

Index

- Acer saccharinum*, 67, 170–1, 311, 329
 acidity of groundwater, 45–6, 114–15
Acilius spp., 60, 299–300
 adaptive environmental assessment, 446–7
 adaptive management, 468–9
 aerenchyma, 22–3, 336, 368
 African mammals
 hippopotamus, 143, 196–7
 other large mammals, 203–5
 rhinoceros, 202–3
 agriculture
 the Americas, 477
 dikes, 84–6
 the Pantanal, 48
 wetland fertility, 118–22
 Yangtze River, 453–5
 alcohol dehydrogenase (ADH)
 production, 331
 alders *see Carex*
 algae, 213–14
 alkaloids, 209–10
 alligators
 causing natural disturbance, 143
 interaction with nutria, 221
 top-down control, 197
 allogenic burial, 229–42
 alluvial sediments, 133–5
 alpine wetlands, plant regeneration
 after burial, 242–6
 the Amazon
 fish species, 290–1, 297
 sediment deposition, 233–4
 woody plant invasion of wetlands,
 189–90
Ambystoma, 174
 the Americas, human impacts in, 477
Amia calva, 25–6, 28
 amphibians
 adaptations to hypoxic soils, 26
 competition among, 174
 number of species, 303–4
 anaerobic conditions *see* hypoxic soils
 angiosperms, 23–4
 animals
 adaptation to hypoxic soils, 25–7
 biodiversity, 296
 competition in wetlands, 190–2
 fertility in wetlands, 104–6
 flooding as influence on, 55–63
 functional classification, 416–18
 impact of burial, 246–8
 impact of salinity, 262–4
 number of species, 288
 nutrient requirements, 96
 overhunting, 278–81
 roadkill, 268–9
 which animals eat which plants,
 204–8
 wildlife management through
 disturbance, 154–5
 zonation, 325
 see also herbivory
 anoxia, 17
 anoxic atmospheres, 368–9
 anoxic soils, 21
 see also flooding
 antagonism, 178–9
 anthropogenic disturbance,
 superimposed upon natural
 ones, 161–6
 anthropogenic impacts *see* historical
 context; human impacts on
 wetlands
 aquatic algae, 213–14
 aquatic invertebrates, 297–301
 aquatic macrophytes, 122–3, 213–14
 aquatic wetlands
 biodiversity, 305–6
 classification of wetlands, 8, 11
 competition between plants, 170–1
 fluctuations in water levels, 78–80
 impact of sedimentation, 246–8
 mycorrhizae, 113
 salinity, 262–4
 secondary constraints, 31–3
 archeological records in wetlands,
 385–7
 archeological sites, flood stories, 52–5
 area–species relationship, 292–3
Arrhenatherum elatius, 332
 artists, inspired by wetlands, 374–6,
 391–2
 assembly rules, 406–13
 asymmetric competition, 176–7
 competitive hierarchies, 177–9
 dominant plants as larger than
 subordinate, 180
 Atatürk Dam, 472
 atmospheric gases, 95–6
 carbon dioxide, 31, 39
 climate change, 35
 methane, 39
 pollution and nutrients, 126–7
 attitudinal inertia, 430
 autogenic burial, 229–42
Avicennia germinans, 145–7
 the Baltic, 121, 265
 Bangladesh, human population density,
 282–4
 bank erosion, 135
Barringtonia acutangula, 227
 Basra reed warbler, 472, 501
 beavers
 and biodiversity, 218
 creation of dams and ponds, 69–72,
 413
 facilitation, 277–8
 food webs, 105
 giant beaver, 211–12
 restored wetlands, 437–9
 Bennett Dam, 82, 84
 Big Meadow Bog, 124–6
 biodiversity
 amphibians, 303–4

- birds, 301–3
 centrifugal model, 186–9
 competition for light, 178
 conservation, 318–19
 and ecosystem services, 373–7, 485
 eutrophication, 122
 fish, 296–7
 functional classification, 414–20
 future of, 319–20
 insects, 297–301
 ‘laws’ of ecology, 292–6
 management for, 218, 377
 modelling, 312–17
 mussels, 304–5
 number of species, 287–90, 292–6
 plants, 305–12
 potential diversity, 317
 restored wetlands, 436
 richness and diversity, 290–2
 and salinity, 260–2, 299, 301–3,
 310–12
 selective herbivory, 218
 species-based research, 397–8
 species pool, 287
 wetlands as diverse habitats, 287–90,
 373–7
- biodiversity hotspots, 289–90, 319
 biogenic accumulation *see* autogenic
 burial
- biomass
 biodiversity, 312–17
 centrifugal model, 186–9
 competitive gradients, 184–6
 eutrophication, 122
 fertility in wetlands, 98–9
 filters and assembly rules, 411
 high production rate of wetlands, 35,
 357–62
 hippopotamus as grazers, 196–7
 natural disturbance, 131–2
 primary production, 358
 secondary production, 358
 and solar energy, 35
- biosphere reserves, 486
see also reserve systems
- biotic integrity, 247–8
- birds
 competition among, 175–6
 ecological dependence upon
 wetlands, 291
 the Everglades case study, 57
 functional classification, 416
 number of species, 301–3, 318
 overhunting, 279
 plants in bird diets, 207
 in salt marshes and deltas, 57
 wildlife management through
 disturbance, 155
see also individually named species
- blackbirds, 175–6
- bogs
 biodiversity, 307
 classification of wetlands, 4, 11, 12
 climate records, 386
 fertility in, 124–6
 fluctuations in water levels, 76
 mycorrhizae, 113
 rates of burial, 237–42
 secondary constraints, 29–31
 terminology, 45–6
 zonation, 329
- bog turtle, 190–2
- boreal peatlands, 240–1
- boreal salt marshes, 198–201
- bottom-up biological control, 219–21
- boundary clustering
 ecological communities and null
 models, 347–50
 more measurements and more
 wetlands, 350–3
 quantifying zonation, 343–7
- bovids, 203–4
- bowfin fish, 28
- Brahmaputra River, 227–9, 282–4
- Bromus erectus*, 332
- bryophyte diversity, 307
- bryophytes, 30, 104, 307, 326
- bud banks, 156
- buffer zones, reserve systems, 486
- burial, 227–30
 ecological thresholds, 248–51
 impact on animal species, 246–8
 plant regeneration after, 242–6
 rates of, 230–42
 sediment accumulation, 251
- buried seeds
 competition between plants, 181–2
 recovery from disturbance, 155–60
 wet meadows, 78
- bush meat, 43, 269, 279
- Caernarvon Freshwater Diversion
 Project, 455–9
- Calamagrostis canadensis*, 178–9
Calamagrostis deschampsoides, 198–201
 calciphilous soil, 114–15
 calcium
 and biodiversity, 307
 fertility gradients, 103–4
 in peatlands, 114–15
Calluna vulgaris, 215–16
 the Camargue, 262–4
 canals, wetland loss, 48, 459
 carbon
 aquatic wetlands, 31–3
 fertility in wetlands, 95–6
 flooded soils, 18–19
 food webs, 104–6
 peatlands, 166
 wetlands as store of, 35, 357, 362–5
 carbon dioxide, 362–5
Carex spp.
 deltaic wetlands, 140
 mycorrhizae, 113–14
 zonation, 329
Carex atherodes, 113
Carex crinita, 184–6
Carex echinata, 98
Carex stricta, 276–7
 carnivorous plants, 30, 109–15
 carrier services, 36
 cartography *see* mapping wetlands
Castor *see* beavers
Castoroides ohioensis, 211–12
 cattails *see Typha* spp.
 cattle, 216
 Central American river turtle, 279–81
 centrifugal organization, 186–9
 change over time *see* temporal change
 characoids, 290–1, 297
 Charles River wetland, 382–3
 chemical plant defences, 209–10
Cladium jamaicense, 98–9, 188
 cladocerans, 247
 Clements, F. E., 348, 466–7
 climate
 coastal wetlands, 258–9
 role of wetlands in regulating, 35,
 362–9
 sea level changes, 265–8
 climatological records in wetlands,
 385–7
 climax vegetation, 329
 clothing, provision by wetlands, 374–6
 coal, 368–9
 coal swamps, 481–4

