

## Index

Page references to figures appear in *italic* type and those for tables appear in **bold** type.

- abiotic heterogeneity, 2, 53–69, 54, 149, 238, 379–88, 394
- Abutilon theophrasti*, 118, 119, 120–5, 120, 126–7
- acclimation, rain forest gaps, 146–9
- Acer rubrum*, 160–2, 161
- adaptive speciation, 181–2, 203–8, 204, 205
- Adenocaulon bicolor*, 134, 135
- aerial photographs, 324
- agent control, 41–3
- agents of heterogeneity, 33–7, 35, 42, 49
- agricultural practices, 6–7
  - see also* deforestation
- Agropyron cristatum*, 58, 59
- Agropyron desertorum*, 78–9, 83
- Agropyron repens*, 58–8, 58
- Ajuga reptans*, 76–7, 76
- algal mats, 303, 304, 310
- Allee effect, 317, 320–1, 327
- Allenby's gerbil (*Gerbillus allenbyi*), 185, 189, 191
- allogenic processes, 41, 43, 417
- allozymes, 268
- Alocasia macrorrhiza*, 133, 134, 136, **137**, 142, 144–5, 145
- ammonium, soil concentration, 72
- amphibians, 343, 347, **349**
- analytical models, flowering patterns, 250–4, 256
- animals
  - adaptive speciation, 181–2, 203–8, 204, 205
  - body size, 407
  - diet selection, 194, 196, 202
  - environment alteration, 16
  - foraging ecology, 181–214, 386
    - harvest rate, 190–7
    - patch use, 184, 189–94
  - fragmentation survival, 337
  - habitat selection, 181–2, 184–9, 194
    - adaptive speciation, 203–8, 204, 205
  - reintroduction, 350
  - species coexistence, 181–2, 199–202
  - annual plants, dispersal and colonization, 239–40
  - antheraxanthin conversion, 140–3, 141, 142
  - Aphanes microcarpa*, 242
  - Apodemus sylvaticus*, 364, 365–8, 365, 366, 367, 370–1
  - aquatic insects
    - predators, 302, 303–7, 308
  - resource sheds, 296–7, 300–10, 301, 302, 304
  - aquatic insect resources, 303, 304, 310
  - aquatic systems, population dynamics, 163, 164
  - Arabidopsis thaliana*, 77, 137
  - arable farmland landscape, 6–7, 357–75
  - arbitrage, 183–8
  - Arenaria serpyllifolia*, 242
  - arid environment, 16–17
  - Arizona pocket mouse (*Perognathus amplus*), 195, 202
  - Artemisia tridentata*, 78–9, 83
  - arthropod predators, 166, 167–8, 170, 171
  - aspen trees, 54–5, 62–3, 62, 65
  - Auchenorrhyncha, 372–5, 374
  - Australia
    - patterned heterogeneity, 16–17
    - sunflecks, 132, 133, 134, 136, **137**, 142–3, 142
    - autogenic processes, 41, 417
    - avian predators, 167–71, 170
  - barley (*Hordeum vulgare*), 74–5, 75
  - barn owls (*Tyto alba*), 185
  - Bayesian foragers, 193–4
  - beavers, dam building, 41–2, 46, 418
  - beetles, farmland conservation, 360
  - behavioural mechanisms, 24
    - host–parasitoid interactions, 215–21, 229–31
  - bet-hedging strategy, 184, 244
  - Betula papyrifera*, 160–2, 161, 297, 299
  - biodiversity *see* diversity
  - biogenic heterogeneity, 53, 54, 57–61, 65
  - Biological Dynamics of Forest Fragments Project (BDFP), 334–5, **335**
  - biotic heterogeneity, 3–5, 61–5, 149, 238
  - birch (*Betula papyrifera*), 160–2, 161, 297, 299
  - birds
    - farmland conservation, 358, 402–3, 403
    - Singapore and Hong Kong, 342–3, 346, **349**
  - black ash (*Fraxinus nigra*), 160–2, 161
  - blackfly larvae, carbon sheds, 296–7, 298
  - Blepharicerid larvae (Diptera), carbon sheds, 296–7, 296
  - Bombacopsis quinata*, 281–2
  - Boselaphus tragocamelus*, 199
  - boundary function, 43–6, 49
  - Bowhead whales, carbon sheds, 298
  - Brazil, 334, 337

