Contents

Preface *page* xi

1 Soil and Its Fauna **1**
1.1 A Brief History of Soil Fauna Ecology As a Field of Research 4
1.2 Soil As a Habitat 9
1.3 The Major Players 14
1.4 Summary 41

2 Functional Roles of Soil Fauna **42**
2.1 Ecosystem Functioning 43
2.2 Aboveground–Belowground Linkages 74
2.3 Plant–Soil Feedbacks 78
2.4 Soil Biodiversity and Ecosystem Functioning 80
2.5 Summary 85

3 Approaches to Studying Soil Fauna and Its Functional Roles **86**
3.1 Quantifying Soil Fauna 87
3.2 Diversity, Distribution, and Phylogeny 94
3.3 Soil Fauna Functional Traits 97
3.4 Contributions to Ecosystem Processes 101
3.5 Soil Fauna As Bioindicators 110
3.6 Statistical Tools 114
3.7 Summary 119

4 Soil Fauna Biogeography and Macroecology **121**
4.1 Biogeographical Patterns 122
4.2 Species-Area Relationship 135
4.3 Distance-Decay Relationships 137
4.4 Latitudinal Gradients 139
4.5 Altitudinal Gradients 144

4.6 Regional versus Local Species Richness 148
4.7 Distribution of Rare versus Abundant Species 149
4.8 Summary 150

5 Soil Fauna Assemblages at Fine Scales to Landscapes 152
5.1 Landscape to Continental Scales 152
5.2 Ecosystem Scales 160
5.3 Fine-Scale Patterns of Biodiversity 175
5.4 Summary 190

6 Anthropogenic Impacts on Soil Fauna Assemblages 192
6.1 Management Practices 193
6.2 Fertilisation and Nitrogen Deposition 203
6.3 Agrochemicals and Other Pollutants 206
6.4 Impacts of Invasive Species 210
6.5 Summary 220

7 Climate Change Impacts on Soil Fauna 221
7.1 Elevated CO_2 222
7.2 Warming 226
7.3 Altered Rainfall Regimes 233
7.4 Elevated O_3 239
7.5 Global Change Interactions 241
7.6 Summary 245

8 Soil Fauna Assemblage Succession and Restoration 246
8.1 Successional Patterns of Soil Fauna Assemblage Structure 247
8.2 Belowground Effects of Restoration Practices 254
8.3 Potential for Soil Fauna to Aid Remediation of Degraded Sites 260
8.4 Implications for Ecosystem Resistance and Resilience 265
8.5 Summary 266

9 The Future of Soil Fauna Assemblages **268**
9.1 The Future of Soil Fauna Assemblages 270
9.2 Managing Soil Fauna Biodiversity 272
9.3 Harnessing Soil Biodiversity for Sustainable Land Use and Human Well-Being 278
9.4 Critical Knowledge Gaps and Research Directions 284
9.5 Summary 290

Bibliography 291
Index 351