Contents

Introduction viii

1. Starting to look at communities 1

1.1 A scientific approach 1
1.2 The topics of community ecology 2
1.3 Getting data – using a spreadsheet 4
1.4 Aims and hypotheses 5
1.5 Summary 5
1.6 Exercises 7

2. Software tools for community ecology 8

2.1 Excel 8
2.2 Other spreadsheets 9
2.3 The R program 10
2.4 Summary 15
2.5 Exercises 15

3. Recording your data 16

3.1 Biological data 16
3.2 Arranging your data 18
3.3 Summary 19
3.4 Exercises 19

4. Beginning data exploration: using software tools 20

4.1 Beginning to use R 20
4.2 Manipulating data in a spreadsheet 28
4.3 Getting data from Excel into R 60
4.4 Summary 62
4.5 Exercises 63

5. Exploring data: choosing your analytical method 64

5.1 Categories of study 64
5.2 How 'classic' hypothesis testing can be used in community studies 66

5.3 Analytical methods for community studies 70
5.4 Summary 73
5.5 Exercises 74

6. Exploring data: getting insights 75

6.1 Error checking 75
6.2 Adding extra information 78
6.3 Getting an overview of your data 80
6.4 Summary 104
6.5 Exercises 105

7. Diversity: species richness 106

7.1 Comparing species richness 108
7.2 Correlating species richness over time or against an environmental variable 119
7.3 Species richness and sampling effort 123
7.4 Summary 148
7.5 Exercises 149

8. Diversity: indices 151

8.1 Simpson's index 151
8.2 Shannon index 160
8.3 Other diversity indices 168
8.4 Summary 194
8.5 Exercises 195

9. Diversity: comparing 196

9.1 Graphical comparison of diversity profiles 197
9.2 A test for differences in diversity based on the *t*-test 199
9.3 Graphical summary of the *t*-test for Shannon and Simpson indices 212
9.4 Bootstrap comparisons for unreplicated samples 227
9.5 Comparisons using replicated samples 252
9.6 Summary 269
9.7 Exercises 270

10. Diversity: sampling scale 272

10.1 Calculating *beta* diversity 272
10.2 Additive diversity partitioning 299
10.3 Hierarchical partitioning 303
10.4 Group dispersion 306
10.5 Permutation methods 309
10.6 Overlap and similarity 315
10.7 *Beta* diversity using alternative dissimilarity measures 325
10.8 *Beta* diversity compared to other variables 327
10.9 Summary 331
10.10 Exercises 333

11. Rank abundance or dominance models 334

11.1 Dominance models 334
11.2 Fisher's log-series 358
11.3 Preston's lognormal model 360
11.4 Summary 363
11.5 Exercises 365

12. Similarity and cluster analysis 366

12.1 Similarity and dissimilarity 366
12.2 Cluster analysis 382
12.3 Summary 416
12.4 Exercises 418

13. Association analysis: identifying communities 419

13.1 Area approach to identifying communities 420
13.2 Transect approach to identifying communities 428
13.3 Using alternative dissimilarity measures for identifying communities 431
13.4 Indicator species 436
13.5 Summary 444
13.6 Exercises 445

14. Ordination 446

14.1 Methods of ordination 447
14.2 Indirect gradient analysis 449
14.3 Direct gradient analysis 490
14.4 Using ordination results 505
14.5 Summary 520
14.6 Exercises 522

Appendices 524
Bibliography 542
Index 547