572 Index

- coarse woody debris, 271–4
 coastal wetlands, 2
 nutria, 216–17
 restoration in, 410–11
 salinity, 255–7, 409–10
 sea level changes, 248–51
 sediment accumulation, 242–6, 251
 snow geese, 198–201
 see also salt marshes
 coastlines
 sea level changes, 248–51, 265–8
 zonation pattern, 266–7
 coexistence of species, 415
 co-limitation, 101
Colossoma, 290–1, 297
 community unit concept, 348, 350–3
 community unit hypothesis, 348
 competition in wetlands, 169–71
 asymmetric, 176–7
 bog turtle case study, 190–2
 dominant plants, 180
 examples in wetlands, 171–6
 as filter, 411–13
 in freshwater marshes, 340–41
 gradients, 182–8
 for light, 177–9
 space and patches, 181–2
 succession, 189
 time and disturbance, 182
 woody plant invasion, 189–90
 zonation, 339–41, 353
 see also limiting factors
 competitive gradients, 182–8
 centrifugal organization, 186–9
 zonation, 323–5
 Comprehensive Everglades Restoration Plan (CERP), 439–40
 confirmation bias, 459
 conservation
 biodiversity, 318–19
 creating reserve systems, 485–92
 future of, 319–20
 global scale, 495–9
 humans as the biggest problem, 499–500
 objectives, 500–1
 perspectives on, 484–5
 protected areas, 319
 terminology and goals, 444–6
 Wicken Fen as a habitat fragment, 492–5
 see also wetland restoration
 contaminated water, 245–6
 see also eutrophication
Coreopsis rosea *see* pink coreopsis
 core protected areas, 485–6
 coumarins, 209–210
 Cowardin classification system, 12
 coypu, 216–18
 creveys, 200–1
 cultural differences, names for
 wetlands, 45–6
 cultural value of wetlands, 377, 391–2
 curlews, 301–2
Cynodon dactylon, 196
Cyperus papyrus, 109–12, 178–9, 358–9, 374–6
 dams, 92
 Euphrates River, 472
 floodplain plants, 64–7
 impact on plants, 63
 impact on surrounding hydrology, 80–6
 predicting wetland responses, 87
 sediment deposition, 234–5
 dams, created by beavers, 69–72
 Dansereau's system of classification, 421, 426
 Danube delta wetland restoration, 441–2
 decomposer food web, 207–8, 359–60
 deforestation
 Bangladesh, 283
 the Pantanal, 48
 sediment load, 232–3, 247–8
 deltas
 birds in, 57
 disturbance by fire, 140
 effect of hurricanes, 150
 Ganges/Brahmaputra, 227–9, 282–4
 rates of burial, 230–42
 De Luc, J. A., 328
 denitrification, 371–2
Dermatemys mawii, 279–81
 deserts, facilitation in, 339
Desmognathus quadramaculatus, 105–6
 dikes
 impact on surrounding hydrology, 84–6
 sediment deposition, 235–7
 dikes (dykes), terminology, 46
 see also levees
Dionaea muscipula, 188
Distichlis, 155
 disturbance *see* anthropogenic
 disturbance; natural disturbance
 ditches
 fertility in wetlands, 124–6
 plugging drainage ditches restoration
 example, 437–9
 diversity *see* biodiversity
 dominant species
 asymmetric competition, 176–7
 biodiversity – richness and diversity, 290–2
 biodiversity – sampling, 294–6
 biodiversity – terminology, 290
 competitive hierarchies, 177–9
 dominant plants as larger than subordinate, 180
 low occurrence in certain conditions, 183
 zonation and species distribution, 350–3
 dragonflies, 299
Drosera intermedia, 188
 ducks, 155, 301
 dune slacks
 fertilization studies, 101
 interdunal wetlands, 97–98
 ecological engineering, 69–72, 413
 ecological response curves, 334–7
 ecological succession *see* succession
 ecological thresholds, 248–51
 economic value of wetlands
 estimates of, 36–9, 357, 380–1, 388–91
 evaluation criteria, 400
 multiplier effects, 379–80
 number of visitors, 379
 three approaches to measuring, 378
 willingness to pay, 378, 380, 381
 see also ecosystem services
 ecoregions, 461–4
 ecosystem engineers, 71–2, 277–8
 ecosystem restoration, history of, 466–7
 see also wetland restoration
 ecosystem services, 35–9
 and biodiversity, 373–7, 485
 carrier, 36
 climate regulation, 362–9
 economic value, 36–9, 357, 388–91
 environmental records, 385–7
 flood risk reduction, 381–5

