

Species Index

Agropyron smithii, 217

Bouteloua eripoda, 14

Bouteloua gracilis, 2, 114, 140, 216

Burkea africana, 121, 234, 333,
391, 394

Digitaria eriantha, 121, 234

Eragostris pallens, 121, 234, 333, 391, 394

Larrea tridentata, 14

Nerium oleander, 26

Ochna pulchra, 121, 234

Paspalum setaceum, 130, 215, 218, 391, 394, 396, 407

Prosopis glandulosa, 130, 215, 218, 391, 394, 396, 407

Quercus douglasii, 174

Subject Index

- Abscisic acid (ABA), 99
 Active soil depth, *see* Rooting depth
 Albedo, 7, 308
 Ammonium, 313, 327, 338
 Apoplastic water, 89, 90, 95
 Assimilation, 98, 179, 188, 189, 190, 201
 water stress, 207
 Atmospheric boundary layer, 179, 185

 Bare soil, 14, 380, 388
 Bimodality, 255, 257, 265
 Biodiversity, 3, 5, 389
 Biomass, 3, 5, 121, 154
 allocation, 203
 microbial, *see* Microbial biomass
 Blue grama, *see* *Bouteloua gracilis*
 Bound, *see* Saturation
 Budyko, 52, 55, 249

 C₃ plants, *see* Photosynthetic pathways
 C₄ plants, *see* Photosynthetic pathways
 C/N ratio, 312, 315, 321, 323, 335
 CAM, *see* Photosynthetic pathways
 Carbon assimilation, *see* Assimilation
 Carbon cycle, 307, 310, 318, 338, 340
 Carbon dioxide, 7, 310
 Carbon-to-nitrogen ratio, *see* C/N ratio
 Carboxylation, 189
 Cavitation, 96, 99, 183, 204
 Cellular automaton, 372, 374, 406
 Chaos, *see* Self-sustained oscillations
 Chapman–Kolmogorov, 238
 backward equation, 61, 82, 83
 forward equation, 33, 36, 61, 82, 355
 Climate change, 25, 55, 209
 Climate–soil–vegetation system, 2, 6
 Closure problem, 239, 240
 Clusters of vegetation, 13, 366, 384, 385, 412, 413
 Coherence function, 401, 403
 Cohesion theory, 93
 Colonization, 12, 374, 386, 390, 406
 Competition, 12, 361, 363, 386, 406
 colonization model, 386, 406
 Competitive-exclusion principle, 361
 Conductance to water flow
 leaf, 26
 soil–root, 96, 181
 stomatal, 96, 183, 186, 188, 194
 xylem, 181
 Cross-correlation, 401, 402
 between relative soil moisture and nitrate, 342
 between soil moisture and nitrate, 341, 342
 Crossing analysis, 59, 66, 68
 frequency of crossing, 65, 68
 mean time of crossing, 62
 number of crossing, 68
 onset of stress, 70
 relation to backward equation, 84
 wilting point, 69

 Decomposition, *see* Nitrogen mineralization
 Deep infiltration, *see* Leakage
 Diffusion, 83, 190, 314, 330, 360
 Drought, 32, 86, 97, 130, 342, 374, 384
 resistance, 159
 Drought deciduousness, 11, 100, 174
 Dryness index, 52, 276

 Ecohydrology, 1
 Ecosystem structure, 12, 360
 Effective rainfall, 114
 Equilibrium, 12, 118, 216, 258, 348, 349, 356, 364, 387
 Evaporation, *see* Evapotranspiration
 Evapotranspiration, 25
 hourly dynamics, 184
 maximum, 45
 optimization, 227, 232
 stressed, 45
 temporal scaling, 200
 three stage sequence of, 46
 unstressed, 45
 Evergreen species, 11, 215
 Extensive users, 213

 Field capacity, 31
 Fire, 87, 154, 333
 First-order kinetics, 312
 Forests
 Amazonian, 215
 eastern European, 13
 northwestern United States, 8, 41
 transition to pastures, 215
 Fractals, 381, 386
 Frequency of crossings, *see* Crossing analysis

 Grasslands
 Konza prairie, 210
 North American, 118
 -to-shrubland transition, 14, 372
 turnover of soil organic matter, 311

