

# CONTENTS

---

## PART I

### BACKGROUND AND BASIC CONCEPTS 1

#### CHAPTER 1

#### INTRODUCTION 3

Ecology, Environment, and Vegetation 4

Specializations Within Plant Ecology 7

#### CHAPTER 2

#### A BRIEF HISTORY OF PLANT ECOLOGY 12

Foundations in Plant Geography 12

The Establishment of Plant Ecology Apart from Plant Geography 15

Plant Ecology Since 1925 21

## PART II

### THE SPECIES AS AN ECOLOGICAL UNIT 27

#### CHAPTER 3

#### THE SPECIES IN THE ENVIRONMENTAL COMPLEX 29

Environmental Factors and Plant Distributions 29

The Taxonomic Species 33

The Ecological Species 35

Summary 51

|  |     |     |
|--|-----|-----|
| CHAPTER 4  |     |     |
| POPULATION STRUCTURE AND PLANT DEMOGRAPHY                                      |     | 52  |
| Density and Pattern  | 52  |     |
| Plant Demography   | 56  |     |
| Summary  | 77  |     |
| CHAPTER 5  |     |     |
| LIFE HISTORY PATTERNS AND RESOURCE ALLOCATION                                  |     | 79  |
| Plant Economics  | 80  |     |
| Life-Span and Reproduction   | 82  |     |
| Life-Span and Environment  | 84  |     |
| Seed Dormancy and Dispersal  | 87  |     |
| Classification of Life History Patterns  | 90  |     |
| Summary  | 103 |     |
| CHAPTER 6  |     |     |
| SPECIES INTERACTIONS: Competition and Amensalism                               |     | 105 |
| Competition  | 109 |     |
| Amensalism   | 119 |     |
| Summary  | 132 |     |
| CHAPTER 7  |     |     |
| SPECIES INTERACTIONS: Commensalism, Protocooperation, Mutualism, and Herbivory |     | 133 |
| Commensalism   | 133 |     |
| Protocooperation   | 139 |     |
| Mutualism  | 140 |     |
| Herbivory  | 147 |     |
| Summary  | 152 |     |
| PART III   |     |     |
| THE COMMUNITY AS AN ECOLOGICAL UNIT  |     | 155 |
| CHAPTER 8  |     |     |
| COMMUNITY CONCEPTS AND ATTRIBUTES  |     | 156 |
| Is the Association an Integrated Unit?   | 156 |     |

|                           |     |
|---------------------------|-----|
| Some Community Attributes | 160 |
| Summary                   | 180 |

## CHAPTER 9

## METHODS OF SAMPLING THE PLANT COMMUNITY 182

|  |     |
|--|-----|
| The Relevé Method  | 183 |
| Random Quadrat Methods                                       | 188 |
| Plotless Methods: Line Intercept, Strip Transect, and Bisect | 198 |
| The Point Method   | 198 |
| Distance Methods   | 203 |
| Summary  | 207 |

## CHAPTER 10

## CLASSIFICATION AND ORDINATION OF PLANT COMMUNITIES 209

|                |     |
|----------------|-----|
| Classification | 210 |
| Ordination     | 223 |
| Summary        | 228 |

## CHAPTER 11

## SUCCESSION 230

|                                   |     |
|-----------------------------------|-----|
| Types of Succession               | 232 |
| Methods of Documenting Succession | 240 |
| General Trends During Succession  | 250 |
| Driving Forces of Succession      | 255 |
| Summary                           | 263 |

## CHAPTER 12

## PRODUCTIVITY 265

|  |     |
|--|-----|
| Terrestrial Vegetation and the Global Carbon Cycle       | 265 |
| Energy Flow Model  | 267 |
| Methods of Measuring Productivity                        | 269 |
| Patterns of Productivity and the Distribution of Biomass | 272 |
| Environmental Factors and Productivity                   | 283 |
| Summary  | 292 |

|   |     |
|---|-----|
| CHAPTER 13  |     |
| MINERAL CYCLES                                    | 294 |
| Introduction                                      | 294 |
| Plant Nutrients                                   | 300 |
| Factors in Nutrient Cycling                       | 302 |
| Nutrient Cycling in Different Vegetation Types    | 313 |
| Stability   | 321 |
| Summary   | 322 |
| <br>PART IV                                       |     |
| ENVIRONMENTAL FACTORS                             | 325 |
| <br>CHAPTER 14                                    |     |
| LIGHT AND TEMPERATURE                             | 326 |
| Solar Energy Budget                               | 327 |
| Measurement and Physical Properties of Radiation  | 329 |
| Variations in Light and Temperature               | 334 |
| Light- and Temperature-Mediated Plant Responses   | 346 |
| Summary   | 353 |
| <br>CHAPTER 15                                    |     |
| PHOTOSYNTHESIS                                    | 356 |
| Photosynthetic Pathways                           | 356 |
| Environmental Factors and Photosynthetic Response | 366 |
| Methods of Photosynthetic Research                | 376 |
| Summary   | 380 |
| <br>CHAPTER 16                                    |     |
| FIRE  | 382 |
| Human History                                     | 383 |
| Classes of Fire                                   | 383 |
| Fire Effects on Soil                              | 384 |
| Forests of the Southeastern United States         | 390 |
| Grassland Fire                                    | 392 |
| Mediterranean Climatic Regions                    | 396 |
| Giant Sequoia Forests                             | 402 |
| Summary   | 405 |

## CHAPTER 17

## SOIL

407

|                                     |     |
|-------------------------------------|-----|
| The Soil Cycle and Soil Development | 408 |
| Soil Profiles                       | 413 |
| Physical Properties of Soils        | 417 |
| Soil Chemistry                      | 424 |
| Soil Taxonomy                       | 429 |
| Summary                             | 432 |

## CHAPTER 18

## WATER: The Soil-Plant-Atmosphere System

434

|   |     |
|---|-----|
| The Water Potential Concept                 | 434 |
| The Soil-Plant-Atmosphere System            | 438 |
| Solute Concentration and Plant Water Status | 456 |
| Plant and Soil Water Status Measurements    | 458 |
| Summary                                     | 462 |

## CHAPTER 19

## WATER: Environment and Adaptations

464

|   |     |
|---|-----|
| Water in the Environment                  | 464 |
| Special Adaptations                       | 476 |
| Life Form Responses and Habitat Selection | 480 |
| Summary                                   | 483 |

## CHAPTER 20

## MAJOR VEGETATION TYPES OF NORTH AMERICA

486

|                  |     |
|------------------|-----|
| Tundra           | 486 |
| Conifer Forests  | 496 |
| Deciduous Forest | 511 |
| Grasslands       | 522 |
| Desert Scrub     | 537 |
| References       | 554 |

## LITERATURE CITED

568

## INDEX

623