

C O N T E N T S

Preface

*Fernando Valladares, Antonio Camacho, Arturo Elosegı, Carlos Gracia,
Marta Estrada, Joan Carles Senar and Josep Maria Gili*..... 17

1. A human and Scientific Portrait of Ramon Margalef (1919-2004)

Carlos Gracia 21

2. Transients and the Dynamics of Ecological Systems

Alan Hastings

2.1. Introduction 39

2.2. Dynamics in ecological systems 40

2.3. Role of stability 41

2.4. Explicit consideration of dynamics 43

2.5. Transient dynamics 45

2.5.1. Spatial systems 46

2.5.2. Multiple species 48

2.5.3. A specific example of transients in *Tribolium* in both
lab and model 50

2.6. Conclusions 50

Acknowledgments 52

References 52

3. Climate and Disturbances Affecting Rivers: From Microbes to Ecosystems

Sergi Sabater

3.1. Introduction: climate and disturbances shape structure
and functioning of river ecosystems 55

3.2. River systems in the context of the global water fluxes 59

3.3. Disturbances at different temporal and spatial scales:	
the response of organisms	63
3.3.1. Scales in river systems	63
3.3.2. Spatial scales operating in microbial organisms in rivers:	
from habitat to reach	65
3.3.3. Short-term vs. long-term disturbances on rivers:	
effects on ecosystem functioning	68
3.4. Conclusions	74
3.5. Summary	75
Acknowledgments	76
References	76
4. From Phosphorus and VOCs to Biodiversity:	
Some Studies on the Effects of Global Change Inspired	
by Margalef's Legacy	
<i>Josep Peñuelas, Alistair Jump, Jordi Sardans, Iolanda Filella, Marc Estiarte,</i>	
<i>Romà Ogaya, Joan Llusà, Sue Owen and Francisco Lloret</i>	
4.1. Introduction	83
4.2. Phosphorus limitation	83
4.3. Secondary compounds that are rich in carbon	85
4.4. Volatile organic compounds	87
4.5. Climate change	87
4.6. Other components of global change	90
4.7. Changes in land use: fragmentation	90
Acknowledgments	93
References	93
5. The Ecology of Environmental Changes:	
A Palaeolimnological Perspective	
<i>Jordi Catalán</i>	
5.1. Introduction	95
5.1.1. Global Change: a challenge for ecology as a science	95
5.1.2. Global Change: a polyhedric amalgam	98
5.1.3. Lakes as records of environmental information	102
5.2. A vision of global change from the perspective	
of palaeolimnology	104
5.2.1. Incipient responses to climate change	104
5.2.2. Timescales of the response	105

5.2.3. Regional coherence of ecosystem dynamics	107
5.2.4. Abrupt climate changes	107
5.2.5. Advantages and limitations of space for time analogies	109
5.2.6. Interdependence between biogeochemistry and ecodemography	111
5.2.7. Interference between different components of global change	113
5.3. Conclusions	114
Acknowledgments	115
References	116

6. Quantifying and Testing Species Coexistence Mechanisms

Peter Chesson

6.1. Introduction	119
6.2. Stable coexistence mechanisms, and their quantification	121
6.2.1. Measuring recovery from low density	122
6.2.2. Quantifying coexistence	124
6.3. Partitioning the growth rate into contributions from different mechanisms	128
6.4. Expressing mechanism contributions in terms of functional components	132
6.4.1. The storage effect	132
6.4.2. Relative nonlinearity of competition	146
6.4.3. Fitness-density covariance	150
6.5. The community average approach	151
6.6. How these measures can be used for hypothesis testing	155
6.6.1. Testing the storage effect	155
6.6.2. Testing mechanisms in combination: the recruitment variation hypothesis	157
6.7. Discussion	160
Acknowledgments	161
References	161

7. Neutral Theory and Community Ecology

Jerome Chave

7.1. Introduction	165
7.2. Statistical models of species abundance	167

7.3. The emergence of neutrality	170
7.3.1. Models in population genetics before the molecular era	170
7.3.2. Neutral models of molecular evolution	173
7.3.3. Statistical inference	174
7.4. Neutrality in community ecology	176
7.4.1. Emergence in the 70s: Watterson, Caswell, and Hubbell	176
7.4.2. Critiques of Hubbell's 1979 model	178
7.4.3. Regional species pools and dispersal limitation	179
7.5. Testing the predictions of the neutral theory	182
7.6. Discussion	185
7.7. Summary	187
Acknowledgments	187
References	188

8. Explorations on Phytoplankton Diversity. An Appreciation of Ramon Margalef's Contributions

Marta Estrada

8.1. Introduction	191
8.2. Diversity and information theory	192
8.3. Diversity and stability	198
8.4. The diversity-stability debates	200
8.5. Diversity and biodiversity	201
8.6. Hydrodynamics and phytoplankton diversity	204
8.7. Diversity and productivity	206
8.8. Measurements in phytoplankton communities.	
An example from the NW Mediterranean	207
8.9. Technological perspectives	215
8.10. Concluding remarks	216
8.11. Summary	217
Acknowledgments	218
References	218

9. Mechanisms of Ecological Control over Time: Evidence from Coastal Ecosystems

Ivan Valiela and Sophia E. Fox

9.1. Introduction	223
9.2. A long-lived odyssey: diversity and its role	223
9.3. Another ecological controversy: top-down or bottom-up control?	232

Acknowledgments	241
References	242

10. Conservation of Plant Populations. Myths and Paradigms

José María Iriondo, Adrián Escudero and María José Albert

10.1. Introduction	247
10.2. Rarity and extinction	249
10.3. Genetic diversity and extinction	253
10.4. Reproductive failure and extinction	256
10.5. Population size and extinction	258
10.6. The clash of paradigms	260
10.7. Conclusions	264
References	265