- high production rate of wetlands, 357–62
- informational, 36
- nitrogen cycle, 362–9
- production, 36, 357–62
- recreation and cultural services, 377, 391–2
- regulation, 36, 362–9, 369–73
- eelgrass, 335–7
- egrets, 303
- Eichhornia crassipes*, 460–1
- Eleocharis interstincta*, 98–9
- Eleocharis*, zonation, 329
- elevation
 - and biodiversity, 306–7, 309
 - coastal wetlands, 410–11
 - as filter, 411
 - zonation and competition, 342
- embankments
 - Bangladesh, 283
 - impact on surrounding hydrology, 84–6
 - sediment deposition, 235–7
 - terminology, 46
- empirical ecology, 403–5
- empty forests, 269
- endangered species
 - large herbivores, 217–18
 - mussels, 304–5
 - protected areas, 319
 - value of wetlands, 373–4
 - wet meadows, 192
 - see also* rare species
- Endangered Species Act, 192
- endemism, 75, 109
- environmental factors, 39–40
 - see also* climate
- environmental records in wetlands, 385–7
- Ephemeroptera, 247, 299
- Erica*, 479–80
- ericoid mycorrhizae, 113
- Eriophorum vaginatum*, 215–16
- Eskimo curlew, 301–2
- ethanol, 24
- Euphrates River, 472–3
- Eurycea wilderae*, 105–6
- eutrophication
 - the Everglades, 121–2, 440
 - fertility in wetlands, 117–26
 - treatment wetlands, 372–3
- the Everglades, 57
 - eutrophication, 121–2, 440
 - fertility in, 98–9, 107
 - fire in, 136–8
 - melaleuca as invasive species, 464–5
 - phosphorus availability, 95
 - wetland restoration, 439–40
- evolutionary history, 415
 - missing herbivores in today's wetlands, 211–12
 - wetland change over time, 481–4
- exclosure experiments, 217–18
- Exocoecaria agallocha*, 376–7
- exotic species, 460–6
 - see also* invasive species
- expenditures, visiting wetlands, 378, 379
- explorers, age of, 395–7
- extinct species, 211–12
- extreme events, 90–1, 147–53
- facilitation, 274–8
 - in freshwater marshes, 340–41
 - plant adaptations to hypoxic soils, 22–3
 - in salt marshes, 338–9
 - zonation, 339–41, 353
- facultative wetland plants, 399
- farming *see* agriculture
- Fasset–Wilson's system of classification, 426
- fens
 - biodiversity, 312–14
 - bog turtle, 190–2
 - classification of wetlands, 8, 11
 - fertilization studies, 101
 - rates of burial, 240–1
 - terminology, 45–6
- fertility in wetlands, 95–7
 - and biodiversity, 307–8, 318
 - causal factors model, 115
 - effects of nutrients on wetlands, 97–104
 - effects on animals, 104–6
 - eutrophication, 117–26
 - global view of nutrient inputs to wetlands, 126–7
 - impact of sedimentation, 247
 - low nutrient content as plant defence, 210–11
 - other issues, 109–15
 - possible global synthesis, 116–17
 - wetlands with low fertility, 106
- Festuca rubra*, 198–201
- fire
 - as anthropogenic disturbance, 165–6
 - in the Everglades, 136–8
 - fertility in soils, 107–8
 - impact of herbivory, 196–7
 - impact of humans, 161–2
 - as natural disturbance, 131, 135
 - peatlands, 135–6
- firths, 74
- fish
 - animal adaptations to hypoxic soils, 25–7
 - assembly rules, 408–9
 - biodiversity, 296–7, 300
 - competition among, 175, 176
 - in floodplains, 58
 - functional classification, 416–17
 - impact of sedimentation, 246–8
 - plants in fish diets, 207
 - and salinity, 262–4
- flamingos, 57, 262–4
- flavonoids, 209–10
- floating-leaved plants, 22–3, 325–6, 342
- flood control
 - Mississippi River, 235–6
 - negative effects of levees, 382, 385
 - value of wetlands in, 381–5
 - Yellow River, 237
 - see also* levees
- flooding, 51
 - biodiversity, 299–300, 310–12
 - biological consequences, 55–63
 - extreme events, 90–1
 - facilitation and competition, 340–41
 - general relationships between wetlands and water level fluctuations, 76–80
 - the Pantanal, 46–9
 - research into, 429
 - reservoirs, dams, and floodplains, 80–6, 92
 - restored wetlands, 439
 - salinity, 259–60
 - sediment deposition, 231–2, 235–7
 - survey of water level fluctuations, 63–76
 - wetland classification, 15–16
- flooding stress, 21–2
 - plant tolerance for, 335–7
 - scientific method in wetland ecology, 27–8
 - see also* hypoxic soils