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- butterflies
  - extinction prediction, 323, 327–8
  - farmland conservation, 359–62, 361, 372, 372
  - Singapore and Hong Kong, 344, 347, **349**
- <sup>12</sup>C, algae uptake, 297
- <sup>13</sup>C, resource shed tracer, 297–9, 305
- <sup>14</sup>C, resource shed tracer, 294–9
- Calluna vulgaris*, 64
- canopies
  - gap creation, 133, 145–9
  - soil seed banks, 392–3
  - species survival, 337
- carbon gain
  - photosynthetic induction, 135
  - sunfleck effects, 133
- carbon sheds
  - forest trees, 297–8, 299–300
  - migratory whales, 298
  - stream-dwelling insects, 296–7, 296
- Carex bigelowii*, 85
- Carlina vulgaris*, 245, 249–50, 249, 250
- Castanospora alphandii*, 134, 136, **137**, 142, 142
- categorical maps, 13
- cattle, grazing patterns, 385, 386–7
- Cavanillesia platanifolia*, 270
- cellular automata, plants, 87
- Cerastium diffusum*, 242
- Cerastium glomeratum*, 242
- charlock (*Sinapis arvensis*), 358
- Chihuahuan Desert, 113, 114, 115
- chlorophyll fluorescence, 143
- chokecherry (*Prunus virginiana*), 160–2, 161
- Choristoneura rosaceana*, 158–63, 161, 171
- Cladophora glomerata*, 303, 304
- climate change
  - climate mapping, 411–13
  - metapopulation dynamics, 401, 410–13
- clonal plants
  - response to heterogeneity, 20–1, 188
  - response to nutrient patches, 97–106
  - ramet development, 100–2
  - stolon growth, 101, 104
- coarse-grained heterogeneity, 188, 199, 200, 203, 205
- colonization
  - competition–colonization trade-off, 229, 241–4, 242, 243, 259, 414–16
  - metapopulation models, 318–19, 320, 322–4, 325, 327, 403
  - plants, 237–65
- common water monitor (*Varanus salvator*), 347
- community ecology, 116, 215–6, 228–31, 402, 409
- competition
  - above-ground, 111, 113–4, 118, 127
  - below-ground, 4, 111, 112–13, 116–18, 126–7
  - community models, 116
  - competition–colonization trade-off, 229, 241–4, 242, 243, 259, 414–16
  - host–parasitoid interactions, 228–9
- interspecific competition, 125–6, 229, 405
- neighbourhood models, 111–17, 112, 114, 127
- plants, 57–61, 58, 80–2, 111–30, 239–41
  - probabilistic models, 127
- complementarity, 184
- complexity, 13
- compositional variance, 12, 13, **15**, 19
- conifers, mating systems, 269
- conservation
  - farmland, 357–78
  - trees, 280–4, 350–1
- Convention on Biological Diversity, 375
- coral reefs, 42
- Cordia alliodora*, 276–8, 276, 277, 278
- Costa Rica, 275, 275
- Cotesia melitaearum*, 227
- creosote bush (*Larrea tridentata*), 61–2, 63, 113, 114, 115
- crops, 358, 359, 363–4, 363, 365–9, 367, 379–8
- Cynoglossum officinale*, 253
- Dacrydium cupressinum*, 148
- deer (*Odocoileus virginicus*)
  - forest edge modification, 46
  - grazing patterns, 384
  - patch dynamics, 47
- deforestation, 315, 328, 333–48
  - deforestation–fragmentation, 333–4, 350
  - post-clearance changes, 338–9, 350–1
  - species loss, 334–9
  - stabilization, 339–48
- diapause
  - Choristoneura rosaceana* larvae, 159–63, 161
  - food quality effects, 158–9
- diet selection, 194, 196
  - seasonal diet switching, 202
- diffusion coefficients, nutrients in soil, 71
- digging
  - by gophers, 34–6, 38, 47
  - by porcupines, 39, 44
- Diploglottis diphyllostegia*, 144–5, 145
- Dipodomys merriami*, 186, 195, 195, 197, 202
- disturbance
  - and diversity, 55–6, 56
  - patterns, 14, 16, 17
- diurnal organisms, species survival, 336–7
- diversity
  - α-diversity, 57
  - β-diversity, 57, 406–7
  - competitive effects, 57–61, 58, 414–16
  - ecosystem processes, 401, 407–10
  - farmland, 358–9, 369, 375, 381–3, 387, 387
  - foraging ecology, 199–202
  - Hong Kong, 348–9, **349**
  - plants, 53–69, 54, 85–6, 86, 387, 387, 394–5, 408
  - post-deforestation, 338–9, 351
  - regional, 53–5, 54, 402–7, 406, 415
  - trees, 267–89
- DNA markers, 268