11. Conservation Biology: Why Conserve Species?

José Luis Tellería

11.1. Introduction	269
11.2. A historical viewpoint	270
11.3. Approaches to conservation	271
11.4. Coarse-grain approach to conservation	273
11.5. Management indicators	274
11.6. Fine-grain conservation	275
11.7. Are all species necessary?	276
11.8. The ecological role of species	277
11.9. Singular and redundant species	279
11.10. Instrumental utility of species	281
11.11. In search of a pragmatic synthesis: landscape ecology	283
11.12. The territory as the unit of conservation management	284
11.13. Why conserve species?	286
Acknowledgments	288
References	288

12. To Be or not to Be (Seen); That is the Question. Crypsis, Aposematism and Mimicry in an Ecological and Evolutionary Context

Joandomènec Ros

12.1. Introduction	291
12.2. My doctoral thesis	292

12.3. What's new on adaptive colouration in opisthobranchs	
and its basis	299
12.3.1. Chemical defences of opisthobranchs	299
12.3.2. Universal nature of synaposematic circles	302
12.3.3. Parasymbiosis in sacoglossans	302
12.3.4. Parallelism between chemical and morphological	
evolution	306
12.4. Making the subjective more objective	307
12.5. Summary	309
Acknowledgments	310
References	310

13. Some Contributions of Capture-Recapture to Evolutionary Ecology and Population Modeling

Michael J. Conroy

13.1. Introduction	315
13.2. Historical advances	316
13.2.1. Separation of encounter from survival and	
other parameters the CJS model	316
13.2.2. Use of multiple alternative hypotheses and	
information theory	319
13.3. Recent advances	320
13.3.1. Modeling of environmental and individual	
covariates	320
13.3.2. Modeling of heterogeneity via random effects	326
13.3.3. Modeling of movement and state transition	326
13.3.4. Modeling the components of population growth	332
13.4. Extension of CR to modeling community dynamics	337
13.5. Other advances	339
13.5.1. Computer software	339
13.5.2. Bayesian modeling of random and hierarchical	
effects	340
13.5.3. Integrated parameter modeling	342
13.5.4. Innovative marking and recapture	342
13.5.5. Occupancy models	343
13.6. Summary	344
Acknowledgments	345
References	346

14. The Role of Behaviour in Ecology: Natural Selection on Individual Strategies and their Effects on Ecological Systems	
<i>Juan Carranza</i>	
14.1. What insight can ecology obtain by being <i>behavioural</i>	349
14.2. Behavioural ecology and modern ethology	351
14.3. Individual-behaviour approaches with ecological consequences	353
14.3.1. Levels of selection	353
14.3.2. Economic decisions of individuals	357
14.3.3. Game theory	360
14.3.4. Reproductive strategies and sexual selection	363
14.4. From ecosystem, physical approach to evolutionary approach	365
14.5. Summary	367
References	367
15. The Network Approach in Ecology	
<i>Miguel A. Fortuna and Jordi Bascompte</i>	
15.1. Introduction	371
15.1.1. Networks as complex systems	371
15.1.2. Network structure and implications for its dynamics	373
15.2. Insight from ecological networks	375
15.2.1. Food webs	376
15.2.2. Plant-animal mutualistic networks	379
15.2.3. Spatial networks	383
15.3. Unity in diversity: towards ecological networks	385
Acknowledgments	388
References	390
16. Internalization of Vertical Transport in Ecosystems: The Xylem of Woody Plants	
<i>Josep Piñol, Jordi Martínez-Vilalta, Lasse Loepfe and Maurizio Mencuccini</i>	
16.1. Introduction	393
16.2. Trees and vertical transport in ecosystems	394
16.3. The structure of the xylem	396
16.4. The ascent of sap and the cohesion-tension theory	398

16.5. Xylem embolism and the limits of the cohesion-tension mechanism	401
16.6. Ecological implications of xylem embolism	405
16.6.1. Case 1: drought resistance in conifers from Montana, USA.....	407
16.6.2. Case 2: embolism and drought resistance in <i>Quercus ilex</i> and <i>Phillyrea latifolia</i>	408
16.6.3. Case 3: drought resistance in <i>Pinus sylvestris</i>	409
16.7. The xylem as a complex network	412
16.8. The scaling of xylem transport: back to the ecosystem	416
16.9. Concluding remarks and prospects for future research	420
Acknowledgments	422
References	423

17. Toward an Ecosystem Theory

Sven Erik Jørgensen

17.1. Why an ecosystem theory?	427
17.2. The basic scientific results and ideas behind the presented ecosystem theory	429
17.3. The thermodynamic concept of eco-exergy	432
17.4. A tentative ecosystem theory consisting of ten basic laws	438
17.5. Discussion of the presented ecosystem theory	446
References	447

18. An Ecological Synthesis: Something Old, Something New

Manuel C. Molles

18.1. Introduction	449
18.2. The subdivisions of ecology	451
18.3. Something old: storytelling	453
18.4. How to tell the tale	456
18.5. Something new: digital storytelling	459
18.6. Promising signs	460
18.7. Summary	460
Acknowledgments	461
References	462

19. Unity in Diversity or Which Way Ecology?	
<i>Fernando Valladares, Antonio Camacho, Arturo Elosegı</i>	
<i>and Marta Estrada</i>	463
19.1. Integrating concepts and ecological theory	465
19.2. Methodological approaches	468
19.3. Ecology and environmental problems	470
19.4. And now what?	473
Acknowledgments	475
References	476
List of Figures and Photos	479
List of Tables	487
Index	489
About the Authors	497