

# Contents

Foreword.....	V
Preface .....	VII
Contributors .....	XVII
Color Plates .....	XXI

## Part 1: Introduction

<b>1 Description of Forests and Forestry in East Kalimantan</b>	
M. FATAWI and T. MORI .....	3
1.1 Introduction .....	3
1.2 Forest Flora and Fauna in East Kalimantan .....	5
1.3 Forestry Activity .....	7
1.4 Forest Conversion and Human Activity .....	9
1.5 Concluding Remark .....	11
<b>2 Climate in Bukit Soeharto, East Kalimantan</b>	
T. TOMA, MARJENAH, and HASTANIAH .....	13
2.1 Introduction .....	13
2.2 General Characteristics .....	14
2.3 Rainfall .....	16
2.4 Microclimate .....	19
2.5 Conclusion .....	25
<b>3 Effects of Droughts and Forest Fires on Dipterocarp Forest in East Kalimantan</b>	
T. MORI .....	29
3.1 Introduction .....	29
3.2 Cause of Forest Fires in 1998 .....	31
3.3 What the Fires Did to the Forests .....	34
3.4 Recovery of the Forest Vegetation .....	40
3.5 Conclusion .....	42
	IX

## Part 2: Soil Characteristics and Human Impacts

<b>4</b>	<b>Are Soils in Degraded Dipterocarp Forest Ecosystems Deteriorated? A Comparison of <i>Imperata</i> Grasslands, Degraded Secondary Forests, and Primary Forests</b>	
	S. OHTA, K. MORISADA, N. TANAKA, Y. KIYONO, and S. EFFENDI	49
4.1	Introduction .....	49
4.2	Study Area, Vegetation and Soils .....	50
4.3	Chemical Properties .....	50
4.4	Conclusion .....	55
<b>5</b>	<b>Vertical Transportation of Chemical Elements Through Water Movement in Different Vegetation</b>	
	N. TANAKA, D. AKSA, S. EFFENDI, and S. OHTA .....	59
5.1	Introduction .....	59
5.2	Sites .....	61
5.3	Change in Water Chemistry Along the Pathways in Different Vegetation .....	61
5.4	Fine Litter Fall and Its Chemical Composition .....	65
5.5	Annual Element Fluxes .....	65
5.6	Conclusion .....	67
<b>6</b>	<b>Changes in Soil Nutrient Status After Abandonment of Swidden Agriculture at Benuaq Dayak Village</b>	
	K. MORISADA, S. EFFENDI, and S. OHTA .....	69
6.1	Introduction .....	69
6.2	Fallow Forests in the Mencimai Village Area .....	70
6.3	Changes in the Physio-Chemical Properties of Soil with Fallow Period .....	71
6.4	Changes in Nutrient Stock with Fallow Period .....	72
6.5	Conclusion .....	76
<b>7</b>	<b>Serpentine Soils on Catena in the Southern Part of East Kalimantan, Indonesia</b>	
	S. EFFENDI, S. MIURA, N. TANAKA, and S. OHTA .....	79
7.1	Introduction .....	79
7.2	Study Area and Soils .....	80
7.3	Chemical Properties .....	82
7.4	Soils on Serpentine Catena .....	85
7.5	Conclusion .....	86

<b>8</b>	<b>Characteristics of Soils Developed on Volcanic Parent Materials in the Barong Tongkok Area</b>	
	D. AKSA, N. TANAKA, S. OHTA, and S. EFFENDI .....	89
8.1	Introduction .....	89
8.2	Study Area .....	90
8.3	Morphology and Physico-Chemical Properties .....	90
8.4	Comparison with Soils on the Tertiary Deposits .....	93
8.5	Conclusion .....	95

### **Part 3: Drought and Fire Impacts on Forest Ecosystems**

<b>9</b>	<b>Tree Species Composition of a Burned Lowland Dipterocarp Forest in Bukit Soeharto, East Kalimantan</b>	
	P. MATIUS, T. TOMA, and M. SUTISNA .....	99
9.1	Introduction .....	99
9.2	The Large-scale Study Plot in Bukit Soeharto .....	100
9.3	Tree Density and Basal Area .....	100
9.4	Species Composition .....	101
9.5	Conclusion .....	104
<b>10</b>	<b>Dynamics of Burned Lowland Dipterocarp Forest Stands in Bukit Soeharto, East Kalimantan</b>	
	T. TOMA, P. MATIUS, HASTANIAH, Y. KIYONO, R. WATANABE, and Y. OKIMORI .....	107
10.1	Introduction .....	107
10.2	Monitoring Plots with Different Intensities of Fire Disturbance .....	108
10.3	Changes After the 1983 Fires .....	109
10.4	Effect of the Drought and Fires in 1997 and 1998 .....	114
10.5	Conclusion .....	117
<b>11</b>	<b>Flowering and Fruiting Phenologies of Dipterocarps in a Rainforest in Bukit Soeharto, East Kalimantan</b>	
	Y. KIYONO and HASTANIAH .....	121
11.1	Phenological Observations at Bukit Soeharto Education Forest .....	121
11.2	Flowering and Fruiting Fluctuations .....	122
11.3	Reproductive Success .....	125
11.4	DBH Ranges of Flowering and Fruiting Trees .....	126
11.5	Death in the Drought and Fires of 1997 and 1998 .....	126
11.6	Conclusion .....	127