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- Douglas fir (*Pseudotsuga menziesii*), 297, 299–300  
 dragonflies, 344, 347, 349  
*Drosophila*, 216, 218–9, 412–14, 414  
*Dryobalanops lanceolata*, 134, 147, 147  
 dung, 386  
 dynamic monophagy, 228  
 dynamic state variable models, 254–5, 255, 256  
 ecosystem engineering, 2, 41–3, 48, 401, 416–18  
 ecotones, 44, 409  
 ecotrophic modules, 291–2  
 edges, 44–5, 409  
*Elatostema repens*, 143  
 elephants, tree uprooting, 38, 42  
 endogenic processes, 41  
 epidemiological theories, 13–14  
*Erica tetralix*, 385  
*Eucalyptus camaldulensis*, 274  
*Eucalyptus urnigera*, 273  
 Europe, agricultural policy, 359, 375  
 extinction  
   Allee effect, 317, 320–1, 327  
   extinction rate, 318–20, 320, 321, 323, 323, 324, 327, 337, 403  
   habitat destruction, 6, 315–31, 340–9, 349  
   extinction debt, 317  
   metapopulation models, 317–28  
   species-area relationships, 316, 317, 319, 403, 404  
   species loss cost estimation, 316–17  
   tropical species survival, 333–55  
   threshold prediction, 317, 319, 320, 321, 324  
 farmland  
   arable, 6–7, 357–75  
   crops, 358, 359, 363–4, 363, 365–9, 367, 379–80  
   ecological experiments, 357–78  
   field boundaries, 357–9, 361–2, 365–6, 371–5  
   grassland restoration, 379–95  
   grazing, 383–7, 387  
   habitat heterogeneity, 359–75  
     farm level, 365–9  
     landscape level, 360–4  
     patches, 369–75  
   harvest time, 367–8, 371  
   hedgerows, 358–9, 361–2, 362, 366, 367, 369  
   organic farms, 360–4  
   restoration ecology, 358  
   fast-growing species, 57  
   feeding behaviour, 183–4  
   feng shui, 345  
   fertilization  
     effects on diversity, 55–6, 58–9, 387, 387, 394–5  
   farmland conservation, 364  
   hay-making, 380–3, 382, 383, 384, 391–3, 391, 392  
   oak herbivore population ecology, 166–8, 167, 168, 169, 171  
   yield effects, 107  
 field boundaries, 357–9, 361–2, 365–6, 371–5  
   mowing effects, 371–3, 372, 373  
 field experiments  
   common garden trials, 272, 279  
   genetic variation in trees, 268, 272–80, 282  
   limitations, 278–80  
   provenance trials, 272–4, 278, 282–4  
   reciprocal transplant experiments, 274–5, 275, 278–9  
 filmy dome spider (*Neriene radiata* (Linyphiidae)), 303–5, 306  
 fine-grained heterogeneity, 187–8, 199–201, 200  
 fires  
   forest fires, 315, 336  
   patch dynamics, 47  
 fish, 344, 347  
 fitness  
   adaptive responses, 186–8, 191–2, 193, 203  
   host-parasitoid interactions, 220–1, 221  
   flexible feeding behaviour, 183–4  
   flow chain models, 36–8, 37, 39–40, 39  
   flowering patterns, 245–61, 245  
   heterogeneity effects, 250–61  
   models, 246–58, 260  
   trees, 269–70  
 food webs, spatial boundaries, 291–314  
 foraging ecology, 181–214, 402  
   diversity, 199–202  
   feeding behaviour, 183–4  
   grazing animals, 386  
   host-parasitoid interactions, 215–35  
   patch use, 189–94  
 predation  
   cost, 191–2  
   risk, 184–9, 186, 190–2, 193, 195, 204  
 predator behavioural effects, 197–9  
 prey capture, 183  
 vigilance, 187–8  
 foraging theory, 182  
 forestry  
   management and conservation, 280–4, 350–1  
   provenance trials, 272, 278, 280, 283–4  
 forests  
   carbon sheds, 297–8, 299–300  
   edge zones, 45–6  
   fire devastation, 315, 336  
   light penetration, 54–5, 62–3, 62, 65  
   nitrogen deposition, 45  
   forest tent caterpillar *Malacosoma disstria*, 226–7  
   fox squirrel *Sciurus niger*, 182, 189–90, 194, 196–7, 197, 206, 207, 208, 208  
 fragmentation, 6, 8, 402–4, 405  
   metapopulation models, 324, 326  
   tree variation and adaptation, 281–2  
   tropical landscapes, 333–51, 335, 336, 341  
*Fraxinus nigra*, 160–2, 161  
 freshwater fish, 344, 347

