

Contents

Preface.....	xiii
Acknowledgments.....	xvii
About the Author	xix

Chapter 1	Working Concepts	1
1.1	Introduction	1
1.2	Common Knowledge Axioms	1
1.3	Wildlife in a Forest	3
1.3.1	What Is Wildlife?	3
1.3.2	Classification	4
1.3.3	Life Form.....	5
1.3.4	Life History of Animals.....	5
1.4	Environment of Forest Wildlife.....	5
1.4.1	The Centrum and Web	6
1.4.2	What Is Habitat?.....	7
1.5	Plants in a Forest	10
1.5.1	Life Form.....	10
1.5.2	Life History of Plants	11
1.6	Water in a Forest.....	11
1.6.1	Water Properties.....	12
1.6.2	Freshwater Habitats	12
1.6.3	Lakes	13
1.6.4	Streams.....	14
1.6.5	Seeps and Springs	14
1.6.6	Riparian Zones	15
1.7	Forest Diversity	16
1.7.1	Horizontal and Vertical Diversity	17
1.7.2	Layers	17
1.7.3	Components.....	18
1.7.4	Arrangement of Components	20
1.7.5	Biological Diversity.....	20
1.7.6	Edge.....	23
1.8	Vegetation	24
1.8.1	Classification	25
1.8.2	Stands of Trees	28
1.8.3	Openings in Stands	28
1.8.4	Dead Trees and Snags	28
1.8.5	Coarse Woody Debris	29

1.9	Forests As Ecological Systems.....	30
1.9.1	Hierarchical Organization.....	30
1.9.2	Structure and Processes	31
1.9.3	Nutrient Cycles.....	32
1.9.4	Energy Flow	33
1.9.5	Nutrient and Energy Pathways	34
1.9.6	Soil.....	35
1.9.7	Time and Space	36
1.9.8	Ecological Amplitude.....	36
1.9.9	Limiting Factors	37
1.10	Forest Succession.....	37
1.10.1	Agents of Change	38
1.10.2	Primary Succession	38
1.10.3	Secondary Succession	39
1.10.4	Tree Structural Stages	39
1.10.5	Old Forest Conditions.....	41
1.10.6	Changes over Time.....	42
1.11	Healthy Forest Conditions	44
1.11.1	Long-Term Productivity	44
1.11.2	Natural Events	44
1.11.3	Sustainability.....	45
1.11.4	Climate Change.....	45
1.12	The Menominee Paradigm	47
1.13	The Principle of Complementarity	48
	Knowledge Enhancement Reading	49
	References	49

Chapter 2	Survive and Reproduce	55
2.1	Introduction	55
2.2	Hazards.....	55
2.2.1	Fire	55
2.2.2	Roads	57
2.2.3	Fences.....	58
2.2.4	Weather.....	58
2.3	Diseases	59
2.3.1	Disease-Producing Agents	59
2.3.2	Pesticides, Herbicides, and Insecticides	61
2.4	Predators.....	61
2.4.1	The Leopold Report	61
2.4.2	Lotka-Volterra Equations	62
2.4.3	General Propositions	63
2.5	Humans.....	64
2.5.1	Habitat Destruction	64
2.5.2	Illegal Hunting	65

2.6	Biology.....	66
2.6.1	Reproduction	66
2.6.2	Behavior	68
2.6.3	Territory.....	68
2.6.4	Ecological Niche	69
2.6.5	Population Characteristics.....	69
2.6.6	Uninhibited Growth Model.....	73
2.6.7	Rates of Population Change	74
2.6.8	Inhibited Growth Model.....	78
2.6.9	Carrying Capacity	81
2.6.10	Life Table.....	82
2.6.11	Fluctuations	83
2.6.12	Demographic Vigor.....	85
2.7	Resources.....	85
2.7.1	Food.....	86
2.7.2	Cover	88
2.7.3	Water	89
2.7.4	Space	91
2.7.5	Mobility	91
2.7.6	Order of Magnitude.....	93
	Knowledge Enhancement Reading	95
	References	95

