

Contents

Section 1 Biosphere	1
1.1 The Blue Planet: of Wholes and Parts and Man. G. M. WOODWELL . .	2
1.1.1 Introduction	2
1.1.2 The CO ₂ Problem	3
1.1.3 Toxification	5
1.1.4 The Effects: Biotic Impoverishment	6
1.1.5 Conclusions	8
Résumé	8
References	9
Section 2 Landscape	11
2.1 Landscape Modification and Changing Ecological Characteristics. M. GODRON and R. T. T. FORMAN	12
2.1.1 Ecosystems and Landscapes	12
2.1.2 Some Ecological Attributes for Comparing Landscapes	13
2.1.2.1 Horizontal Structure	14
2.1.2.2 Stability	14
2.1.2.3 Thermodynamic Characterization	16
2.1.2.4 Chorology	16
2.1.2.5 Minimal Area (or Grain)	16
2.1.2.6 Nutrient Cycling	17
2.1.2.7 Net Production	17
2.1.2.8 Tactics	17
2.1.2.9 Phylogeny	18
2.1.2.10 Type of Resistance	18
2.1.2.11 Conclusion	18
2.1.3 Disturbance Regimes	19
2.1.4 Effect on Landscape Patch Structure	20
2.1.4.1 Patch Origins	20
2.1.4.2 Patch Size	22
2.1.4.3 Patch Shape	22
2.1.4.4 Patch Numbers and Configuration	22
2.1.4.5 Summary for Patch Trends	23
2.1.5 Effect of Linkage Characteristics of the Landscape	23
2.1.5.1 Line Corridors	23
2.1.5.2 Strip Corridors	23

2.1.5.3	Stream Corridors	24
2.1.5.4	Networks	25
2.1.5.5	Habitations	25
2.1.5.6	Matrix	25
2.1.5.7	Summary of Trends for Linkage Characteristics	25
2.1.6	Conclusions	25
	Résumé	26
	References	27
2.2	Ecological Modeling of Landscape Dynamics. D. A. WEINSTEIN and H. H. SHUGART	29
2.2.1	Introduction	29
2.2.2	Approaches to Modeling Landscape Dynamics	30
2.2.3	A Differential Equation Model of Landscape Change	33
2.2.4	Complex Digital Computer Model of Forest Dynamics	36
2.2.5	Evaluating the Impact of Regional Scale Problems on Localized Stands	37
2.2.6	Evaluating Impact of Regional Scale Problems Across Landscapes	41
2.2.7	Future Directions in Simulation Analysis of Landscapes	43
2.2.8	Conclusions	44
	Résumé	44
	References	45
Section 3 Ecosystem Functions		47
3.1	Research on the Characteristics of Energy Flows within Natural and Man-Altered Ecosystems. M. LAMOTTE	48
3.1.1	Introduction	48
3.1.2	Examples of Energy Flows in Selected Ecosystems	49
3.1.3	Primary Production	53
	3.1.3.1 Effect of Rejuvenating Forest Stands	53
	3.1.3.2 Effect of Cutting on the Production of Grasslands	54
	3.1.3.3 Effect of Grazing	54
	3.1.3.4 Effects of Fire on Grasslands	57
	3.1.3.5 Destruction and Transformation of Wooded Areas	58
3.1.4	Diversity of Energy Flows in Animal Populations	59
	3.1.4.1 A/I Assimilation Efficiency	60
	3.1.4.2 P/A Tissue Growth Efficiency	60
	3.1.4.3 P/I Ecological Efficiency	61
	3.1.4.4 Possibility of Changing the Energy-use Efficiency at the Individual Level	62
	3.1.4.5 Possibility of Changing the Energy-use Efficiency of Populations	65
3.1.5	Conclusions	65
	Résumé	68
	References	70