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- gall-formers, 166
- gambier (*Uncaria gambir*), 339
- gaps
  - light heterogeneity, 133, 145–9
  - promotion of species coexistence, 148, 149
  - treefalls, 44
- Gause's principle, 228
- geese, 386
- genetic algorithms, 255–6, 257–8
- genetic diversity
  - field experiments, 268, 272–80, 282
  - genetic markers, 268–72
  - trees, 267–89
    - gene flow, 268, 269, 271–2, 280–2
    - genetic distance, 276–7, 277
    - genetic structure, 270–1
    - human disturbance effects, 281, 284
    - long-term effects, 279, 280, 283
    - temperate zone species, 273–4, 280
    - tropical species, 274, 275–8, 280
    - wet/dry zone populations, 276–8, 278
- Gentianella amarella*, 259–60
- geographical information systems (GIS), 324
- geostatistical techniques, nutrient distribution
  - in soil, 72
- Gerbilus allenbyi*, 185, 189, 191
- Gerbilus pyramidum*, 189, 197–8, 198
- GIS *see* geographical information systems
- giving-up density, 192–6, 193, 195, 196–7, 197, 206, 207, 208, 208
- Glanville Fritillary (*Melitaea cinxia*), 227
- Glechoma hederacea*, 76, 76, 100–6, 103, 105, 106, 188
- gophers, digging activity, 34–6, 38, 47
- gradients, and diversity, 56–9
- grasses
  - diversity, 387, 387, 394
  - competitive effects, 58–61, 86
  - scale effects, 61–5, 64
- grasshoppers, response to heterogeneity, 20, 21–2, 22
- grasslands
  - farmland restoration, 379–95
  - grasshopper movement, 20, 21–2, 22
  - soil seed banks, 388–95, 390, 391, 392, 394
  - tenebrionid beetle movement, 19–20
- grazing, 383–7, 387
- grey squirrel (*Sciurus carolinensis*), 182, 189–90, 206, 207, 208, 208
- groundwater levels, 390–395
- habitats
  - destruction, 6, 244–5, 315–31
  - extinction debt, 317
  - metapopulation models, 5, 6, 317–28, 403–4
  - patterns, 324, 325
  - road effects, 324, 325
  - species-area relationships, 316, 317, 319, 403, 404
  - species loss cost estimation, 316–17
- farmland conservation, 357–78
- fragmentation, 6, 8, 402–4, 405
  - metapopulation models, 324, 326
  - tree variation and adaptation, 281–2
  - tropical landscapes, 333–51, 335, 336, 341
  - patchiness, 1–8, 13, 16–18, 184, 357, 409–10
    - farmland, 369–75
    - patch occupancy, 318–24, 320, 322, 323, 326, 327–8, 411
- plant response, 4–5, 91–110
- river changes, 306–10
- selection by animals, 181–2, 184–9, 194
  - adaptive speciation, 203–8, 204, 205
  - diet selection, 194, 196, 202
  - scale effects, 184–9
- harvester ants (*Pogonomyrmex occidentalis*), 16, 17, 23
- harvest time, 367–8, 371
- hay-making, 380–3, 382, 383, 384, 386, 388, 391–3, 391, 392
- heathland, 389
- hedgerows, 358–9, 361–2, 362, 366, 367, 369
- herbaceous plants, diversity, 408
- herbicide use, 359, 370–1, 375
- herbivores
  - impact on forest edges, 45–6
  - plant resources, 5
  - photosynthetic capacity, 135
- Honduras, 275, 275, 279
- Hong Kong
  - numbers of species, 348–9, 349, 350
  - species loss, 345–9, 349
  - tropical forest fragmentation, 342, 344–8, 345, 350
- Hordeum vulgare*, 74–5, 75
- host-parasitoid interactions, 5, 215–35, 412–13
  - behavioural ecology, 215–21, 229–31
    - chemical cues, 216–7
    - host location, 216–8
  - community ecology, 215–6, 228–31
    - competition, 228–9
    - dynamic monophagy, 228
  - patchy resources, 218–21, 221, 224
  - population ecology, 215–6, 221–7, 229–31
    - models, 222–4
    - non-random search, 222–4
    - over-exploitation, 222
    - spatial distribution, 225–7, 226
    - refuge, 223–4, 229
- human activities
  - deforestation, 315, 328, 333–9
  - effects on genetic variation in trees, 281, 284
  - habitat destruction, 315, 336, 348, 402, 411
  - population growth, 328
- humid tropics *see* tropical rain forests
- hurricanes
  - patch dynamics, 47
  - tree root binding, 41
- hydraulic lift, and diversity, 60
- hydropsychid caddisflies (Trichoptera), carbon sheds, 296–7, 296

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- ichneumonid wasp (*Venturia canescens*), 219
- Imperata cylindrica*, 340
- inbreeding trees, 280–1
- individual-specific heterogeneity, 250–2, 257, 257, 259
- Indonesia, treefall gaps, 44
- insect herbivores
  - diapause, 158–9, 161
  - oak herbivores, 163–71
  - population dynamics
    - bottom-up forces, 163–71
    - impact of plant quality, 5, 155–79
    - models, 155–8, 172
    - mortality curves, 156–8, 157
    - predation pressure, 156–7, 157, 163–71
    - top-down forces, 163–71
- insecticides, 380
- insects
  - aquatic, 300–10, 301, 302, 304
  - river-derived, 303–7
  - Singapore and Hong Kong, 344, 347
  - stream-dwelling, 296–7
  - see also* host-parasitoid interactions; insect herbivores
- invasion analysis, 239–41, 240, 259
- invertebrates, farmland conservation, 359, 368–9, 369, 372, 373
- island effect, 339, 344
- isodars, 203, 204
- isolegs, 199, 200
- isotopes, resource shed delineation, 294–9
- iteroparous species, repeated reproduction, 245
- Juncus acutiflorus*, 391–2, 391, 392
- lalang (*Imperata cylindrica*), 340
- LANDSAT images, 324–5, 326
- landscape patterns, 13, 16, 18, 25, 409–10
  - farmland conservation, 360–4
  - geographical information systems, 324–5, 326, 327
- Larrea tridentata*, 61–2, 63, 113, 114, 115
- leaf-chewers, 166, 167, 169–71, 170
- leaf litter
  - generation of heterogeneity, 71
  - nitrogen dynamics, 60
- leaf-miners, 166, 168, 231
- leaf-roller *Choristoneura rosaceana*, 158–63, 161, 171
- leaves
  - chlorophyll fluorescence, 143
  - folding, 139–40
- leopards (*Panthera pardus*), 199
- Leptopilina boulardi*, 412–14
- Leptopilina heterotoma*, 220
- Levins metapopulation models, 317–24, 320, 321, 323
  - spatially explicit, 323–4
  - stochastic, 321–4, 322, 326
- light heterogeneity
  - gap creation, 133, 145–9
- long-term variation, 145–8
- short-term variation, 133–45
- sunflecks, 131, 132–45, 132
- tropical rain forests, 131–53
- Liquidambar styraciflua*, 95, 96, 115
- loblolly pine (*Pinus taeda*), 95, 96, 115, 283–4, 283
- locational variance, 12, 13, 15
- Lolium perenne*, 80–2, 82
- MacArthur–Wilson metapopulation model, 318, 327
- macroecology, spatial population dynamics, 401–7
- Malacosoma disstria*, 226–7
- Malaysian forests, 343
- mammals
  - farmland conservation, 360, 364–8, 370–1, 373
  - Singapore and Hong Kong, 343, 346–7, 349
- Maniola jurtina*, 361, 362, 372
- marginal value theorem, 190–1
- marine systems, population dynamics, 163–4
- Markov chain models, 323–4
- Melitaea cinxia*, 227
- Merriam's kangaroo rat (*Dipodomys merriami*), 186, 195, 195, 197, 202
- metapopulation dynamics, 227, 245, 403–4, 412–13, 414
  - climate change, 401, 410–13
  - models, 5, 6, 317–28, 403–4
    - Levins model, 317–24, 320, 321, 323
    - MacArthur–Wilson model, 318, 327
    - shortcomings, 327–8
    - spatially-explicit, 323–4
    - spatially-realistic, 324–5, 327
    - stochastic, 317, 321–4, 322, 326
- microbial activity
  - competition for nitrogen, 81–2
  - soil organic matter, 73–4
- Micromelum minutum*, 136, 136, 137, 144–5, 145
- microtopography, 14, 16
- Microtus pennsylvanicus*, 46
- moles, farmland conservation, 365
- Molinia caerulea*, 385
- moment-closure method, 241
- monocarpic plants
  - dispersal and colonization, 237–61
  - flowering patterns, 245–61, 245
- morphology, response to nutrients, 84, 104, 106
- mosaics
  - diversity, 13, 18, 19–20
  - patch dynamics, 49
- moss-dwelling arthropods, 404, 405
- movement
  - grasshoppers, 20, 21–2, 22
  - tenebrionid beetles, 19–20
- mowing, field boundaries, 371–3, 372, 373
- mycorrhizae
  - carbon shed tracing, 297, 299