Chapter 3 Integrating Forestry and Wildlife Management..... 101

3.1	Introduction	101
3.2	Forest Types.....	101
3.2.1	Eastern Forest Types	103
3.2.1.1	White-red-jack pine (Type 10).....	103
3.2.1.2	Spruce-fir (Type 11).....	106
3.2.1.3	Longleaf-slash pine (Type 12)	106
3.2.1.4	Loblolly-shortleaf pine (Type 13)	108
3.2.1.5	Oak-pine (Type 14)	108
3.2.1.6	Oak-hickory (Type 15).....	109
3.2.1.7	Oak-gum-cypress (Type 16)	109
3.2.1.8	Elm-ash-cottonwood (Type 17)	109
3.2.1.9	Maple-beech-birch (Type 18).....	110
3.2.1.10	Aspen-birch (Type 19)	110
3.2.2	Western Forest Types	110
3.2.2.1	Douglas-fir (Type 20).....	110
3.2.2.2	Hemlock-Sitka spruce (Type 21).....	111
3.2.2.3	Ponderosa pine (Type 22)	111
3.2.2.4	Western white pine (Type 23).....	112
3.2.2.5	Lodgepole pine (Type 24).....	112
3.2.2.6	Larch (Type 25)	112

	3.2.2.7	Fir-spruce (Type 26)	112
	3.2.2.8	Redwood (Type 27)	113
	3.2.2.9	Pinyon-juniper (Type 28)	113
	3.2.2.10	Western hardwoods (Type 29)	114
3.3		Forest Management	114
	3.3.1	Silvicultural Systems	115
	3.3.2	Tree Species Tolerance	115
	3.3.3	Even- and Uneven-Aged Stands	116
	3.3.4	Clearcutting	116
	3.3.5	Shelterwood	119
	3.3.6	Seed Tree	120
	3.3.7	Selection	120
	3.3.8	Old Forest Conditions	120
	3.3.9	Thinning	121
	3.3.10	Spacing of Trees	121
	3.3.11	Forest Regulation	121
	3.3.12	Rotation	122
	3.3.13	Cutting Cycle	123
3.4		Wildlife Management	124
	3.4.1	Hazards	124
	3.4.2	Diseases	125
	3.4.3	Humans	127
	3.4.4	Predators	127
	3.4.5	Biology	128
	3.4.6	Resources	134
3.5		Integrating Factors	136
	3.5.1	A Matter of Scale	137
	3.5.2	Time	137
	3.5.3	Natural Rotation	137
	3.5.4	Stand Size and Distribution	138
	3.5.5	Log-Normal Distribution	138
	3.5.6	Nonadjacency Constraint	139
	3.5.7	The Landscape Factor	140
	3.5.8	Tradition and Other Considerations	141
	3.5.9	Grazing Systems	143
	3.5.10	Conflicts and Competition	143
	3.5.11	National Research Council	145
3.6		Restore and Maintain Resources and Diversity	146
	3.6.1	Wildlife Coordination and Restoration Measures	151
	3.6.2	Timber Coordination and Restoration Measures	153
	3.6.3	Range Coordination and Restoration Measures	155
	3.6.4	Engineering Coordination and Restoration Measures	156

3.6.5	Watershed Coordination and Restoration Measures.....	157
3.6.6	Recreation Coordination and Restoration Measures.....	157
3.6.7	Land Use Coordination and Restoration Measures.....	158
3.6.8	Aquatic Coordination and Restoration Measures	158
	Knowledge Enhancement Reading	159
	References	160