- Höfler diagram, 96
 Hierarchical model, 386
 Hillslope, 10, 269, 292
 Humus, 310, 321
 Hurst coefficient, 382, 399, 400
 Hydraulic conductivity, 31
 Hydrometeorology, 7
 Hygroscopic point, 25, 69, 89
- Immobilization, *see* Nitrogen
 Infiltration, 21, 271, 370
 Information entropy, *see* Shannon entropy
 Intensive users, 213
 Interannual rainfall fluctuations, *see* Rainfall
 Interception, 19, 45
 Inverse soil texture effect, 119, 140, 148, 218
- Kalahari, 149, 164
- Leaching, *see* Nitrogen
 Leaf area index, 19, 168, 171, 181, 204
 Leakage, 31, 45
 Light, *see* Solar radiation
 Litter, 310, 312, 316, 317, 320, 335, 338, 339, 340
- Macroporosity, 293, 296, 297, 308, 370
 Macroscopic equation, 238
 Markovian process, 22, 38, 60, 68, 107, 390
 Master equation, *see* Chapman–Kolmogorov
 Maximum daily transpiration rate, E_{\max} , 201
 Mean first passage time (MFPT), *see* Crossing analysis
 Mean soil moisture, *see* Soil moisture
 Mean time of crossing, *see* Crossing analysis
 Mediterranean climate, 9, 10, 41, 118, 173, 248
 Mesquite, *see* *Prosopis glandulosa*
 Microbial biomass, 310, 312, 322, 335, 338
 Mineralization, *see* Nitrogen
 Minimalistic models, *see* Soil moisture
 Monte Carlo simulation, 254, 262
 Mortality rate, 387
- New Mexico, 14, 372
 Sevilleta LTER, 14
 Nitrate, 313, 327, 338, 340
 flushes, 342
 Nitrogen, 306
 biological fixation, 308
 cycle, 312, 313, 318
 denitrification, 308, 350
 hierarchy of models, 352
 immobilization, 308, 312, 323
 leaching, 308, 315, 327, 339, 340
 mineralization, 11, 12, 308, 310, 315, 320, 323, 336, 339
 oxide emissions, 308, 350, 352
 second-order model, 354
 temporal scales, 337, 339
 uptake, 11, 98, 315, 328, 329, 339, 340
 Nonlinear dynamics, 261, 358
- Number of crossings, *see* Crossing analysis
 Nutrients, *see* Nitrogen
 Nylsvley, *see* Savanna
- Oak, 13, 173
 Onset of stress, *see* Water stress
 Optimality, 73, 113, 114, 116, 207, 229, 233, 364, 372
 Organic matter, *see* Soil organic matter
 Osmotic adjustment, 96, 97, 99, 100, 132, 227
- Patterns of vegetation, 360, 382, 406, 411
 Penman–Monteith equation, 27, 183, 184
 pH, 314
 Photorespiration, 190
 Photosynthesis, 11, 28, 88, 179, 189, 309
 effect of water stress on, 109
 Photosynthetic pathways, 28
 C₃ plants, 28, 135, 191, 193, 213
 C₄ plants, 28, 135, 191, 213
 CAM, 27, 99
 Plant residues, *see* Litter
 Plant strategies, 212
 Plant water uptake, 271
 Plasmolysis, 97
 Poisson process, 18, 59, 107
 Porosity, 16, 23
 Power law, 385, 398, 399, 414
 Power spectra, 341, 380, 381, 399
 Precipitation, *see* Rainfall
 Pressure potential, 95
 Priestly–Taylor equation, 166
 Probability distribution
 assimilation, 205
 of nitrogen and carbon cycles, 346, 347
 soil moisture, 36, 49, 52, 54
 static water stress, 102
 Productivity, 45, 116, 135, 372
- Rainfall
 depth of events, 18
 frequency and amount, 8, 45, 74, 113, 115, 207, 209
 gradient in Kalahari, 149
 interannual fluctuations, 2, 10, 12, 119, 129, 154, 236, 250, 259, 366, 373, 377, 386, 389, 393, 396, 406, 408
 rate, 43
 stochastic modeling, 17, 46
 Relative humidity, 91, 99, 184
 Resistance to water flow, 95 *see* Conductance to water flow
 Respiration, 98, 190
 soil, 308, 310, 322
 Retention curves, 29, 30, 89
 Richards' equation, 268, 270
 Ripley's *K*-function, 382
 Root area index, 181, 204
 Rooting depth, 10, 23, 56, 74, 79, 130, 292, 312
 Runoff, 17, 21, 42, 45, 55, 271, 276, 292, 304, 370