3.2	“Natural” Mixed Forests and “Artificial” Monospecific Forests.	
	D. AUCLAIR	71
3.2.1	Introduction	71
3.2.2	Advantages of Mixed Forests	73
3.2.3	The Yield of Mixtures	75
3.2.4	Economic Considerations	77
3.2.5	Conclusions – Research on Mixed Forests	78
	Résumé	79
	References	82
3.3	Disturbance and Basic Properties of Ecosystem Energetics. W. A. REINERS	83
3.3.1	Introduction	83
3.3.2	Biomass and Energy Flow in Infrequently Disturbed Ecosystems .	84
	3.3.2.1 Net Primary Production and Energy Flow Pathways .	84
	3.3.2.2 Biomass and Detritus Accumulation	87
	3.3.2.3 Net Ecosystem Production	88
	3.3.2.4 Variation in Infrequent Disturbance Events	88
3.3.3	Biomass and Energy Flow in Multiple Disturbance Ecosystems .	89
	3.3.3.1 Constant Species Composition and Site Quality	89
	3.3.3.2 Changing Ecosystem Structure with Disturbance Frequency	92
3.3.4	Conclusions: Integration	93
	Résumé	96
	References	96
3.4	Ecosystem Water Balance. R. LEE	99
3.4.1	Basic Concepts	99
	3.4.1.1 Water Budgeting	99
	3.4.1.2 Energy Budgeting	101
	3.4.1.3 Practical Limitations	103
3.4.2	Ecosystem Influences	105
	3.4.2.1 Gross Precipitations	105
	3.4.2.2 Evaporation Losses	107
	3.4.2.3 Discharge Losses	108
3.4.3	Human Influences	110
	3.4.3.1 Major Disturbances	110
	3.4.3.2 Flow Regimes	113
	3.4.3.3 Miscellaneous Influences	115
3.4.4	Conclusions	115
	Résumé	116
	References	116
3.5	Some Problems of Disturbance on the Nutrient Cycling in Ecosystems.	
	M. RAPP	117
3.5.1	Introduction	117

3.5.2	Fire	118
3.5.3	Reforestation by Conifers	118
3.5.4	Forest Fertilization	120
3.5.5	Removal of Forest Products	122
3.5.6	The Mineral Budget and Plant Succession	123
3.5.7	Conclusions	126
	Résumé	126
	References	127
3.6	Mechanisms of Ion Leaching in Natural and Managed Ecosystems. P. M. VITOUSEK	129
3.6.1	Introduction	129
3.6.2	Leaching of Anions and Cations	130
	3.6.2.1 Measurement of Leaching Losses	130
	3.6.2.2 Leaching Mechanisms – Anion Mobility	131
	3.6.2.3 The Major Anions	132
	3.6.2.4 Effects of Management Practices on Nitrate Fluxes	138
	3.6.2.5 Leaching Losses in Other Biomes	140
3.6.3	Conclusions	141
	Résumé	141
	References	142
Section 4 Species Physiological Characteristics		145
4.1	The Determinants of Plant Productivity – Natural Versus Man-Modified Communities. H. A. MOONEY and S. L. GULMON	146
4.1.1	Introduction	146
4.1.2	Comparisons of Productivity	147
4.1.3	The Components of Plant Productivity	147
	4.1.3.1 The Biotic Component	147
	4.1.3.2 Environmental Influences on the Biological Components of Productivity	148
	4.1.3.3 Interactions of Productivity Components and Resource Level in Natural Communities	150
4.1.4	Succession and Plant Productivity	151
4.1.5	Succession Anomalies	152
4.1.6	Convergence in Productivity	154
4.1.7	Agricultural Versus Natural Community Productivity	155
4.1.8	Conclusions	155
	Résumé	156
	References	157
4.2	Plant Growth and Its Limitations in Crops and Natural Communities. B. SAUGIER	159
4.2.1	Introduction	159
4.2.2	Plant Growth Parameters	159