574 Index

- floodplain forests, 63–8, 133–5, 207, 474–7
- floodplain mapping, 90–1
- floodplains
 economic value of, 380–5
 fish in, 58
 humans living on, 383–4
 impact of reservoirs and dams, 80–6, 92
 natural disturbance, 133–5
 rhinoceros, 202–3
 sediment deposition, 233–4
- flood protection *see* flood control
- flood pulses
 among years, 52
 as causal factor, 52, 91–2
 and humans, 52–5, 92
 predicting wetland responses, 87–90
 within years, 52
- flood stories, in human history, 52–5, 472–3
- flood walls *see* embankments; levees
- fluvial deposition *see* autogenic burial
- food, provision by wetlands, 374–6
- food webs
 decomposers, 207–8, 359–60
 fertilization experiments, 100–1, 104–6
 herbivory, 359–60
 in ponds, 303–4
 top-down control, 220
 which animals eat which plants, 204–8
see also population modelling
- forests *see* floodplain forests; mangrove forests; woody plants
- Fraxinus pennsylvanica*, 67
- freshwater marshes
 biodiversity, 310–12
 competition and facilitation, 340–41
 fertilization study, 101
 muskrats, 197–8
 plant regeneration after burial, 242–6
 zonation patterns, 333, 344–7
- freshwater wetlands
 classification of wetlands, 2
 differences and commonalities with saline, 256
- frogs
 biodiversity, 303–4
 roadkill, 268
 tepui, 109
 vernal pools, 57
- frost
 assembly rules, 409–10
 impact on mangrove swamps, 145–7
- functional classification of ecology, 414–20
 animals, 416–18
 expert systems, 426–8
 general procedure, 422–3
 plants, 417–20, 420–1, 425
 problems and prospects, 420
- fundamental niches, 334–7
- fungi, 112–14
- furber lousewort, 62–3, 188
- fynbos, 75
- Gambusia affinis*, 264
- Ganges River, 227–9, 282–4
- gap analysis, reserve systems, 486, 496
- gap creation, effect of hurricanes, 153
see also succession
- Gardiken Reservoir, 81–2
- gator holes, 143
- geographical discoveries, 395–7
see also research
- geographical distribution of wetlands, 2–3
- geological time scales, 481–4
- Geum peckii*, 124–6
- Gilgamesh, 472
- glaciation, and sea level change, 250–1, 265–8
- global biodiversity, vs. local, 318–19
- global distribution of wetlands, 2–3
- global scale wetland reserves, 495–9
- global view of wetlands classification, 12, 115
- glucosinolates, 209–10
- gopher frogs, 57
- grasses
 fertility in wetlands, 98–9
 human impacts on wetlands, 215–18
 overgrazing, 196
 tolerance for flooding, 336–7
 wet savannas, 74–5
 wildlife management through disturbance, 155
 zonation, 332
- grazing *see* herbivory
- great egret, 303
- Great Lakes
 conservation, 445–6
 economic value of, 381
- eutrophication, 118–20
- fluctuations in water levels, 68
- predicting wetland responses to flood pulses, 87
- Grime, J. P., 21, 312–14, 317
- groundwater
 acidity of, 45–6, 114–15
 calcium, 114–15
 classification of wetlands, 12
 in peatlands, 30–1
see also flooding
- Guadalquivir River delta, 308–10
- Gulf of Mexico, 121, 309
- gymnosperms, adaptations to hypoxic soils, 23–4
- habitat destruction
 bird species, 301–3
 impact on large herbivores, 217–18
 as principal cause of wildlife loss, 278
 Wicken Fen, 492–3
see also reserve systems
- habitats provided by wetlands, 377
see also biodiversity
- hedonic price indices, 378
- herbaceous plant communities, general model for biodiversity, 312–17
- herbivory
 examples of herbivores with large impacts on wetlands, 196–7, 196–205
 as filter, 411–13
 food webs, 359–60
 general patterns, 213–14
 human impacts on, 215–18
 importance in wetlands, 195
 missing herbivores in today's wetlands, 211–12
 plant defences, 208–11
 plants consumed by different herbivores, 204–8
 and salinity, 259–60
 theoretical models, 218–23
 in tropical wetlands, 196–7
- herring gulls, 124–6
- hippopotamus
 causing natural disturbance, 143
 facilitation, 277–8
 in tropical wetlands, 196–7
- historical context
 anthropogenic disturbances to wetlands, 161–6

- archeological and climatological records in wetlands, 385–7
 evolutionary history, 211–12, 415
 flood stories, 52–5, 472–3
 the great age of explorers, 395–7
 human impacts over the ages, 471–7
 wetland restoration, 466–7
 Wicken Fen, 492–5
 Holme Fen, 493–5
 horses, 216
 hotspots *see* biodiversity hotspots
 human cultures
 cultural value of wetlands, 377, 391–2
 flood stories, 52–5, 472–3
 missing herbivores in today's wetlands, 211–12
 names for wetlands, 45–6
 see also ecosystem services; human impacts on wetlands
 human impacts on wetlands
 anthropogenic disturbance, 161–6
 contaminated water, 245–6
 dams and reservoirs, 63, 80–6
 eutrophication, 117–26
 the Everglades, 121–2, 440
 flood pulses, 52–5, 92
 global view of nutrient inputs, 126
 herbivory rates, 215–18
 historical examples, 471–7
 humans as barrier to conservation, 499–500
 irrigation, 72
 at larger scales, 477–81
 levee construction, 84–6, 235–7
 New Jersey Pine Barrens, 450–1
 overhunting, 278–81
 population density, 281–4
 roads, 43, 268
 sediment yields, 247–8
 human management of wetlands
 floodplain plants, 64–7
 increasing biodiversity, 318–19
 see also conservation
 human uses of wetlands
 bog iron, 21
 by selected species, 374–6
 value of the ecosystem, 35–9, 357, 388–91
 see also ecosystem services
 hundred-year flood, 90–1
 hunting, 278–81
 hurricanes, 90–1
 effects on wetlands, 149
 moving sediment, 150
 as natural disturbance, 148
 news reports, 148–9
 and salinity, 264–5
 sediment deposition, 229–32
 Hussein, Saddam, 473
 Hutchinson's system of classification, 426
Hydrocharis morsus-ranae, 174, 176
 hydrogen, 95–6
 hydrogeomorphic view, wetland classification, 12
 hydroperiod, 59–61
 hypoxia, 17
 hypoxic soils
 changing with time and depth, 18
 coastal wetlands, 261–2
 flooding stress, 21–2
 how animals are affected, 25–7
 how plants cope, 22–4
 mycorrhizae, 113
 nitrogen, 370–1
 plant tolerance for, 335–7
 processing of carbon, nitrogen, phosphorus, sulfur and iron, 18–21
 ibis, 57
 ice ages, and sea level change, 250–1, 265–8
 ice, as natural cause of disturbance, 140
 Ilisu Dam, 472
 inclusive niches, 335–7
 individualistic hypothesis (ecological communities) 349, 351
 informational services, 36
 insects
 adaptations to hypoxic soils, 27
 functional classification, 417
 impact of sedimentation, 247
 number of species, 288, 297–301
 and salinity, 262–4
 vernal pools, 59–61
 see also invertebrate communities
 inselbergs, 109
 interdunal wetlands, nutrient availability, 97–8
 interior wetlands, 2
 intermediate diversity model, 312–14
 intertidal environments, biodiversity in, 308–10
 invasive species
 definition, 462–3
 distinction from exotic species, 461–4
 forest succession, 189–90
 peripheral habitats, 187–8
 wetland restoration, 460–6
 inventories, 399–400
 invertebrate communities
 factors affecting diversity, 297–301
 number of species, 288
 and salinity, 262–4
 vernal pools, 59–61
 see also insects
 Iraq–Iran war, 473
 iron
 flooded soils, 19–20
 humans and bog iron, 21
Isoetes, 31–3
 isostatic rebound, 250–1
 IUCN Red List, 319–20, 373–4
Iva frutescens, 274, 338–9

Juncus gerardii, 171–4, 176, 274
Juncus roemerianus, 100–1
Juncus tenuis, 113
 juveniles, differences from adults, 422