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- diversity, 408
- effects on root proliferation, 83, 125
- Myosotis ramosissima*, 242
- Myotis blythii*, 200
- Myotis myotis*, 200
- Myristicaceae, 342
- <sup>15</sup>N, resource shed tracer, 299
- Nasutitermes* spp., 16, 17
- natural selection, 230
- nectar sources, 372
- Negev Desert, Israel, 39, 44, 47–8, 185, 191
- neighbourhood models, 111–17, 112, 114
  - sensitivity, 117
  - zones of influence, 112, 112, 113, 115, 127
- Neriene radiata* (Linyphiidae), 303–5, 306
- Netherlands, restoration ecology, 384, 385, 391, 394
- New Zealand, old-growth forests, 148
- niche axes, 202, 241–4, 373, 407–8, 416
- Nicholson–Bailey host–parasitoid model, 222
- nilgai antelope (*Boselaphus tragocamelus*), 199
- nitrates
  - concentration variation, 72, 73
  - diffusion in soil, 71, 77
- nitrogen
  - concentration in oak foliage, 168
  - deposition at forest edges, 45
- nitrogen availability
  - diversity, 54–6, 58–9, 61–3, 62
  - dung from grazing animals, 386
  - hay-making, 380–3, 382, 383, 388
  - root proliferation, 77–83, 78
- nitrogen sheds
  - riparian plants, 6, 299
  - salmon, 295, 298, 311
- nocturnal organisms, species survival, 336–7
- non-clonal plants, response to nutrient patches, 97–106
- non-specific heterogeneity, 250–2, 254–7, 256, 259, 259, 260
- North America, squirrel behaviour, 182
- Norway spruce (*Picea abies*), 283–4, 283
- Nothofagus menziesii*, 148
- numerical maps, 12–13
- nutrients
  - concentrations in soil, 72–3
  - dung from grazing animals, 386
  - hay-making, 380–3, 382, 383, 388
  - ion mobility, 71–2
  - mineralization and diversity, 60–1
  - morphological response, 84, 104, 106
  - plant performance, 91–110, 386–8, 387, 395
    - competitive effects, 117–26
  - root responses, 74–83, 76, 92–107
  - tracer uptake, 121–5, 122, 124, 125
- oak herbivores, foliage quality effects, 163–71
- oceanic islands, 244
- Ochloides venata*, 360–1
- Odocoileus virginicus*, 46, 47
- Oenothera glazioviana*, 247–9, 248, 254–6, 255, 256
- oil-seed rape, 366, 370
- Omalanthus novoguineensis*, 134, 136, 137, 144, 145
- Onopordum illyricum*, 245, 247, 249, 257–8, 257, 258, 259, 260–1
- organic farms, 360–4, 362
- organisms
  - ecosystem engineering, 416–18
  - generation of heterogeneity, 33–52
    - diversity, 57–61
    - evolution, 37
    - maintenance, 35, 38, 46
    - transformation, 34, 38, 40, 46
  - response to heterogeneity, 3, 7–8, 16, 18–25
    - movement, 18–20
    - patch choice, 20
    - perceptual scale, 20–1
    - size effects, 61–5
- Orgyia vetusta*, 227
- outbreeding depression, 282
- outcrossing, 269–71, 281
- Oxalis acetosella*, 76, 76
- Oxalis oregana*, 139–40
- Panthera pardus*, 199
- Panthera tigris*, 199
- paper birch (*Betula papyrifera*), 160–2, 161, 297, 299
- parasitoids *see* host–parasitoid interactions
- partitioning heterogeneity, 56–7, 66
- patch dynamics, 40, 46–9
- patch–matrix theory, 14
- patch theory, 13, 218
  - marginal value theorem, 190–1
  - patch-leaving rules, 219–20
- patterned variance, 12, 12, 15, 16, 20
- pea (*Pisum sativum*), 92–4, 94
- perceptual scale, 20–1
- Perognathus amplus*, 195, 202
- pesticide use, 359, 371
- Phasianus colchicus*, 346
- phloem-feeders, 166, 168
- phosphorus
  - concentration variation, 72, 73, 86
  - diffusion in soil, 71
  - and plant diversity, 387–8, 387, 408
  - root uptake, 78–9, 106–7
- photon flux density, 132–3, 132, 134–5
- photosynthesis
  - effects of light heterogeneity, 131–53
  - photodamage, 140, 147–8
  - photoinhibition, 139–43, 144, 147–8
  - photoprotection, 140–1, 141
  - photosynthetic induction, 135–9, 136, 144
  - shade plants, 134–7, 143–5
- Phyllonorycter* (Gracillariidae), 231
- phytophagous insects *see* insect herbivores
- Picea abies*, 283–4, 283
- Picea glauca*, 59

