Biodiversity in southern Africa

Norbert Jürgens, Ute Schmiedel

University of Hamburg, Biocentre Klein Flottbek and Botanical Garden

and

M. Timm Hoffman

University of Cape Town, Plant Conservation Unit

(Overall editors for concept and structure; for citation please refer to Volumes 1 to 3 separately)





SPONSORED BY THE





Göttingen & Windhoek 2010

Volume 1 Patterns at local scale—the BIOTA Observatories

Preface	VII
Organisations that participated in BIOTA Southern Africa	X
Acknowledgements of the editors	XI
Authors' general acknowledgements	XII

Part I BIOTA Southern Africa

I.1	Challenges and international framework	1
I.2	Structure and elements of the project and course of the project over the three Phases	2
I.3	BIOTA's contribution to global biodiversity monitoring and standardization—in the past, at present,	
	and in the future	4

Part II The BIOTA Observatories

II.1 Methods

II.1.1	The BIOTA transects in southern Africa	
II.1.2	Spatial design of the BIOTA Biodiversity Observatories	12
II.1.3	Responsible authors per Section type and Observatory in alphabetic order	
II.1.4	Sampling and analytical methods used for the standardised descriptions of the Observatories	
II.1.5	How to read the Observatory descriptions	
II.2	Woodland Savanna	
II.2.1	Mile 46 (S01)	
II.2.2	Mutompo (S02)	
II.2.3	Sonop (S03)	118
II.2.4	Ogongo (S42)	
II.2.5	Omano go Ndjamba (S43)	152
II.3	Thornbush Savanna	164
II.3.1	Toggekry (S04)	168
II.3.2	Otjiamongombe (S05)	194
II.3.3	Okamboro (S06)	222
II.3.4	Rooisand (S37)	
II.3.5	Claratal (S38)	
II.3.6	Sandveld (S41)	280
II.3.7	Alpha (S17)	300

II.4	Nama Karoo
II.4.1	Narais (S39)
II.4.2	Duruchaus (S40)
II.4.3	Niko North (S08)
II.4.4	Niko South (S09)
II.4.5	Gellap Ost (S10)
II.4.6	Nabaos (S11)
II.4.7	Karios (S12)
11.5	Namib Desert
II.5.1	Wlotzkasbaken (S16)
II.5.2	Kleinberg(S34)
II.5.3	Gobabeb (S35)
II.5.4	Ganab (S36)
II.6	Succulent Karoo
II.6.1	Koeroegap Vlakte (S18)
II.6.2	Numees (S20)
II.6.3	Groot Derm (S21)
II.6.4	Soebatsfontein (S22)
II.6.5	Paulshoek (S24)
II.6.6	Remhoogte (S25)
II.6.7	Goedehoop (S26)
II.6.8	Ratelgat (S27)
II.6.9	Moedverloren (S28)
II.7	Fynbos
II.7.1	Rocherpan (S29)
II.7.2	Riverlands (S31)
II.7.3	Elandsberg (S32)
II.7.4	Cape of Good Hope (S33)
II.7.5	Nieuwoudtville (S45)
II.8	References

Volume 2 Patterns and processes at regional scale

Part III Patterns and processes at regional scale

III.1	Reconstruction of historical changes
III.1.1	Climate history of Namibia and western South Africa
III.1.2	Landscape and vegetation change in Namibia since 1876 based on the photographs of the Palgrave Commission 6
III.1.3	An analysis of 20th century vegetation change in Namaqualand using repeat photography
III.2.	Large-scale patterns and dynamics
III.2.1	Regional climatological patterns and their simulated change
III.2.2	Spatial patterns of topography in southern Africa
III.2.3	Large-scale vegetation assessments in southern Africa: concepts and applications using multi-source
	remote sensing data
III.2.4	Towards a user-friendly vegetation map of Namibia: ground truthing approach to vegetation mapping
III.2.5	Diversity and endemism of true bugs (Heteroptera) in the arid biomes of south-western Africa
III.2.6	Dragonfly diversity from the Cape to the Kavango
III.2.7	The relevance of perennial springs for regional biodiversity and conservation
III.3.	Patterns and dynamics along the BIOTA transects
III.3.1	Surface climate and its simulated change along the BIOTA transects
III.3.2	Elevation profile along transects
III.3.3	Soils along the BIOTA transects
III.3.4	Biological soil crusts along the BIOTA Southern Africa transects
III.3.5	Patterns of soil lichen diversity along the BIOTA transects in relation to climate and soil features
III.3.6	Changing patterns of lichen growth form distributions within the lichen fields of the Central Namib 107
III.3.7	Lichen distribution along an ocean-inland transect in the fog zone of the Central Namib 112
III.3.8	Patterns and dynamics of vascular plant diversity along the BIOTA transects in southern Africa 118
III.3.9	Life forms along the BIOTA transects—new perspectives on biomes in southern Africa
III.3.10	Using the MODIS Enhanced Vegetation Index (EVI) for BIOTA transect analyses
III.3.11	Basic patterns of Lepidoptera diversity in Namibia
III.4.	Case studies on biodiversity patterns
III.4.1	Mapping of biological soil crusts in the Succulent Karoo using hyperspectral remote sensing data
III.4.2	Snail shells as shelters for arthropods in the sand dunes of the Namaqualand Sandveld
	(Northern Cape Province, South Africa) 163
III.4.3	Dispersal strategies of desert inhabiting dragonflies—comparative population genetic study of
	five widely distributed species
III.4.4	Reptile diversity in savanna rangelands at a regional scale
III.4.5	Coloniality of birds in the Kalahari-spatial distribution of trees and nests of the
	Sociable Weaver (Philetairus socius) 179
III.4.6	Shrub pattern affects reproductive success in the Yellow Mongoose (<i>Cynictis penicillata</i>) 184