 Labrador duck, 301
 Lake Erie, 87–90
 lakes
 assembly rules, 408–9
 biodiversity, 297
 competition between species, 175
 eutrophication, 118–20
 flood pulses as causal factor, 52
 fluctuations in water levels, 67–9
 functional classification of ecology, 425
 wave effects, 141–2
 zonation, 325–6, 328
 Lake Victoria, 68
 large-number systems, 402
 latitude, number of species, 292
 lechwe, 203–4
Lepomis, 175, 176
 levees
 Danube River wetland restoration, 441–2
 impact on surrounding hydrology, 84–6
 Louisiana wetland restoration, 455–9
 Mississippi River, 235–6
 negative effects, 382, 385
 sediment deposition, 230, 235–7
 terminology, 46
 Yellow River, 237

576 Index

- light
 competition in wetlands for, 177–9
 as limiting factor, 109–12
 swamps, 33
 woody plant invasion, 189–90
- limiting factors
 fertility in wetlands, 101
 infertile habitats, 109–15
 light, 109–12
see also competition in wetlands
- literature, inspired by wetlands, 391–2
- Litsea monopetala*, 202–3
- litter mass, 140
- Littoraria irrorata*, 201–2
- Lobelia dortmanna*, 31–3, 113
- local biodiversity, vs. global, 318–19
- logging, 163–5
- logjams, 271–4
- lousewort, 62–3
- the Low Countries, Rhine delta, 474–7
- Lycopodium*, 32–3
- Lythrum salicaria*, 180, 184–6
- macroinvertebrates *see* invertebrate communities
- macrophyte piercers, 420
- Mallotus philippinensis*, 202–3
- mammals
 dependence on wetlands, 291–2
 functional classification, 418
 herbivores with large impacts on wetlands, 196–7, 196–205
see also individually named species
- management of wetlands
 adaptive management, 468–9
 biodiversity, 377
 research into, 428–31
see also conservation; reserve systems; wetland restoration
- mangal vegetation, 260–1
- mangrove forests, 145–7, 151–2
 Sundarbans, 235, 282
- mangrove swamps
 effect of frost, 145–7
 effect of hurricanes, 151
 facilitation, 274–6
 and salinity, 256, 260–1
- mapping wetlands, 398–9
 flood plains, 90–1
 global distribution of wetlands, 2–3
 reserve systems, 496, 498–9
- marshes
 biodiversity, 314
 classification of wetlands, 4, 11
 competition between animals, 175
 competition between plants, 169
 economic value of, 381
 effect of hurricanes, 151
 fertilization studies, 98, 101
 fluctuations in water levels, 78
 functional classification of ecology, 425
 Mesopotamia, 472–3
 natural disturbance, 156–60
 the Pantanal, 46–8
 secondary constraints, 33–5
 succession, 189
 zonation, 332–3, 336–7
see also salt marshes
- mayflies, 247, 299
- medicinal plants, 374–7
- Mediterranean biodiversity, 299
- medium-number systems, 402
 assembly rules, 406–13
 empirical ecology, 403–5
- megafloods, 90–1
- Mekong River, 290–1, 299
- melaleuca, 464–5
- meltwater, and contamination, 245–6
- meristems, 34, 156, 420–1
- Mesopotamia, tale of Gilgamesh, 52–5, 472–3
- methane
 aerenchyma, 22
 climate change, 362
 decomposition of carbon to, 18–19
 soil chemistry, 18
 wetland regulation, 365–8
- Millennium Ecosystem Assessment, 391
- mires, terminology, 45–6
see also bogs
- Mississippi gopher frog, 57
- Mississippi River
 dike construction, 84–6
 sediment deposition, 230
- mitigation, 443
see also wetland restoration
- mole salamanders, 174
- morphological plant defences, 208
- mosquitofish, 264
- mountain avens, 124–6
- mowing
 history of, 162
 wildlife management through disturbance, 154–5
- muskrats, 145, 197–8
- mussels, 304–5
- mutualism
 distinction from facilitation, 274
 plant adaptations to hypoxic soils, 22–3
- mycorrhizae, 112–14
- Myocastor coypus*, 216–18
- Myrica gale*, 109
- national classification systems, 12
- natural disturbance, 131–2
 and biodiversity, 307
 competition between plants, 181–2
 competitive gradients, 182–8
 examples of and effects on wetlands, 133–47
 extreme events, 147–53
 peripheral habitats, 187–8, 192
 pothole vegetation, 72
 properties of, 132–3
 recovery by seeds and rhizomes, 155–60
 wildlife management, 154–5
 woody plant invasion of wetlands, 189–90
 zonation and succession, 328–30, 342
- the Netherlands, human impacts in, 474–7
- New Jersey Pine Barrens, 450–1
- niche ecology, 334–7
- Niger River, 296
- the Nile, 63–8, 395–6
- nipa palm, 256
- nitrogen
 denitrification, 371–2
 effects on wetlands, 97–104
 eutrophication, 117–26
 fertility in wetlands, 95–7
 flooded soils, 19
 food webs, 104–6
 global view of nutrient inputs to wetlands, 126–7
 low nutrient content as plant defence, 210–11
 plants tolerant to shortages in, 109–15
 role of wetlands in regulating, 369–73
 treatment wetlands, 372–3