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- Pinus caribaea*, 274, 279
- Pinus ponderosa*, 279
- Pinus sylvestris*, 273
- Pinus taeda*, 95, 96, 115, 283–4, 283
- Pisum sativum*, 92–4, 94
- Plantago*, 57
- plants
  - abiotic heterogeneity, 53–69, 54, 149, 238, 379–88, 394
  - annual, 239–40
  - biogenic heterogeneity, 53, 54, 57–61, 65
  - biotic heterogeneity, 3–5, 61–5, 149, 238
  - clonal, 20–1, 97–106, 188
  - coarse/fine-grained heterogeneity, 187–8, 199–201, 200, 203, 205
  - colonization, 237–65
    - competition–colonization trade-off 229, 241–4, 242, 243, 259
  - competition, 57–61, 58, 80–2, 111–30, 239–41
    - size effects, 118–121, 126
  - diversity and ecosystem processes, 401, 407–8
  - fragmentation survival, 337
  - habitat selection, 4–5
  - herbaceous, 408
  - light heterogeneity response, 131–53
  - monocarpic, 237–61, 245
  - non-clonal, 97–106
  - nutrient supply effects, 91–110, 386–8, 387, 395
    - competition, 117–26
  - patchy soil response, 71–110
    - contrast effects, 102, 104–6, 105, 106, 120
  - quality
    - foraging ecology, 192–3
    - insect herbivore population ecology, 155–79
    - predation pressure on oak herbivores, 163–71
    - voltinism in *Choristoneura rosaceana*, 158–63, 161, 171
  - restoration ecology, 379–400
  - riparian, 6, 298–9
  - seed dispersal, 237–65
  - vascular, 340–2, 345–6, 349
  - yield factors, 102, 103, 104, 106, 107
    - see also understorey plants
- Pogonomyrmex occidentalis*, 16, 17, 23
- pollen flow, 269, 270, 271–2, 279, 281–2
- Polygonum convolvulus*, 55
- Polyommatus icarus*, 360–1
- pond sediments, 42, 46
- ponies, grazing patterns, 384
- pools, 305, 306, 308
- population ecology
  - aquatic systems, 163, 164
  - climate mapping, 411–13
  - host–parasitoid interactions, 215–6, 221–7, 229–31
  - insect herbivores, 5, 155–79
    - models, 155–8, 172
  - macroecology, 401–7
- marine systems, 163–4
- metapopulations, 5, 6, 227, 245, 317–28
- range–abundance correlation, 402–4, 403, 405, 411
- regional distribution, 53–5, 54, 402–7, 406, 415
- trees, 267–89
- population growth, 328
- porcupines, digging for geophytes, 39, 44
- post-agricultural succession, patch dynamics, 46–7
- potassium, and plant diversity, 387–8
- Potentilla reptans*, 99–100
- Potentilla simplex*, 98–9, 99
- prairies, light penetration, 54–5, 62–3, 62, 65
- predation pressure
  - foraging ecology, 184–9, 186, 190–2, 193, 195, 204
  - insect herbivore population dynamics, 156–7, 157
  - oak herbivores, 163–71
- predators
  - behavioural effects of foragers, 197–9
  - resource sheds, 292, 293, 302, 303–7, 308
- prey
  - capture, 183
  - resource sheds, 292, 293
  - spatial distribution, 196–7
- propagule availability, 379, 388–93, 395
- provenance trials, 272–4, 278, 282–4
- Prumnopitys ferruginea*, 148
- Prunus virginiana*, 160–2, 161
- Pseudomonas fluorescens*, 415–16
- Pseudotsuga menziesii*, 297, 299–300
- Pyronia tithonus*, 362
- Quercus prinus*, 166–71, 167, 168, 169, 170
- Quercus rubra*, 166–71, 167, 168, 169, 170
- Quercus* spp., 47
- radio-tracking, 366–7, 370–1
- rainfall, Singapore and Hong Kong, 342
- rain forests *see* tropical rain forests
- reaction–diffusion models, 13–14
- reciprocal transplant experiments, 274–5, 275, 278–9
- red cedar (*Thuja plicata*), 297
- red maple (*Acer rubrum*), 160–2, 161
- relative growth rate, 247
- reproduction
  - iteroparous species, 245
  - monocarpic plants, 245–59
- reptiles, 343, 347, 349
- resource sheds
  - aquatic insects, 296–7, 300–10, 301, 302, 304
  - diffusion gradients, 299–300
  - predators, 292, 293, 302, 308
  - spatial boundaries, 291–314, 299–300
  - time dimension, 294, 295
  - tracer use, 294–9
  - watershed analogy, 6, 291–4, 293

