FOREST STAND DYNAMICS

UPDATE EDITION

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# TABLE OF CONTENTS

Preface xv

## Chapter 1. Introduction

The "Niche" of Stand Dynamics 2  
Historical Perspective 4  
Approach of This Book 6  
General Applications to Management 6

## Chapter 2. Plant Interactions and Limitations of Growth 9

### Introduction

9

### Mutualism and Competition Among Species

Mutualism 10  
Competition 11  
Mutualism and competition 13

### Where Plants Are Found

14

### The Niche

14

- The gradient of soils 14  
- The gradient of climate 18  
- Three-dimensional niche 19  
- Multidimensional niche 20  
- Other gradients 20

### Limitations to Growth

21  
**Sunlight** 22  
**Water** 23  
**Nutrients** 23  
**Free-growing microorganisms and nutrient availability** 24  
**Temperature** 26  
**Oxygen** 26  
**Carbon dioxide** 27  
**Other factors** 27

### The Concept of Growing Space

27  
- Factors which limit growing space 28  
- Variations in growing space between areas 29  
- Variations in growing space within a site 29  
- Variations in growing space caused by disturbances 34  
- Changes in growing space during forest development after a disturbance 35  
- Growing space available to each plant 36
Diversity and Stability in Plant Communities
Applications to Management

Chapter 3. Tree Architecture and Growth

Introduction
General Growth Patterns
  Primary vegetative growth of the stem
  Floral shoot growth
  Root growth
  Secondary growth
Shoot Development Patterns
  Apical meristem
  Prefonned growth
  Sustained growth
  Recurrent flush growth
  Terminal florescence growth
  Aborted tip growth
  Other growth forms
  Changes in shoot development patterns
Crown Shapes
  Epinastic control
  Changes in crown shapes
Height Growth
  General patterns
  Variation in height growth
Regeneration Mechanisms
Root Growth
Crown and Tree Development
  Growth of a tree in the open
  Growth with side shade
  Growth and allocation of photosynthate
  Increases in crown size
  Effects of high shade
Applications to Management

Chapter 4. Disturbances and Stand Development

Introduction
Awareness of Disturbances
Impact of Disturbances
  Magnitude of the disturbance agent
  Predisposition of the stand to the disturbance
Classification of Disturbances
  Amount of overstory removed: major (stand replacing)
    and minor disturbances
  Frequency of disturbances
  Spatial patterns of disturbances
Characteristics of Different Disturbance Agents
  Fires
Winds 107
Floods 115
Erosion 117
Siltation 118
Landslides 119
Avalanches 120
Glaciers 120
Volcanic activities 122
Ice stonns 123
Mammals 124
Insects and diseases 125

Tree Responses to Disturbances 126
Trees surviving minor disturbances 126
Disturbances and regeneration mechanisms 128

Applications to Management 140

Chapter 5. Overview of Stand Development Patterns 145

Introduction 145

Development Patterns Following Major (Stand Replacing) Disturbances 146

Single- and Multiple-Cohort Stands (Even-Aged and Uneven-Aged Stands) 147

Stages of Stand Development 148
Stand initiation stage 148
Stem exclusion stage 152
Understory reinitiation stage 157
Old growth stage 158

Development Patterns following Minor Disturbances 159
Overview 159
Development of multicohort stands 163

Overview of Forest Development Patterns 164
Structural vs Process Approaches to Stand Classification 165
Disturbance Frequency and General Forest Type 166
Applications to Management 167

Chapter 6. Temporal and Spatial Patterns of Tree Invasion 171

Introduction 171

Age Distributions in Single- and Multiple-Cohort Stands 172
Age distributions in single-cohort stands 173
Age distributions in multicohort stands 177

Spatial Distributions of Trees in Single- and Multiple-Cohort Stands 180

Development of Different Spatial and Temporal Patterns 183
Behaviors of the component individuals and species 183
Influence of events before a disturbance 184
Influence of the disturbance 190
Influence of events after the disturbance 192

Applications to Management 192
Chapter 7. Stand Initiation Stage:
  Single-Cohort Stands

Introduction 195
Factors Affecting Early Stand Development 195
  Many growth patterns of competing vegetation 196
  Many species and individuals 198
  Broad relative range of plant ages 199
  Small sizes of plants compared with their physical surroundings 199
  Rapidly changing environment 201
  Presence of available growing space 203
Pattern of Stand Development in the Stand Initiation Stage 203
  Free growth (open growth) period 204
  Competition 205
  Later development of the stand initiation stage 206
Emergent Properties 208
Applications to Management 209

