CONTENTS

PREFACE xiii
CONTRIBUTORS xvii

Section 1 HISTORY AND DEFINITIONS OF ECOSYSTEM ENGINEERING

1 • ON THE PURPOSE, MEANING, AND USAGE OF THE PHYSICAL ECOSYSTEM ENGINEERING CONCEPT 3

Clive G. Jones and Jorge L. Gutiérrez

1.1 Introduction 3
1.2 On the Definition 5
1.3 On Process Ubiquity 12
1.4 On Effect Magnitude and Significance 13
1.5 On Usage 15
1.6 On Breadth and Utility 17
1.7 On the Underlying Perspective 18
1.8 A Concluding Remark on Concept and Theory 19
Acknowledgments 19
References 20

2 • A HISTORICAL PERSPECTIVE ON ECOSYSTEM ENGINEERING 25

Natalie Buchman, Kim Cuddington, and John Lambrinos

2.1 Introduction 25
2.2 Soil and Sediment Processes 27
2.3 Succession 31
2.4 Microclimate Modification, Facilitation, and Inhibition 32
2.5 Habitat Creation 34
2.6 Conclusion 36
References 37
3 - A NEW SPIRIT AND CONCEPT FOR ECOSYSTEM ENGINEERING? 47

William G. Wilson

3.1 Introduction 47
3.2 A Short Historical Perspective 49
3.3 A Connection with Keystone Species? 54
3.4 A Unique Feature for Ecosystem Engineering? 59
3.5 A Selective Argument for Ecosystem Engineering? 62
3.6 Discussion 64
Acknowledgments 66
References 66

4 - ECOSYSTEM ENGINEERING: UTILITY, CONTENTION, AND PROGRESS 69

Kim Cuddington

Section II  EXAMPLES AND APPLICATIONS

5 - EARTHWORMS AS KEY ACTORS IN SELF-ORGANIZED SOIL SYSTEMS 77

Patrick Lavelle, Sebastien Barot, Manuel Blouin, Thibaud Decaëns, Juan José Jimenez, and Pascal Jouquet

5.1 Introduction 77
5.2 Adaptation of Earthworms and Other Organisms to Soil Constraints: The Power of Mutualism 79
5.3 The Drilosphere as a Self-Organizing System 82
5.4 Harnessing the Drilosphere to Restore Ecosystem Functions in Degraded Soils 96
5.5 Conclusion 98
References 100

6 - MICROHABITAT MANIPULATION: ECOSYSTEM ENGINEERING BY SHELTER-BUILDING INSECTS 107

John T. Lill and Robert J. Marquis

6.1 Introduction 107
6.2 Shelters and Shelter-Builders 108
10 • LESSONS FROM DISPARATE ECOSYSTEM ENGINEERS 203

James E. Byers

Section III  THEORIES AND MODELS

11 • COMMUNITY RESPONSES TO ENVIRONMENTAL CHANGE: RESULTS OF LOTKA-VOLTERRA COMMUNITY THEORY 211

William G. Wilson and Justin P. Wright

11.1 Introduction 211
11.2 Lotka-Volterra Community Model 213
11.3 Discussion 222
Acknowledgments 225
References 225

12 • MODEL STUDIES OF ECOSYSTEM ENGINEERING IN PLANT COMMUNITIES 229

Ehud Meron, Erez Gilad, Jost von Hardenberg, Antonello Provenzale, and Moshe Shachak

12.1 Introduction 229
12.2 A Mathematical Model for Plant Communities in Drylands 231
12.3 Ecosystem Engineering in the Model 236
12.4 Applying the Model to Woody-Herbaceous Systems 240
12.5 Concluding Remarks 247
Acknowledgments 248
References 248

13 • BALANCING THE ENGINEER–ENVIRONMENT EQUATION: THE CURRENT LEGACY 253

Kim Cuddington and Alan Hastings

13.1 Introduction 253
13.2 Population Models of Ecosystem Engineers: The Simplest Cases 255
13.3 Population Models: Spatially Explicit and Mechanistically Detailed Cases 259
13.4 Population Models: Cases with an Evolutionary Focus 262
13.5 Community and Ecosystem Models 263
13.6 Conclusions 267
References 271

14 • SYNTHESIS OF ECOSYSTEM ENGINEERING THEORY 275
William G. Wilson

Section IV  SOCIO-ECONOMIC ISSUES AND MANAGEMENT SOLUTIONS

15 • RESTORING OYSTER REEFS TO RECOVER ECOSYSTEM SERVICES 281
Jonathan H. Grabowski and Charles H. Peterson
15.1 Introduction 281
15.2 Evaluating Ecosystem Services Provided by Oyster Reefs 283
15.3 Challenges and Conclusions 293
References 294

16 • MANAGING INVASIVE ECOSYSTEM ENGINEERS: THE CASE OF SPARTINA IN PACIFIC ESTUARIES 299
John G. Lambrinos
16.1 Introduction 299
16.2 Spartina Invasion in Willapa Bay 300
16.3 Difficulties Predicting Spread 301
16.4 Invasion Impact Mechanisms 302
16.5 Choice of Control Studies 306
16.6 Alternative Restoration Trajectories 309
16.7 Collateral Impacts of Control 314
16.8 Recommendations 316
References 317
20 MANAGEMENT AND ECOSYSTEM ENGINEERS: CURRENT KNOWLEDGE AND FUTURE CHALLENGES 387

Alan Hastings

20.1 Introduction 387
20.2 Effects and Impacts of Single Engineering Species 388
20.3 Effects and Impacts of Engineers in the Context of Ecosystems 389
20.4 Conclusions and Further Directions 391

References 393

INDEX 395