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- resting, 191
- restoration ecology
  - farmland, 358, 379–400
  - trees, 282, 350
- Rhus typhina*, 47
- riffles, 305, 306, 308
- ring-necked pheasant (*Phasianus colchicus*), 346
- riparian plants, nitrogen sheds, 6, 299
- river-derived insects, 303–7
- rivers, habitat changes, 306–10, 309
- roots
  - diversity
    - competitive effects, 59–60
    - scale effects, 63, 65
  - heterogeneity generation in soil, 71–2
  - mycorrhizal colonization, 83, 125
  - nitrogen capture, 77–83, 78
    - microbe competition, 81–2
    - plant competition, 80–2
  - nutrient patch response, 74–83, 76, 92–107
  - phosphorus capture, 78–9, 106–7
  - proliferation, 74–83, 92–107, 113
    - clonal plants, 97–106
    - differential root growth, 92–4
    - ecological significance, 77–83
    - free root movement, 94–106
    - non-clonal plants, 94–7
  - tracer uptake, 121–5, 122, 124, 125
- round-tailed ground squirrel (*Spermophilus tereticaudus*), 195, 202
- rubidium, nutrient tracing, 121, 122, 123, 125
- Rubisco activity, light heterogeneity, 135, 137–8
- runoff–runon dynamics, 16–17, 18
- ryegrass (*Lolium perenne*), root proliferation, 77, 79
- Salix* vegetation, 245
- salmon, nitrogen sheds, 295, 298–9, 311
- salt marshes, 384, 386–7
- satellite images, 324–5, 326, 327
- savanna, sodic patches, 45
- Saxifraga tridactylites*, 242
- scales of response, 17, 22–5, 23, 36, 38, 48, 357, 409
  - habitat selection by animals, 184–9
  - interspecific competition, 125–6
  - plants, 61–6, 64
  - root proliferation, 97, 102, 104, 105, 106, 106, 120–1
- Schizachyrium scoparium*, 55
- Sciurus carolinensis*, 182, 189–90, 206, 207, 208, 208
- Sciurus niger*, 182, 189–90, 194, 196–7, 197, 206, 207, 208, 208
- Scots pine *Pinus sylvestris*, 273
- seeds
  - dispersal, 237–65, 238
  - definition, 238
  - gene flow, 271–2
  - grasslands, 388–95
  - habitat destruction, 244–5
- invasion analysis, 239–41, 240, 259
- models, 239–41
  - spatial, 239–41, 244, 259
- flux at forest edges, 45
- longevity index, 385, 389–90, 390
- soil seed banks, 388–95, 390, 391, 392, 394
- selfing, 269, 280
- self-organizing properties, 10, 16, 17, 18
- semiarid environment, 16–17
- Setaria viridis*, 55
- shade
  - photoinhibition, 143–5, 145
  - photosynthetic capacity, 134–5
  - photosynthetic induction, 136–7
  - root proliferation, 99–100
- sheep, grazing patterns, 384, 385
- Shorea leprosula*, 134, 147, 147
- Silene dioica*, 76, 76
- Simuliid (blackfly) larvae (Diptera), carbon sheds, 296–7, 296
- Sinapis arvensis*, 358
- Singapore
  - species loss, 340–4, 348, 349
  - tropical forest fragmentation, 339–44, 340, 341, 342, 345, 348
- sink patches, 44–5, 48
- slow-growing species, 57
- sodic patches, 45
- soil
  - acid layers, 85–6, 86
  - calcareous layers, 85–6, 86
  - chemistry, 78–9
  - demographic effects, 83–4
  - ecological consequences of heterogeneity, 83–7
  - gopher digging activity, 35–6, 38, 47
  - moisture scale effects, 63–4, 64
  - nutrient concentration, 71–3, 83–4
  - organic matter mineralization, 73–4
  - patch classification, 72–3
  - plant response to patchiness, 71–90
  - porcupines digging for geophytes, 39, 44
  - properties, 16, 45
  - seed banks, 388–95, 390, 391, 392, 394
  - sink patches, 44–5, 48
  - solid phase, 71–2
  - transplanted cores, 62–3
- Sonoran Desert, Arizona, 186, 194, 195
- South Africa, sodic patches, 45
- spatial heterogeneity, 9–31
  - animal foraging, 184, 185
  - consequences, 18–22
  - forms, 11–14, 15
  - generation by organisms, 33–52
    - controllers, 35–6
    - mechanistic models, 34–8, 35
    - as a process, 36–49
    - substrates, 35, 35, 36, 42, 49, 55
  - host–parasitoid interactions, 225–7, 226
  - macroecology, 401–7
  - plant colonization, 237