Chapter 8. Stem Exclusion Stage:
  Single-Cohort Stands, Single-Species Stands

Introduction 213
Idealized Stand Development 214
Stand Development with Differentiation 217
  Variations in spacings 219
  Variations in microsites 222
  Variations in ages 224
  Variations in genetic makeup 225
  Other factors 225
Emergent Properties of Developing Stands 226
  Variations in species behavior 226
  Site and differentiation 226
  Narrowly spaced stands 226
  Changes in spatial patterns 227
  Waves of mortality 227
  Autogenic life span of stands with different initial spacings 228
Responses to Thinning 228
  Innate crown characteristics 229
  Release of trees with small crowns 230
  Release of trees with large crowns 231
  Tree vigor, stand structure, and tree response to release 232
  Release in well-differentiated stands 232
Responses to Limitations Other Than Light 232
Applications to Management 233
Chapter 9. Stem Exclusion Stage: Single-Cohort Stands, Mixed-Species Stands

Introduction 235
General Patterns of Mixed-Species Stands 236
  Development patterns 236
  Canopy strata and crown classes 237
  Emergent patterns 237
Examples of Mixed-Species Development 238
  Northern red oak, red maple, black birch, and hemlock (Figs. 9.1 and 9.2) 238
  Cherrybark oak and sweetgum 240
  Cherrybark oak and loblolly pine 241
  Cherrybark oak and sycamore (Fig. 9.3) 241
  Oak and tulip poplar (Fig. 9.4) 241
  Douglas-fir and western hemlock (Fig. 9.5) 241
  Douglas-fir, red alder, western hemlock, western redcedar, and bitter cherry (Fig. 9.6) 243
  Sitka spruce and red alder 246
  Western larch, lodgepole pine, Douglas-fir, and grand fir (Fig. 9.7) 246
  Sitka spruce and western hemlock (Fig. 9.8) 246
  Pacific silver fir and western hemlock 248
  Western redcedar 249
Factors Influencing Development 250
  Height growth 251
  Branch and limb stiffness 251
  Shade tolerance 252
  High shade, crown shapes, and height growth 253
  Spatial pattern 253
  Slight differences in ages 253
  Regeneration mechanics 254
  Site 255
  Numbers of trees, life spans, and mortality rates 255
  Compounding effects of many species 256
Applications to Management 256

Chapter 10. Understory Reinitiation Stage 259

Introduction 259
Changes in the Overstory 259
  Changing development and physiognomy of the trees 260
  Changing effects of mortality 260
  Changing understory environment 261
  Changes caused by minor disturbances 262
Development of the Forest Floor Vegetation 262
Eventual Fates of the Stands 266
Applications to Management 266
Chapter 11. Old Growth Stage 269

Introduction 269
Process and Structural Definitions of "Old Growth" 270
Time when the old growth stage is reached 273
Development of transition and old growth stands 275
Fates of old growth stands 279
Definitions of Old Growth Structures 279
Applications to Management 281

Chapter 12. Multicohort Stands: Behavior of Component Cohorts 283

Introduction 283
Factors Influencing Development of Each Cohort 284
Influences common to single- and multicohort stands 284
Influences of associated cohorts 284
Low shade and high shade 284
Angle of sunlight 284
Crown expansion and densification 285
Soil moisture and nutrients 286
Other influences 288
Behavior of a Single-Cohort in Multicohort Stands 288
Initiation of a cohort 288
Growth beneath an overstory 289
Disturbances to an understory cohort 292
Release from overhead competition 292
Applications to Management 293

Chapter 13. Development of Multicohort Stands 295

Introduction 295
Interpretations of Multicohort Stand Development 295
Relay floristics 295
Sizes and ages of trees 296
Selection harvesting of mixed-species stands 297
Patch concept of stand development 300
Idealized Development of Multicohort Stands 300
Idealized height growth patterns 301
Tree shapes 302
Variations in Development Patterns and Emergent Properties 302
Diameter distributions 302
Variations in height growth 305
Species composition 306
Overstory and understory vigor 308
Spatial patterns 311
Commonness of Multicohort Stands 311
Applications to Management 312
Chapter 14. Stand Edges, Gaps, and Clumps