III.5.	Human	impacts of	n biodiversity

III.5.1	Biodiversity conservation under Namibian environmental law	. 190
III.5.2	Traditional and modern use of biodiversity—customary law and its potential to protect biodiversity	. 195
III.5.3	Economic and ecological indicators of land reform projects in eastern Namibia	. 200
III.5.4	Evaluation of the soil degradation state along fence-line contrasts	. 207
III.5.5	Impact of landuse at landscape scale, using fenceline contrasts and a best-practice case study	. 214
III.5.6	Plant functional traits and types as a tool to analyse landuse impacts on vegetation	. 222
III.5.7	The impact of grazing on pollinators and pollination	. 233
III.5.8	Overgrazing favours desert species-differences in arthropod and small mammal communities	
	of the twin sites Gellap Ost and Nabaos	. 239

III.6 Expanding knowledge through experiments

III.6.1	Responses of dwarf succulent plants, lichens, and soils to experimental climate warming in an arid	
	South African ecosystem	. 246
III.6.2	Exclosures and experimental grazing plots at the BIOTA Observatories Narais and Duruchaus	. 251
III.6.3	Restoration of a gully system in the Highland Savanna of Namibia	. 255
III.6.4	The effectiveness of sucrose applications as a restoration aid in transformed lowland fynbos ecosystems	. 260
III.6.5	Understanding norms and propensities for cooperation and collective action: economic experiments within BIOTA	265
III.7	Expanding knowledge through models	
III.7.1	The role of models in biodiversity observation schemes	
III.7.2	Modelling vegetation change in arid and semi-arid savannas	
III.7.3	Modelling animal responses to changes in climate and landuse	. 283
III.7.4	A spatially explicit model for interacting populations of dragonflies in arid Namibia	. 289
III.7.5	Bio-economic modelling in BIOTA Southern Africa: approaches developed, empirical foundation, results,	
	and lessons learnt	. 295
III.7.6	Model-based simulation tools	. 302
III.8	Stakeholder interactions and capacity development	
III.8.1	BIOTA's strategies for stakeholder interaction and capacity development	. 308

111.0.1	Dio 1715 stategies for stateholder interaction and capacity development	500
III.8.2	Learning from each other: participatory research with landusers on management applications	311
III.8.3	The BIOTA para-ecologist programme—towards capacity development and knowledge exchange	319
III.8.4	Film making as an instrument of research communication and capacity development	326
III.8.5	Recommendations and decision support for local to national level decision makers	332
III.8.6	Data access and availability: BIOTA data facility	337
III.8.7	Lessons learnt from interdisciplinary participatory research in the BIOTA project	343

Volume 3 Implications for landuse and management

Part IV Implications for landuse and management

IV.1	Causes and perspectives of land-cover change through expanding cultivation in Kavango	
IV.1.1	Introduction	. 2
IV.1.2	Research site, setting, and methodologies	. 3
IV.1.3	The status quo of the cultivation system	. 6
IV.1.4	The dynamics of expanding cultivation	. 7
IV.1.5	Biodiversity status quo and potentials	. 8
IV.1.6	Human aspects of cultivation within the farming system	16
IV.1.7	The role of statutory and customary law in governing the cultivation of land	22
IV.1.8	Summarising results	24
IV.1.9	Discussion and steps forward	27
IV.2	Impacts of landuse and climate change on the dynamics and biodiversity in the Thornbush Savanna Biome	
IV.2.1	Introduction: current knowledge and key challenges	34
IV.2.2	"When is a Change a Change?"	35
IV.2.3	Eco-hydrology of Thornbush Savanna	38
IV.2.4	Vegetation pattern and biodiversity dynamics	44
IV.2.5	Risk assessments	54
IV.2.6	Integrated socio-economic and ecological research	63
IV.2.7	Recommendation for landusers and conservation planners	65
IV.2.8	Future research needs	70
IV.3	An ecological-economic analysis of the pastoral systems of the Nama Karoo in southern Namibia	
IV.3.1	Introduction	76
IV.3.2	Rehoboth area: dynamics of small-scale commercial pastoral systems	
IV.3.3	Keetmanshoop region: socio-economic analysis of large commercial ranching systems of south-central Namibia	84
IV.3.4	Namaland: drivers of landuse in communal pastoralism	92
IV.3.5	Rangeland-landuse interactions and suggestions for the management of pastoral systems in the Namibian	
	Nama Karoo 1	.04

IV.4	4 Environmental and socio-economic patterns and processes in the Succulent Karoo—		
	frame conditions for the management of this biodiversity hotspot		
IV.4.1	Introduction	111	
IV.4.2	Interdependence of soils and vascular plant vegetation in the Succulent Karoo	114	
IV.4.3	Old field succession in the Namaqua National Park, Succulent Karoo, South Africa	119	
IV.4.4	Restoring degraded rangelands in the Succulent Karoo: lessons learnt from four trials	122	
IV.4.5	Land management in the biodiversity hotspot of the Succulent Karoo. A case study from		
	Soebatsfontein, South Africa	133	
IV.4.6	Conclusions and further research needs	154	
IV.5	Keeping the Cape Lowland archipelago afloat		
IV.5.1	Introduction	153	
IV.5.2	Diversity disrupted	158	
IV.5.3	Processes disrupted	168	
IV.5.4	How to deal with fragmentation and its effects-management and intervention	170	

Part V Indices

V.1	Abbreviations	82
V.2	List of scientific names	84
V.3	Biosketches of authors and editors	09