Chapter 4	Management Strategies	163
4.1	Introduction	163
4.2	Ecosystems	163
4.2.1	Local and Formational	164
4.2.2	Landscapes	164
4.2.3	Habitat Area	164
4.3	Wildlife Habitat Relationships	166
4.3.1	Single Species.....	168
4.3.2	Multispecies	169
4.3.3	Featured Species.....	170
4.3.4	Guilds	171
4.3.5	Life Form.....	171
4.4	Ecological Factors	172
4.4.1	Indicators.....	173
4.4.2	Biological Diversity.....	174
4.4.3	Edge.....	174
4.4.4	Habitat Corridors.....	176
4.4.5	Gap Analysis	177
4.5	Habitat Models	177
4.5.1	Factors to Consider.....	178
4.5.2	Decision Making	180
4.5.2.1	Decision Tree	181
4.5.2.2	Expert Systems	181
4.5.3	Pattern Recognition.....	183
4.5.4	Habitat Indices.....	185
4.5.5	Stand Structure Model	186
4.5.6	Wildlife Data Models	186
4.6	Habitat Evaluation and Monitoring	188
4.6.1	Ecosystem Functioning	188
4.6.2	Habitat Quality and Populations	189
4.6.3	Habitat Suitability Index	189
4.6.4	Condition and Trend.....	190
4.6.5	Monitoring Habitat Change.....	194

4.7	Integrated Management.....	194
4.7.1	Adaptive Management.....	195
4.8	Planning.....	196
4.8.1	Laws and Policy	197
4.8.2	Fish and Wildlife Coordination Act.....	197
4.8.3	Multiple-Use, Sustained-Yield Act.....	198
4.8.4	Sikes Act.....	198
4.8.5	National Environmental Policy Act	198
4.8.6	Endangered Species Act.....	198
4.8.7	Forest and Rangeland Renewable Resources Planning Act (RPA).....	199
4.8.8	National Forest Management Act (NFMA)	199
4.8.9	Governing Policies	199
4.8.10	Why Plan?	201
4.8.11	Factors to Consider.....	201
4.8.12	Operational Plans	202
4.8.13	Checklist for Background Information	203
4.8.14	Decision Support Systems.....	203
4.8.15	Project Implementation	204
4.9	Inventory.....	205
4.9.1	Multiresource Inventory.....	205
4.9.2	Categories of Inventory	206
4.9.3	Intensity of Inventory	207
4.9.4	Map Scale.....	208
4.9.5	Geographic Information Systems.....	209
4.10	Sampling.....	209
4.10.1	Types of Sampling.....	210
4.10.2	Shape and Size of Sample Units.....	211
4.10.3	Sampling Design	212
4.10.4	Information to be Collected	213
4.10.5	Uses of Habitat Data.....	214
4.10.6	Estimating Animal Numbers	215
4.10.7	Counting Animals (Direct)	215
4.10.8	Counting Signs (Indirect).....	216
4.10.9	Tree Measurements	218
	Knowledge Enhancement Reading	220
	References	220

Chapter 5 Forest Attributes and Wildlife Needs (FAAWN) 225

5.1	Background Information	225
5.2	Relational Database Systems.....	228
5.2.1	Structure and Organization	228
5.2.2	Quality Control.....	228
5.2.3	Relation Theory	228
5.2.4	Relationship Systems.....	229

5.2.5	Design Criteria	230
5.2.6	How Relational Systems Work	231
5.2.7	Rules for Placing the Links	231
5.2.8	Determining the Links	232
5.2.9	Evaluate and Test the Design	232
5.3	Developing a Relational Data Model	233
5.3.1	Animals	243
5.3.2	Food	245
5.3.3	Life-Needs	245
5.3.4	States	246
5.3.5	Hypothesized	247
5.3.6	Regions	247
5.3.7	Types-States	248
5.3.8	Types-Codes	248
5.3.9	Plants-Types	248
5.3.10	Plants	248
5.3.11	National	248
5.4	A Way of Learning	248
5.4.1	Using the Data Model	248
5.4.2	Examples of Output	249
5.4.3	Suggested Additions	249
5.4.4	Entering and Editing Data	250
5.5	Using the Computer Disk	250
	Knowledge Enrichment Reading	251
	References for Validating Information	251
	References	253
	Appendix: Conversion Factors	255
	Index	257