4.2.2.1	Photosynthesis	159
4.2.2.2	Respiration	161
4.2.2.3	Other Growth Processes	162
4.2.3	Comparison of Cultivated and Wild Species	162
4.2.3.1	The Case of Wheat	162
4.2.3.2	Adaptation of Natural Species to a Given Level of Resources	163
4.2.4	Crops Versus Natural Communities	167
4.2.5	Towards an Estimate in the Level of Available Resources . . .	170
4.2.5.1	Light	171
4.2.5.2	Water	171
4.2.5.3	Nutrients	172
4.2.6	Conclusions	173
	Résumé	173
	References	173
4.3	Patterns of Nutrient Absorption and Use by Plants from Natural and Man-Modified Environments. F. S. CHAPIN III	175
4.3.1	Introduction	175
4.3.2	General Patterns and Nutrient Use	176
4.3.3	Successional Changes in Nutrient Use	177
4.3.4	Nutritional Patterns Related to Disturbance	179
4.3.4.1	Abandoned Fields	179
4.3.4.2	Post-Fire Succession	180
4.3.4.3	Tundra Disturbance	180
4.3.4.4	Disturbances Causing Reduced Nutrient Availability .	181
4.3.5	Conclusions	184
	Résumé	184
	References	185
4.4	Comparisons of Water Balance Characteristics of Plant Species in "Natural" Versus Modified Ecosystems. P. C. MILLER	188
4.4.1	Introduction	188
4.4.2	Theoretical Background	189
4.4.2.1	Heat and Water Exchange Processes	189
4.4.2.2	Water Availability and Plant Characteristics	191
4.4.3	Survey of Plant Characteristics	196
4.4.3.1	General Relations	196
4.4.3.2	Factors and Processes Affecting Water Loss	196
4.4.3.3	Factors and Processes Affecting Water Uptake	197
4.4.3.4	State of Water in the Plant	199
4.4.3.5	Growth and Death in Relation to Plant Water Content .	201
4.4.4	Theoretical Considerations Relating Plant Characteristics and Successional State	201

4.4.4.1	Water Availability and Vegetative Recovery in the Semiarid Mediterranean Regions of Southern California	201
4.4.5	Conclusions	206
	Résumé	206
	References	207
Section 5	Population Characteristics	213
5.1	Reproductive Strategies and Disturbance by Man. P. H. GOUYON et al.	214
5.1.1	Introduction	214
5.1.2	Chemical and Sexual Polymorphism in Thyme	214
5.1.2.1	Sexual Polymorphism	214
5.1.2.2	Chemical Polymorphism	215
5.1.2.3	Environment and Population Genetic Structure	217
5.1.3	Enzymatic Polymorphism in Orchard Grass	220
5.1.4	Conclusions	223
	Résumé	224
	References	224
5.2	Demographic Strategies and Originating Environment. P. JACQUARD and G. HEIM	226
5.2.1	Introduction	226
5.2.2	Description of the Originating Environments	226
5.2.3	Between and Within-Population Variations of Strategies in <i>Arrhenatherum elatius</i>	227
5.2.4	Between and Within-Population Variations of Strategies in <i>D. glomerata</i>	230
5.2.5	Conclusions	234
	References	238
5.3	Genetic Characteristic of Populations. S. JAIN	240
5.3.1	Introduction	240
5.3.2	Population Studies in <i>Avena</i> spp.	241
5.3.3	Rose Clover, a Case History of Recent Colonization	244
5.3.4	Population Dynamics of Species in a Coastal Grassland Ecosystem	246
5.3.5	Variation and Colonization Success of Crop-Weed Hybrids	247
5.3.6	Alternative Strategies of Colonizing Success	248
5.3.7	Evolutionary Genetics of Adaptive Responses	250
5.3.8	Recombination Properties of Genetic Systems	251
5.3.9	Interspecific Interactions in Community Dynamics	252
5.3.10	Conclusions	254
	Résumé	255
	References	256
5.4	Characteristics of Populations in Relation to Disturbance in Natural and Man-Modified Ecosystems. F. A. BAZZAZ	259

5.4.1	Introduction	259
5.4.2	The Nature of Disturbance	260
5.4.3	Disturbance Characteristic with Relevance to Population Response	261
5.4.3.1	Size	261
5.4.3.2	Frequency of Occurrence	262
5.4.3.3	Intensity	263
5.4.3.4	Time of Disturbance	263
5.4.3.5	Level of Environmental Heterogeneity	263
5.4.3.6	Nature of the Biologic Neighborhood	266
5.4.4	Population Characteristics Responsive to Disturbance.	266
5.4.4.1	Density, Dispersion and Age Structure	266
5.4.4.2	Genotypic Variability in Populations	267
5.4.4.3	Interactions Between Species	268
5.4.5	Life History Characteristics and Disturbance	268
5.4.5.1	Life Span	268
5.4.5.2	Reproductive Strategies	269
5.4.5.3	Germination, Growth and Response Breadth	270
5.4.6	Conclusions	272
	Résumé	273
	References	273
	Subject Index	277