

Contents

Preface

Section I Fundamental and Empirical Foundations

I.1	Ecosystems as Complex Systems <i>S. E. Jørgensen and F. Müller</i>	5
I.2	Ecosystem Structure <i>F. Golley</i>	21
I.3	Ecosystems as Functional Entities <i>F. Müller and W. Windhorst</i>	33
I.4	Uncertainty in Ecology and Ecological Modelling <i>B. Breckling and Q. Dong</i>	51
I.5	Fundamentals of Ecosystem Theory from General Systems Analysis <i>A. Gnauck</i>	75
I.6.1	Ecosystem Research <i>O. Fränzle</i>	89
I.6.2	Ecological Modelling: Systems Analysis and Simulation <i>W. Grant, E.K. Pedersen and S.L. Marin</i>	103

Section II Different Approaches in Recent Ecosystem Theory

II.1.1	A General Outline of Thermodynamic Approaches to Ecosystem Theory <i>S.E. Jørgensen</i>	113
II.1.2	Ecosystems as Self-Organising Holarchic Open Systems: Narratives and the Second Law of Thermodynamics <i>J. Kay</i>	135
II.1.3	The Tentative Fourth Law of Thermodynamics <i>S.E. Jørgensen</i>	161
II.2.1	Ecosystems as Subjects of Self-Organising Processes <i>F. Müller and S.N. Nielsen</i>	177
II.2.2	Emergent Properties of Ecosystems <i>S.N. Nielsen and F. Müller</i>	195
II.3	Ecosystems as Information Systems <i>S.N. Nielsen</i>	217
II.4	Ecosystems as Cybernetic Systems <i>S.E. Jørgensen and M. Straskraba</i>	249
II.5	Ecosystems as Hierarchical Systems <i>S. Hári and F. Müller</i>	265
II.6	Ecosystems as Energetic Systems <i>H.T. Odum, M.T. Brown and S. Ulgiati</i>	281
II.7.1	Ascendancy: A Measure of Ecosystem Performance <i>R.E. Ulanowicz</i>	303
II.7.2	Ecosystems as Dynamic Networks <i>C. Pahl-Wostl</i>	317

II.7.3 Ecosystem Theory: Network Environ Analysis <i>B.D. Fath and B.C. Patten</i>	345
II.8.1 Stability Concepts in Ecology <i>Y. Svirezhev</i>	361
II.8.2 Resilience in Ecological Systems <i>L.H. Gunderson, C.S. Holling and G.D. Peterson</i>	385
II.8.3 Continuity and Discontinuity in Ecological Systems <i>G. Bendoricchio</i>	395
II.8.4 Ecosystems as Chaotic Systems <i>S.E. Jørgensen</i>	411
II.8.5 Ecosystems as States of Ecological Successions <i>K. Dierssen</i>	427
II.9 Ecosystems on the Landscape: The Role of Space in Ecosystem Theory <i>R.V. O'Neill</i>	447
II.10 Towards a Unifying Theory <i>S.E. Jørgensen and F. Müller</i>	465
Section III Application of Ecosystem Theoretical Aspects	
III.1.1 Conservation Biology <i>K. Dierssen</i>	475
III.1.2 Applications of Ecological Theory and Modelling to Assess Ecosystem Health <i>D. Rapport and R. Moll</i>	487
III.1.3 Hedging Our Bets: The Utility of Ecological Integrity <i>J. Barkmann and W. Windhorst</i>	497
III.1.4 Sustainability: Application of Systems Theoretical Aspects to Societal Development <i>H. Bossel</i>	519
III.1.5 Ecological Engineering <i>S. Jørgensen and W. Mitsch</i>	537
III.1.6 Ecosystem and Economic Theories in Ecological Economics <i>R. Costanza, C. Cleveland and C. Perrings</i>	547
III.2 Ecological Orientors: A Path to Environmental Applications of Ecosystem Theories <i>F. Müller and S.E. Jørgensen</i>	561
Index	577