Preface vii

Acknowledgments ix

Timeline: From the Glaciers to the Present xi

Prologue: Step into the Forest—Today 1

#### PART 1. THE FOREST ECOSYSTEM AS A LABORATORY

- 1 Ecosystem and Ecological Studies at Hubbard Brook 9
- 2 The Small Watershed-Ecosystem Approach 17

### CONTENTS

#### PART 2. CHARACTERISTICS OF THE WATERSHED-ECOSYSTEMS

- 3 Physical Setting and Climate 25
- 4 The Forest: Past and Present 33
- 5 A Rich Array of Organisms and Their Interactions 49

# PART 3. UNDERSTANDING FOREST ECOSYSTEM STRUCTURE AND FUNCTION

- 6 How Is Energy Transformed? 75
- 7 Hydrology: Water Balance and Flux 90
- 8 Biogeochemistry: How Do Chemicals Flux and Cycle? 95
- 9 The Discovery of Acid Rain at Hubbard Brook 114

## PART 4. DISCOVERIES FROM LONG-TERM STUDIES AND EXPERIMENTAL MANIPULATIONS

- 10 The Consequences of Acid Rain and Other Air Pollutants 127
- 11 The Effects of Forest Harvesting and Other Disturbances: Whole-Watershed Manipulations 138
- 12 How Does the Forest Ecosystem Recover After Harvesting and Other Disturbances? 148
- 13 How Stream Ecosystems Are Integrated with Their Watersheds 155
- 14 What Causes Population Change in Forest Birds? 167
- 15 Scaling Up: Ecosystem Patterns and Processes Across the Valley 186
- 16 How Is Climate Change Affecting the Forest Ecosystem? 201

### PART 5. BROADER IMPACTS AND LOOKING TO THE FUTURE

- 17 Reaching Out: Hubbard Brook's Influence on Environmental Policy, Management, and Education 215
- 18 A Look Ahead: The Forest Ecosystem in the Future 225

Epilogue: Step into the Forest-2065 233

APPENDIX 1. Scientific Units: Conversions and Abbreviations 237 APPENDIX 2. Scientific Names and Lists of Selected Organisms 239

Notes 243 Bibliography 249 Index 265