- Saturation, 36, 38, 51, 60
 Savanna, 361
 California blue oak, 173
 Nylsvley, 8, 12, 41, 119, 234, 332, 364, 390
 soil nitrogen cycle, 12, 334
 Texas, 13, 118, 129, 215, 218, 366, 390, 406
 tree–grass coexistence, 361, 362, 364, 373
 Scale invariance, *see* Self-affinity
 Seasonal fluctuations, 9, 41, 236, 237, 245, 247
 Self-affinity, 381, 398, 399, 412
 Self-similarity, *see* Self-affinity
 Self-sustained oscillations, 349, 358, 359, 401
 Shannon entropy, 404, 405
 Shot noise, *see* Poisson process
 Shrublands, 10, 14
 arizona, 268
 southern Texas, 41
 Soil
 crust, 370
 parameters, 24
 types, 309
 Soil depth, *see* Rooting depth
 Soil moisture, 2
 crossing, *see* Crossing analysis
 cumulative probability distribution, 57, 65
 definition, 16, 52
 initial condition, 8, 41, 63, 66, 118, 213
 losses, 28, 32, 47
 mean, 49, 53, 54, 238, 242, 253, 362
 minimalistic models, 51, 54, 76, 79, 209, 355
 probabilistic dynamics, 15, 33
 simpler models, 47
 steady state, 54
 stochastic dynamics
 steady state, 36, 41
 transient, 41
 transient dynamics, 59, 244
 variance, 50, 53
 vertically averaged, 10
 Soil organic matter, 306, 308, 310, 311
 Soil–plant–atmosphere continuum, 28, 93, 94, 179, 181
 Soil textural triangle, 219
 Soil texture, 119, 140, 218
 Soil–water deficit, *see* Water stress
 Solar radiation, 99, 186
 SPAC, *see* Soil–plant–atmosphere continuum
 Spatial interactions, 12, 364, 374, 406
 Spatial scales, 10
 continental scale, 7
 plot, 6, 10
 vertical, 268, 269
 Steppe, 2
 Colorado, 2, 41, 114, 119, 140, 216
 Patagonia, 41, 268
 Stomata, 25, 93, 99, 186
 Stomatal control, 95, 98, 99, 227
 Stress, *see* Water stress
 Subtropical climate, 10, 130
 Symplastic water, 89, 90, 95, 96
 Takacs problem, 36, 51
 Temperature
 air, 183
 leaf, 186, 187
 potential, 185
 seasonality, 249
 soil, 314
 Temporal scales, 8
 daily, 8, 25, 179, 200
 decadal, 12, 308
 hourly, 8, 179, 180, 194
 in the soil nitrogen cycle, 337, 339
 Thornthwaite equation, 249
 Tiger bush, 370
 Topography, *see* Hillslope
 Transpiration, *see* Evapotranspiration
 Tree seedlings, 374
 Tree–grass coexistence, 118, 119, 164, 268, 377
 Turgor, 86, 88, 90, 95, 96, 99, 228
 Turing instability, 360
 Vegetation catenae, 9, 10
 Volumetric water content, 16
 Walter hypothesis, 129, 268, 361, 380
 Water balance, 15, 33, 41, 46, 47, 57, 239
 global, 25, 55
 minimalistic models, 55
 Water potential, 28, 88
 atmospheric, 90
 gravitational, 89, 90
 leaf, 186, 187, 195
 matrix, 29, 89, 90
 osmotic, 89, 90, 95
 plant, 88, 89, 93, 97
 pressure, 89
 soil, 89
 Water stress, 7, 71, 86, 88, 100, 369, 372
 assimilation-based, 207
 dynamic, 100, 107, 110
 extended definition, 214
 impact of interannual rainfall fluctuations, 259
 minimization, 232, 366
 onset, 25, 101, 201, 229
 optimization, 362
 static, 100, 101
 Water table, 11, 32, 113, 174
 Water use, 212
 optimistic and pessimistic behaviors, 229
 Water use efficiency, 136, 196
 Water vapor deficit, 187
 Water vapor pressure, 91, 183
 Wilting point, 25, 29, 101, 201
 Winter recharge, 59, 213
 WUE, *see* Water use efficiency
 Xylem, 89, 90, 93, 95, 96