Introduction
Causes of Stand Edges
Soil variations
Microclimate variations
Ages of adjacent stands
Different disturbance types
Different residual overstory densities
Differences in more than one factor
Development Patterns of Stand Edges
Edge between two stands of the same age
Edge of a stand developing adjacent to an opening
Edge of a stand beginning next to an older stand
Characteristics of Edges
Root occupancy by edge trees
Shade influences
Seed dispersal
Wind and temperature amelioration
Animal influences
Patches-Gaps and Clumps and Independent Stands
Applications to Management

Chapter 15. Quantification of Stand Development

Introduction
Measures of Growth and Yield
Tree and stand growth
Tree and stand yield
Single-Species, Single-Cohort Stands
Undifferentiated stands
Tree and stand yield
Stands undergoing differentiation
Growth and yield with thinning
Growth, growing stock, and stand density
Constant final yield
Summary of quantitative relations
Mixed-Species, Single-Cohort Stands
Species characteristics
Stage of development
Site characteristics
Other factors
Multicohort Stands
Applications to Management
Stand management guides
Adaptive management
### Chapter 16. Forest Patterns over Long Times and Large Areas

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>365</td>
</tr>
<tr>
<td>Changes on a Single Area over Time</td>
<td>366</td>
</tr>
<tr>
<td>The component species</td>
<td>366</td>
</tr>
<tr>
<td>Changes between disturbances</td>
<td>368</td>
</tr>
<tr>
<td>Disturbances</td>
<td>373</td>
</tr>
<tr>
<td>Forest Patterns over Large Areas</td>
<td>380</td>
</tr>
<tr>
<td>Geomorphology and stand spatial patterns</td>
<td>382</td>
</tr>
<tr>
<td>Climate</td>
<td>383</td>
</tr>
<tr>
<td>Disturbance patterns</td>
<td>385</td>
</tr>
<tr>
<td>Development following disturbances</td>
<td>390</td>
</tr>
<tr>
<td>Vegetation of the area</td>
<td>390</td>
</tr>
<tr>
<td>Consequences of Changing Vegetation Patterns</td>
<td>390</td>
</tr>
<tr>
<td>Impacts of future stands</td>
<td>390</td>
</tr>
<tr>
<td>Impact on species</td>
<td>391</td>
</tr>
<tr>
<td>Applications to Management</td>
<td>394</td>
</tr>
<tr>
<td>Anticipating future concerns</td>
<td>394</td>
</tr>
<tr>
<td>&quot;Sustainable development,&quot; &quot;ecosystem management,&quot; and related terms</td>
<td>396</td>
</tr>
<tr>
<td>The role of silviculturists in managing forests</td>
<td>398</td>
</tr>
<tr>
<td>References</td>
<td>399</td>
</tr>
<tr>
<td>Appendix: Scientific Names of Plant Species Discussed</td>
<td>499</td>
</tr>
<tr>
<td>Source Notes</td>
<td>503</td>
</tr>
<tr>
<td>Index</td>
<td>509</td>
</tr>
</tbody>
</table>
PREFACE

This book describes the various growth patterns of forests from a mechanistic point of view. Its purpose is to help silviculturists and forest managers understand and anticipate how forests grow and respond to intentional manipulations and natural disturbances. Demands on the forest have been increasing for timber production, wildlife habitat, water protection, recreation, and protection from fires, insects, and diseases. These demands have created an emphasis on prescribing site-specific treatments for individual stands of trees, rather than treating broad areas uniformly.

The book is a result of discussions with silviculturists in many parts of North America and elsewhere. Foresters in all regions have wanted to know how forests will grow with and without various manipulations so they can prescribe the most appropriate treatments. Informal discussions and seminars have led to short courses for midcareer silviculturists about stand dynamics. Travels to forests in many regions of the continent and world have led us to realize that similar patterns and processes of development are occurring in many places. As we synthesized material on forest development, we were further encouraged to make it available to a wide audience by publishing it as a book.
Strong interest in the 1990 edition of the book has led us to publish this updated version. Knowledge has advanced and expanded in many fields, and we have tried to update this knowledge and expand the references, although they are by no means exhaustive. Interest from abroad in the book and continued evidence that similar patterns and processes are occurring in forests in many places led us to expand the book to include more global references and examples. Recent advances in understanding climate change, multicoHORT stand development, mixed species stands, pruning, and stand edges has led us to update information in these areas. We are increasingly realizing that many of the values from the forest can not be provided by managing individual stands without regard to the surrounding landscape. Consequently, we have expanded our discussion on landscapes in many places in the book. Because concerns about protecting all species and "sustainability" directly relate to stand dynamics, we have included discussions of the relation of stand and landscape development to population changes of animals and plants. This discussion is different from many, since it regards the species from the perspective of the changing forest environment, rather than viewing the environment from the perspective of the species. We have expanded the discussion of applications to management include such topics as "sustainable development," "ecosystem management," and "adaptive management."