- North Sea, 474
Notonecta spp., 60, 299–300
 null models (zonation), 347–50
Nuphar lutea, 399
 nutria
 in coastal wetlands, 216–17
 fenced enclosure experiments, 218
 interaction with alligators, 221
 nutrient inputs
 effects on wetlands, 97–104
 eutrophication, 117–26, 372–3
 global view, 126–7
 see also fertility in wetlands
Nymphaea odorata, 208
Nypa fruticans, 261–2
Nyssa spp., 399
- obligate wetland plants, 399
 Odonata, 299
 ombrogenous raised bogs, 30, 76
 ombrotrophic bogs, 239–41
 orchids, 30, 109
 overgrazing, 196
 overhunting, 278–81
 oxidized soils, 17, 18
 oxygen availability
 fertility in wetlands, 95–6
 flooding stress, 21–2
 over time and depth, 18
 processing of carbon, nitrogen,
 phosphorus, sulfur and iron,
 18–21
- padinas, 74
 paleoenvironmental records in
 wetlands, 385–7
 palms, 256, 311
 paludification, 76
 Pampean grasslands, 216
 the Pantanal, 46–9
 paper, harvesting plants to make, 374–6
 papyrus, 109–12, 186, 374–6
 patches
 competition in wetlands, 181–2
 disturbance by fire, 137
 effect of hurricanes, 153
 storms uprooting trees, 149
 use in wildlife management, 154–5
 Peace–Athabasca delta, 82, 84
 Pearl River Marsh, 91, 150
 peat cutting, 162, 493
- peatlands
 calcium availability, 114–15
 climate records, 386–7
 ecosystem services, 357
 fertility gradients, 103–4, 106–7
 fertilization study, 98
 fire in, 135–6, 165–6
 fluctuations in water levels, 76
 herbivory rates, 215–16
 rates of burial, 237–42
 Rhine delta, 474–5
 succession, 189
 terminology, 45–6
 zonation, 325–6, 329
 see also bogs; fens
Pedicularis furbishii, 62–3, 188
Peltandra virginica, 24, 336–7
 peripheral habitats
 animals, 190–2
 plants, 187–8
 pH, 103–4
Phalaris arundinacea, 180
 phenols, 209–10
 phosphorus
 effects on wetlands, 97–104
 the Everglades, 95, 439–40
 fertility in wetlands, 95–7
 flooded soils, 19
 food webs, 104–6
 global view of nutrient inputs to
 wetlands, 126–7
 plants tolerant to shortages in,
 109–15
 treatment wetlands, 372–73
 wet savannas, 107–8
 photosynthesis, 360–2
Phragmites australis, 109–12, 178–9,
 314
Phragmites communis, 72
 physiological response curves, 334–7
 phytometers, 183
 Pine Barrens, New Jersey, 450–1
Pinguicula, 188
 pink coreopsis, 62–3, 188
 pitcher plants, 74–5
 plant height, 180
 plants
 adaptation to hypoxic soils, 22–4
 biodiversity, 305–12
 competition among, 171–4, 176–7
 defences against herbivores, 208–11
- dominant plants as larger than
 subordinate, 180
 eutrophication, 122–3
 fertility in wetlands, 97–104, 109–15
 flooding as influence on, 55–63,
 76–80
 functional classification, 417–20,
 420–1, 425
 impact of salinity, 257
 number of species, 288–90
 nutrient requirements, 96
 rare plants in wet meadows, 62–3
 regeneration after burial, 242–6
 which animals eat which plants,
 204–8
 see also ecological succession;
 individually named species
Platanthera leucophaea, 109, 399
 playas, 72–4
 Plecoptera, 247
 Plymouth gentian, 62–3, 188, 399
 pneumatophores, 22–3
 poaching
 the Pantanal, 48
 rhinoceros, 202–3
Poa palustris, 332
 pointed shoots, 242–6
 polders, 46
 pollen records, 387
 pollution
 eutrophication, 118–26, 372–3
 global view of nutrient inputs to
 wetlands, 126–7
 ponds
 amphibian biodiversity, 303–4
 natural disturbance, 143
 vernal pools, 57, 59–61, 74
Pontederia cordata, 208, 399, 411
 population density, humans, 281–4
 population modelling
 bottom-up and top-down biological
 control, 219–21
 empirical ecology, 403–5
 growth and crashes, 221–3
 large-number systems, 402
 medium-number systems, 402
 selective herbivory, 218
 small-number systems, 402
 positive interactions, as causal factor,
 43
 post-glacial rebound, 250–1

578 Index

- Potamogeton*, 60, 209–10
 pot experiments, 178, 183
 potholes, 72–3, 145, 247, 459–60
 prairie wetlands
 assembly rules, 407–8
 impact of sedimentation, 247
 muskrats, 197–8
 mycorrhizae, 113
 natural disturbance, 145
 wetland restoration, 459–60
 precipitation
 classification of wetlands, 12
 sediment load, 232–3
 as source of nutrients, 123–4
 predictive ecology, 403–5
 preservation, 444
 see also wetland restoration
 prickles (as defence against herbivores), 208
 primary production
 consumption and decomposition, 359–60
 high production rate of wetlands, 35, 358
 photosynthesis, 360–2
 production services, 36
 productivity of wetlands, 35, 357–62
 protected areas, 319, 490–2
 see also conservation; reserve systems
 provision of services, value of wetlands, 35–9, 357
 see also ecosystem services
Pterocarpus draco, 330
Pterocarpus officinalis
 biodiversity, 311
 coastal wetlands, 151–2
 competition in wetlands, 170–1
Puccinellia–Carex swards, 198–201
 quantitative relationships
 environmental factors – properties of wetlands, 40–1
 in science, 404–5
 radiocarbon dating, 239–41
 raised bogs
 biodiversity, 307
 classification of wetlands, 12
 fluctuations in water levels, 30, 76
 Ramsar definition of wetlands, 44–5
 ranching, 48
Raphia spp., 311
 rare species
 bog turtle, 190–2
 endangered, 192
 large herbivores, 217–18
 overhunting, 278–81
 peripheral habitats, 187–8
 value of wetlands, 373–4
 wet meadows, 62–3
 Raunkiaer's system of classification, 419–21, 426
 realized niches, 334–7
 recreational value of wetlands, 377
 Red List (endangered species), 319–20, 373–4
 reduced soils, 17
 changing with time and depth, 18
 see also hypoxic soils
 reeds, 109–12, 187–8, 374–6
 regulation services, 36
 climate, 362–9
 nitrogen, 369–73
 rehabilitation, 444
 see also wetland restoration
 replacement cost, 378
 reptiles
 adaptations to hypoxic soils, 26
 roadkill, 268–9
 research
 assembly rules, 406–13
 empirical ecology, 403–5
 four basic types of information, 397–400
 the great age of explorers, 395–7
 limitations to species-based research, 401–3
 science and wetland ecology, 395
 simplification through functional groups, 413–28
 six tactical guidelines, 428–31
 reserve systems, 485–92
 buffer zones, 486
 conservation objectives for wetland ecology, 498–9
 core protected areas, 485–6
 at global scale, 495–9
 scientific objectives for wetland ecology, 501–2
 Wicken Fen as a habitat fragment, 492–5
 see also conservation
 reservoirs, 92
 floodplain plants, 64–7
 fluctuations in water levels, 80–6
 impact on plants, 63
 resource partitioning, 334–7
 restoration, meaning of, 442–6
 see also wetland restoration
Rhexia virginica, 188
 the Rhine delta, 474–7
 rhinoceros
 Ganges/Brahmaputra, 227
 in tropical floodplains, 202–3
 rhizomes
 competition for light, 109–12, 178–9
 marshes, 34–5
 natural disturbance, 155–60, 181–2
 plant adaptations to hypoxic soils, 22–3
 regeneration after burial, 242–6
Rhizophora mangle, 330
Rhynchospora, 74–5
 rice paddies, 374–6
 Rigler, F. H., 175, 402, 403
 rivers
 eutrophication, 120–1
 flood pulses as causal factor, 52
 fluctuations in water levels, 63–8
 logs and woody debris, 271–4
 natural disturbance, 133–5
 sediment load, 227–9
 zonation, 325–6
 roads
 animal mortality rates, 268–9, 305
 bush meat, 43, 279
 as causal factor, 43, 268
 empty forests, 269
 expansion of, 268
 indirect effects, 269–71
 overhunting, 278–81
 Roman Empire, 473–4
 root competition, 184–6
Sabatia kennedyana, 62–3, 188, 399
Sagittaria lancifolia
 disturbance, 158–61
 Great Lakes, 68
 as obligate wetland species, 399
 salinity, flooding, and herbivory, 259–60, 414
 tolerance for flooding, 336–7
 saladas, 74
 salamanders, 57, 105–6, 174, 303, 488
 Chinese giant salamanders, 320
Salicornia virginica, 158–61

