12.4.5	Pathways of Nutrient Loss	260
12.4.6	Soil Fertility and Pasture Productivity	261
12.5	Conclusions	261
	References	262
 13	 Changing Microbial Ecology with Changes in Grazing and its Management	 265
	M. BÖLTER and R. MÖLLER	
13.1	Introduction	265
13.1.1	Effects of Changes in Land Use	265
13.1.2	Soil Habitats in Northern Fennoscandia	267
13.2	Locations, Sampling, and Analytical Methods	268
13.2.1	Areas of Investigation	268
13.2.2	Sampling	270
13.2.3	Analyses	270
13.3	Results	271
13.3.1	Forest Environments (Vuotso Area)	271
13.3.2	Dry Tundra (Jauristunturit Area)	274

13.3.3	Microbial Communities	279
13.4	Discussion	281
13.4.1	Effects of Climate and Soil Conditions on Soil Biota	282
13.4.2	Effects of Grazing on Soil Biota	284
13.4.3	Effects on Microbial Communities	285
13.4.4	Effects on Soil Respiration	286
13.5	Conclusion	287
	References	288

14	Hygienic Status of Soils and Surface Waters in Reindeer Herding Areas in Northernmost Europe	297
	N. KEMPER, C. HÖLLER and A. ASCHFALK	

14.1	Introduction	297
14.2	Reindeer as an Animal Reservoir for Pathogens with Zoonotic Potential	298
14.3	Pathogens in Soils	299
14.4	Pathogens in Surface Waters	300
14.5	Materials and Methods	301
14.5.1	Fecal Samples	301
14.5.2	Soil Samples	304
14.5.3	Surface Water Samples	304
14.6	Results	305
14.7	Discussion	308
	References	310

**Part III: Integrative Models for Reindeer Management:
The Interface Between Social and Natural Sciences**

Preface	317
-------------------	-----

15	Population Trends of Semi-Domesticated Reindeer in Fennoscandia – Evaluation of Explanations	319
	T. HELLE and I. KOJOLA	

15.1	Introduction	319
15.2	Material and Methods	320
15.3	Synchrony in Population Trends	322
15.4	Explanations of Population Trends	323

15.5	Evaluation of Explanations	327
15.6	Discussion	332
References	336

16 **Systems Analysis of Finnish Reindeer Management** 341

B. BURKHARD and F. MÜLLER

16.1	Introduction	341
16.2	Methods and Data Basis	343
16.3	The Investigation Sites	344
16.4	Modeling and Indicator Derivation	345
16.5	Analysis	348
16.5.1	Land Use Pattern	349
16.5.2	Ecological Integrity	350
16.5.3	Economic Welfare	352
16.5.4	Social Welfare	353
16.6	Future Scenario Derivations	354
16.6.1	Land Use Pattern	356
16.6.2	Ecological Integrity	356
16.6.3	Economic Welfare	357
16.6.4	Social Welfare	358
16.6.5	Potentially Sustainable Scenario	358
16.7	Conclusion	360
References	362

17 **Synthesis: Environmental and Socio-Political Conditions for Modern Reindeer Management in Europe's North** 365

L. MÜLLER-WILLE, J. HUKKINEN, F. MÜLLER, M. BÖLTER,
and B.C. FORBES

17.1	Introduction: Linking Practical and Scientific Knowledge	365
17.2	Issues of Sustainable Reindeer Herding and Management	366
17.2.1	Competing Interests: Space, Mobility, and Land Use Practices	367
17.2.2	Potential Impact of Climatic Change and Radiation	368
17.2.3	Environmental Conditions and Herding Strategies	369
17.3	Herders and Reindeer: The Human Dynamics of Herding and Management	371
17.3.1	Divergent Cultural and Philosophical Premises	371
17.3.2	Knowledge and Science: Bridging Diverse Approaches	372
17.3.3	Socioeconomic Considerations	374

17.3.4	Political and Legal Aspects	374
17.4	Anticipated Issues in Herding and Management Practices .	375
17.5	Conclusions: Recommendations for Reindeer Management	376
References	378

Epilogue	381
----------	-----------	-----

Subject Index	385
---------------	-----------	-----

Reindeer Management in Northernmost Europe
Linking Practical and Scientific Knowledge in
Social-Ecological Systems

Forbes, B.C.; Bølter, M.; Müller-Wille, L.; Hukkinen, J.;

Müller, F.; Gunsley, N.; Konstantinov, Y. (Eds.)

2006, XXII, 400 p., Hardcover

ISBN: 978-3-540-26087-5