This book serves several purposes:

- It gives the state of knowledge of how forest stands develop, so future silvicultural practices can be done with a higher level of expertise.

- It synthesizes knowledge on the subject, to allow future research efforts to build on this knowledge.

- It shows that similar development patterns are occurring in many forests in North America and beyond.

- It puts a scientific perspective on the various ways society is considering relating to forests.

Recent appreciation of the role of disturbances and the continued responses of stands to natural disturbances has brought silvicultural and ecological research closer together. Many individual pieces of knowledge reported in this book are not new; however, no book has previously synthesized the information from physiology, ecology, and silviculture and compared patterns in different regions as is done here. We have intentionally given citations from a broad range of new and old applied forestry and basic ecology literature. The references show that many ideas have existed in forestry literature for many decades but have not been synthesized. Some of these ideas are more recently being reported in ecological literature.

The book emphasizes the constant change of all forests and shows that similar patterns of change are occurring within different regions. This book first gives a philosophical perspective from which to view forests--competition, the «niche," and "growing
space." It then describes individual tree growth patterns. Disturbances are then described, not as black boxes, but as specific events with different characteristics and degrees of predictability. The rest of the book builds on individual tree growth and disturbance patterns to show how forest physiognomies change in time both qualitatively and quantitatively. "Even-aged" development of stands beginning after stand-replacing disturbances are first described. Then, "uneven-aged" stands with new "cohorts" beginning after minor disturbances are described. Finally, the broad perspective of forest changes over landscapes is discussed.

The intent of the book is to describe patterns and to include and reconcile as many other perspectives of forest development as possible. In several places we suggest new terminology and/or refrain from using old terminology. The intent is not to establish new laws or to proliferate jargon, but to be more accurate in describing patterns. Time will determine if the new words are useful enough to last. Some statements in the book have not been referenced. These statements are generally based on personal observations or those of reliable colleagues. We felt it was important to raise certain issues to be scrutinized rather than err in omission.

The book is meant to give a biological basis for more applied books such as *The Practice of Silviculture* (Smith, 1986) and *Principles of Silviculture* (Daniel et al., 1979). On the other hand, it covers more of the patterns of stand development but delves less into basic physiology and ecology than do *Forest Ecology* (Spurr and Barnes, 1980), *Forest Ecology* (Kimmins, 1987), and *Forest Ecosystems: Concepts and Management* (Waring and Schlesinger, 1985).

Many people have contributed to this book. We are grateful to our students (graduate and undergraduate) who have provided ideas and sounding boards at Harvard University, University of Washington, Duke University, Yale University, and Middle East Technical University (Turkey). Many midcareer silviculturists around the country have given helpful input in midcareer short courses on the subject. Our scientific colleagues in North America and abroad have also been very helpful. We are especially grateful to Mr. E. C. Burkhardt of Vicksburg, Mississippi, for his enthusiasm and encouragement, which made us realize the importance of this subject; without his encouragement this book would not have been written. David M. Smith gets our special thanks for his encouragement and emphasis on studying stand dynamics. The encouragement of Walter Knapp of the U.S. Forest Service, Portland, Oregon, was also instrumental in our writing this book. Ernest Gould, Walter Lyford, and Hugh Raup will always be remembered by us for the education and encouragement we received from them at the Harvard Forest many of their ideas are in this book. Kenneth J. Mitchell provided many of the ideas on forest growth through his careful research, for which we are grateful. We are also thankful for the careful reviews and many suggestions of Graeme Berlyn, Melih Boydak, Mary Ann Fajvan, Douglas Fredericks, Glenn Galloway, Judy Greenleaf, John Helms, John Kershaw, Karen Kuers, David Larsen, Jim Mc Carter, David Marquis, Xiandong Meng, Michael G. Messina, Melinda Moeur, Kevin O'Hara, Akira Osawa, Reza Pezeshki, Gerardo Segura, Fiorenza Ugolini, Robert van Pelt, Daniel Vogt, and Kristiina Vogt. We appreciate the help and thoughtfulness of Mrs. Carol Green and Ms. Carol Bruun of the University of Washington Forest Resources Library, and of Mrs. Dorothea Kewley,
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