- salinity
 assembly rules, 409–11
 and biodiversity, 260–2, 299, 301–3, 310–12
 bird species in salt marshes and deltas, 57
 as causal factor, 42, 255–7
 depressing growth of many plants, 257
 due to rising sea levels, 265–8
 effect of hurricanes, 151–3
 effect on animals, 262–4
 freshwater and saltwater wetlands, 2
 natural disturbance, 156–60
 nutrient availability in wetlands, 115
 pothole vegetation, 72
 as pulse, 264–5
- salt marshes
 biodiversity, 317
 birds in, 57
 effect of frost, 145–7
 fertilization study, 100–1
 natural disturbance, 156–60
 plant regeneration after burial, 242–6
 sea level changes, 248–51
 snails, 201–2, 221
 snow geese, 198–201
 zonation patterns, 332–3, 338–9, 343–7
- saltwater wetlands
 classification of wetlands, 2
 differences and commonalities with freshwater, 256
- Salvinia molesta*, 210–11
- sand plains, fertility in, 107–8
- Sarracenia* spp.
 peripheral habitats, 188
 wet savannas, 74–5
- savannas
 disturbance by fire, 138
 fertility in, 107–8
 water level fluctuations, 74–5
 woody plant invasion, 189–90
- sawgrass, 98–9
- science, and wetland ecology, 395
see also research
- scientific definitions, 44
- scientific method in wetland ecology
 causal factors and consequences, 27–8, 39, 42
 four further causal factors, 42–3
- scientific objectives for wetland ecology, 501–2
- Scirpus fluviatilis*, 113
- Scirpus* spp., 68, 72
- Sculthorpe, C. D., 178–80
- sea level
 Bangladesh, 283
 ecological thresholds and sedimentation, 248–51
 impact on salinity, 265–8
 Rhine delta, 474–7
 seasonal use of wetlands, 358–9
- secondary metabolites, 209–10
- secondary production, 358
- sedges
 biodiversity, 307
 bog turtle, 191
 fertilization studies, 98–9
 mycorrhizae, 113–14
 tolerance for flooding, 336–7
 wet savannas, 74–5
 zonation, 332–3
- sediment deposition
 burial, 227–30
 dams, 234–5
 effect of hurricanes, 150, 153
 levees, 235–7
 producing variety of wetland types, 233–4
 rate of accumulation, 251
 rivers, 133–5
 sea level changes, 250–1
 zonation, 330–1
- sediment load
 deforestation, 232–3
 precipitation, 232–3
 in rivers, 227–9
 storm surges, 231–2
see also burial
- seeds
 competition and disturbance, 181–2
 natural disturbance, 155–60
 wet meadows, 78
- Selaginella selaginoides*, 32–3, 125–6
- shading
 competition for light, 178
 competition in patches, 181–2
- Shannon–Weaver diversity index, 296
- shared preference, 335–7
- sheep, 215–16
- shoot competition, 184–6
- Shorea robusta*, 227
- shorelines
 fertility in, 107–8
 ice, 140
 as a model system for the study of wetlands, 325–6
 as a prism, 323–5
- siluroids, 290–1, 297
- silver maple, 67, 170–1, 311, 329
- Simpson's diversity index, 296
- slugs, 215–16
- small-number systems, 402
- snails, 201–2, 221
- snow geese, 198–201
- snowmelt, and contamination, 245–6
- soils in wetlands, 16–21
 flooding stress, 21–2
 how animals are affected, 25–7
 how plants cope, 22–4
 wave effects, 142
see also hypoxic soils
- solar energy, high production rate of wetlands, 35, 357–8
- South Pole, 396–7
- space, competition in wetlands, 181–2
see also patches
- Sparganium*, 60
- Spartina* spp.
 competition among, 171–4
 zonation, 332–3
- Spartina alterniflora*
 coastal wetlands, 261–2
 fertilization study, 100–1
 herbivory, 201–2
 natural disturbance, 156–60
- Spartina foliosa*, natural disturbance, 158–61
- species-based research, 397–8
 assignment to functional groups, 426–7
 inventories, 399–400
 limitations of, 401–3
 mapping wetlands, 399
- species pool, 287
 assembly rules, 406–13
 indicators for wetland restoration, 449–50
see also biodiversity
- species response curves, 350–53
- species richness, 290–2, 294–6
see also biodiversity