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

- quantification, 14, 15
- scale dependence, 17, 22–5, 23, 36, 38, 48, 61–6
- sources, 14, 16–17
- trees, 269–70
- spatial variance, 12, 12, 15, 16
- metapopulation models, 317–28
- species coexistence
  - animals, 181–2, 199–202
  - isolegs, 199, 200
  - plants, 148, 149
- species loss, 316–17, 334–9, 349
  - see also* extinction
- species richness, 55–6, 401, 406–16, 410
- Spermophilus tereticaudus*, 195, 202
- spiders
  - farmland conservation, 360, 362–4, 368–9, 368, 372–3, 373
  - resource sheds, 303–5, 306
- squirrels *see* fox squirrel; grey squirrel; round-tailed ground squirrel
- Stachys sylvatica*, 76, 76
- stemflow, soil heterogeneity, 63
- stochastic metapopulation models, 317, 321–4, 322, 326
- stomatal behaviour, light heterogeneity, 135, 137, 138–9
- stream-dwelling insects, resource sheds, 296–7
- strontium, nutrient tracing, 121, 122, 123, 124
- substrates, 35, 35, 36, 42, 49, 55
- sunflecks, 131, 132–45, 132
  - carbon gain enhancement, 133
  - stomatal activity, 138–9
  - whole plant responses, 143–5
- Sweden, grasslands, 389, 393, 394
- sweetgum (*Liquidambar styraciflua*), 95, 96, 115
- Swietenia humilis*, 275, 275, 279, 281–2
- Symporicarpos occidentalis*, 59
- temperate zone trees, genetic variation and adaptation, 273, 280
- temporal heterogeneity, 3–7, 9–11, 57, 63–5
  - animal foraging, 184–8, 185
  - farmland conservation, 267–8
  - flowering patterns, 250–1, 254, 258, 259–60, 259
  - seed dispersal, 244, 388–93
  - soil, 86–7
  - trees, 269
- tenebrionid beetles (*Eleodes* spp.), movement, 19–20
- termites (*Nasutitermes* spp.), 16, 17
- Thiessen polygons, 112, 112
- three-dimensional heterogeneity, 401, 407–8, 414–16
- Thuja plicata*, 297
- tigers (*Panthera tigris*), 199
- tilling, effects on diversity, 55–6, 56
- tracers
  - nutrient uptake, 121–5, 122, 124, 125
  - resource shed delineation, 294–9
- trees
  - canopy gap effects, 148, 149
  - carbon sheds, 297–8, 299–300
  - ecosystem engineering, 416–17
  - flowering patterns, 269–70
  - fragmentation survival, 337
  - genetic variation and adaptation, 267–89
    - field experiments, 268, 272–80, 282
    - gene flow, 268, 269, 271–2, 280–2
    - human disturbance effects, 281, 284
    - long-term effects, 279, 280, 283
  - management and conservation, 280–4, 350–1
  - mating systems, 269–70, 280
  - oak herbivores, 163–71
  - pollen flow, 269, 270, 271–2, 279, 281–2
  - pumping mineral-laden water, 45
  - restoration ecology, 282, 350
  - root binding around rocks, 41
  - scaling relationships, 36, 40, 61–3
  - structure controls, 42
  - uprooting by elephants, 38, 42
- Trifolium repens*, 100
- Triticum aestivum*, 77–8, 78
- trophic levels, 5–6, 60–1
- tropical rain forests
  - deforestation, 315, 328, 333–8
    - post-clearance changes, 338–9, 350–1
  - gap creation, 133, 145–9
  - light heterogeneity, 131–53
  - species survival, 333–55
- tropical trees
  - extinction prediction, 323
  - genetic variation and adaptation, 274, 275–8, 280
  - mating systems, 269
  - Tsuga canadensis*, 47
  - Tyto alba*, 185
- UK
  - farmland conservation, 358, 359–75
  - numbers of species, 348, 349
- Uncaria gambir*, 339
- understorey plants
  - acclimation potential, 146–9
  - gap effects, 145–9, 149
  - sunfleck effects, 131, 132–45, 132
    - light interception, 133–6, 139
- urbanization effects, 244–5, 281
- Varanus salvator*, 347
- vascular plants, 340–2, 345–6, 349
- Venturia canescens*, 219
- Veronica arvensis*, 242
- Veronica montana*, 76, 76
- vigilance, foraging ecology, 187–8
- Viola riviniana*, 76, 76
- violaxanthin conversion, 140–3, 141, 142
- voles (*Microtus pennsylvanicus*), forest edge modification, 46
- voltinism, *Choristoneura rosaceana*, 158–63, 161, 171

Cambridge University Press

978-0-521-54935-6 - The Ecological Consequences of Environmental Heterogeneity

Edited by Michael J. Hutchings, Elizabeth A. John and Alan J. A. Stewart

Index

[More information](#)

## INDEX

von Bertalanffy equation, 246, 248, 248, 249  
vulnerable species, 337

watersheds  
  aquatic insect flux, 300–10, 301, 302, 304, 306  
  drainage networks, 306–10  
  genetic variation in trees, 276–8, 278  
  resource shed analogy, 6, 291–4, 293  
wetland plants, substrate effects, 55  
whales, carbon sheds, 298  
wheat (*Triticum aestivum*), 77–8, 78

wild flowers, 373, 374  
windstorms, generation of heterogeneity, 38,  
  39–40, 47  
woodland, Vale of York, 324–5, 326, 327  
wood mice (*Apodemus sylvaticus*), 364, 365–8,  
  365, 366, 367, 370–1  
woody species, diversity, 63–4, 64  
xanthophyll cycle, 140–3, 141, 142  
zeaxanthin conversion, 140–3, 141, 142