580 Index

- specified geographical areas, 461–4
- Sphagnum* moss
 in bogs, 4
 climate records, 386
 fluctuations in water levels, 76
 rates of burial, 237–42
 succession, 189
- spike-rush, 98–9
- spines (as defence against herbivores), 208
- Sporobolus pyramidalis*, 196
- storm surges
 carrying saline water, 151, 153
 sediment deposition, 229–32
- stress gradient hypothesis (SGH), 276–7, 339
- stress tolerators, 190–1, 335–6
see also peripheral habitats
- succession
 burial and vegetation transitions, 237–42
 woody plant invasion of wetlands, 189–90
 zonation patterns, 328–30
- sulfides, 24
- sulfur
 fertility in wetlands, 95–6
 flooded soils, 19
- Sundarbans, 282, 285
- sunfish, 175, 176
- sunlight *see* light; solar energy
- surface water, classification of wetlands, 12
- suspended sediment load, 227–9
- swamps
 biodiversity, 310–12
 classification of wetlands, 4, 11
 competition between plants, 170–1
 competition in patches, 181–2
 effect of hurricanes, 149, 151
 floodplain forests, 63–8
 fluctuations in water levels, 77
 mangroves, 145–7
 secondary constraints, 33
 terminology, 45–6
- Taxodium distichum*
 assembly rules, 411
 biodiversity, 311
 competition for light, 178
 competition in wetlands, 170–1
- Taxodium* spp., 399
- temporal change, 41–2
 flood pulses among years, 52
 historical examples of human impacts, 471–7
 natural change over time, 481–4
 zonation and succession, 328–30
- tepui, 109
- terpenoids, 209–10
- terrestrial plants, importance in wetlands, 213–14
- thorns (as defence against herbivores), 208
- Three Gorges Dam, 80, 234–5
- Tiber River, 473–4
- Tibetan plateau, 308, 453
- tidal cycles, deltas, 57
- time
 as causal factor, 43
 competition in wetlands, 182
see also succession
- top-down biological control, 219–21
- topographical variation, number of species, 293–4, 306–7
- tourism to wetlands, 377
- toxic substances, contaminated water, 245–6
- trait matrixes, 422–3, 425
see also functional classification of ecology
- travel costs, to wetlands, 378
- trees *see* floodplain forests; mangrove forests; woody plants
- Trewia nudiflora*, 202–3
- Trichoptera, 247
- trophic cascades *see* top-down control
- tropical cyclones *see* hurricanes
- tundra
 environmental change in Ireland, 387
 woody plant invasion, 189–90
- turf excavation, 162–3, 492
- turtles
 bog turtle case study, 190–2
 low nutrient content as plant defence, 210–11
 overhunting, 279–81
- Twin Limit model, 87–90
- Typha angustifolia*, 178, 333
- Typha domingensis*
 assembly rules, 411
 competition for light, 178–9
- disturbance, 158–61
 fertilization studies, 98–9
- Typha latifolia*
 human impacts, 479–80
 plant height, 180
 potholes, 72
 zonation, 333
- Typha* spp.
 core and peripheral habitats, 186, 187–8
 as fast-growing, 109–12
 tolerance to anaerobic conditions, 24
 wildlife management through disturbance, 154–55
- typhoons *see* hurricanes
- Utricularia purpurea*, 31–3
- Utricularia vulgaris*, 188
- Valisneria*, 243
- vascular plants, as classification, 414
- vegetative reproduction rates, 178–9
- Venus fly-trap, 109–15
- vernal pools
 frogs in, 57
 macroinvertebrates, 59–61
 water levels, 74
- visiting wetlands *see* recreational value of wetlands
- Wadden Sea, 476
- wading birds, 57
- war, Iraq–Iran, 473
- water hyacinth, 460–1
- water regime
 classification of wetlands, 12
 pothole vegetation, 72
see also flooding
- watersheds, predicting wetland responses to flood pulses, 87–90
- water sources view, wetland classification, 12
- water strainers, 420
- waves, as natural disturbance, 141–2
- weather, extreme events, 90–1
see also hurricanes
- Western Lake, 91
- wet depressions, 72–3
- wetland classification
 six main types, 4–8
 complications, 44–6

- duration of flooding, 15–16
- general relationships between wetlands and water level fluctuations, 76–80
- global view, 12, 115
- hydrogeomorphic view, 12
- mapping wetlands, 399
- the Pantanal, 46–9
- secondary constraints, 29–35
- water sources view, 12
- wetland restoration, 435–6
 - adaptive management, 468–9
 - brief history of, 466–7
 - Danube River levee removal example, 441–2
 - the Everglades example, 439–40
 - goals of, 444–7, 467–8
 - indicators, 447–51, 468
 - invasive species, 460–6
 - Louisiana levee breach example, 455–9
 - meaning of, 442–6
 - methods, 468
 - monitoring, 446–51
 - plugging drainage ditches example, 437–9
 - prairie potholes example, 459–60
 - success criteria, 452–3
 - Yangtze River example, 453–5
- wetlands, 1–2
 - definitions and terminology, 2, 44–6
 - formation, 2
 - high production rate, 35, 357–62
 - natural change over time, 481–4
 - provision of valuable services, 35–9, 357
 - see also* ecosystem services
 - where do wetlands occur? 2–3
- wet meadows
 - bog turtle, 190–2
 - classification of wetlands, 8, 11
 - endangered species, 192
 - floodplain plants, 64–7
 - fluctuations in water levels, 78
 - rare plants, 62–3
 - zonation, 325–6
- wet savannas
 - disturbance by fire, 138
 - fertility in, 107–8
- white ibis, 57
- whooping crane, 279
- Wicken Fen, 492–5
- wildlife management, natural disturbance, 154–5
 - see also* management of wetlands
- willingness to pay, 378, 380, 381
- Wisconsin lakes, 297
- wood storks, 57
- Woodwalton Fen, 493–5
- woody debris, clogging rivers, 271–4
- woody plants
 - amphibians and forest cover, 304
 - biodiversity in swamps, 310–12
 - competition between, 170–1
 - competition for light, 189–90
 - dams and reservoirs, 82–4
 - floodplain forests, 63–8, 133–5, 207, 474–7
 - flood-tolerant species, 77
 - human impacts, 480–1
 - impact of herbivory, 202–3
 - invasion of wetlands, 189–90
 - logging, 163–5
- mangrove forests, 145–7, 151–2
- Rhine delta, 474–7
- zonation, 325–6, 334
- World Wildlife Fund (WWF), 388–91
- Yangtze River
 - lakes within the watershed, 68–9
 - Three Gorges Dam, 80
 - wetland restoration, 453–5
- Yellow River, 231, 308
- zonation, 323
 - adding more measurements and more wetlands, 350–3
 - biological interactions, 332–4
 - context for future experiments, 342
 - ecological and physiological response curves, 334–7
 - ecological communities and null models, 347–50
 - ecological succession, 328–30
 - experimental test for competition and facilitation in freshwater marshes, 340–41
 - physical factors and physiology, 330–1
 - positive interactions also affect zonation in salt marshes, 338–9
 - research into, 430
 - reserve systems, 485–92
 - shorelines as a model system for the study of wetlands, 325–6
 - shorelines as a prism, 323–5
 - statistical analysis, 343–7
 - zooplanktivores, 420
 - Zostera*, 335–7