<b>12 Leaf Gas Exchange and Canopy Structure in Wet and Drought Years in <i>Macaranga conifera</i>, a Tropical Pioneer Tree</b>	
A. ISHIDA, T. TOMA, and MARJENAH .....	129
12.1 How Does Drought Affect the Leaf Gas Exchange Process? .....	129
12.2 Canopy Structure and Leaf Characteristics .....	131
12.3 Leaf Gas Exchange of the Uppermost Canopy Leaves .....	133
12.4 Chlorophyll Fluorescence Within Canopy Leaves .....	139
12.5 Conclusion .....	140
<b>13 Responses of Dipterocarp Seedlings to Drought Stress</b>	
S. ITO, Y. NISHIYAMA, and W. KUSTIAWAN .....	143
13.1 Need for Evaluation of Drought Tolerance in the Wet Tropics .....	143
13.2 Plant Materials and Irrigation Treatments .....	144
13.3 Growth Response to Drought Stress .....	145
13.4 Changes in Dry Matter Allocation .....	146
13.5 Functional Changes of Seedling Architecture .....	147
13.6 Conclusion .....	150
<b>14 The Effect of Droughts and Fires on Coleopteran Insects in Lowland Dipterocarp Forests in Bukit Soeharto, East Kalimantan</b>	
H. MAKIHARA, H. KINUURA, K. YAHIRO, and C. SOEYAMTO .....	153
14.1 Introduction .....	153
14.2 Sampling Procedure .....	155
14.3 Effects of Drought and Fire on Various Coleopteran Insects .....	155
14.4 Conclusion .....	162
<b>Part 4: Human Impacts on Forest Ecosystems</b>	
<b>15 Mechanism of Changes in the Kenyah's Swidden System: Explanation in Terms of Agricultural Intensification Theory</b>	
M. INOUE .....	167
15.1 Introduction .....	167
15.2 Changes in Swidden Agriculture by the Kenyah Dayak .....	169
15.3 New Concepts for Study of the Shortening of Fallow Period .....	171
15.4 Intensification Process of the Kenyah's Swidden System .....	176
15.5 Conclusion .....	182

<b>16 Tropical Secondary Forest and Its Succession Following Traditional Slash-and-Burn Agriculture in Mencimai, East Kalimantan</b>	
Y. OKIMORI and P. MATIUS .....	185
16.1 Introduction .....	185
16.2 Secondary Forests in Mencimai Village .....	186
16.3 Changes in Forest Structure and Species Richness .....	187
16.4 Dynamics of Pioneer and Sprouting Trees .....	194
16.5 Regeneration Characteristics of <i>Shorea parvifolia</i> .....	195
16.6 Conclusion .....	196
 <b>17 The Role of Slash-and-Burn Agriculture in Transforming Dipterocarp Forest into <i>Imperata</i> Grassland</b>	
Y. KIYONO and HASTANIAH .....	199
17.1 Introduction .....	199
17.2 Transformation of Dipterocarp Forests into <i>Imperata</i> Grasslands .....	200
17.3 Succession in <i>Imperata</i> Grassland .....	206
17.4 Conclusion .....	207
 <b>18 Impact of Different Intensities of Selective Logging on a Low-Hill Dipterocarp Forest in Pasir, East Kalimantan</b>	
Y. OKIMORI and P. MATIUS .....	209
18.1 Introduction .....	209
18.2 Research Site, Methods, and Trees Harvested .....	209
18.3 Effects of Logging at Different Intensities .....	210
18.4 Countermeasures for Reducing the Damage and Promoting Sustainable Management .....	216
 <b>19 A Case Study of Second Felling in a Logged-Over Dipterocarp Forest</b>	
Y. RUSLIM, P. MATIUS, and M. SUTISNA .....	219
19.1 Introduction .....	219
19.2 Study Site and Forest Structure Before Logging .....	220
19.3 Felling and Skidding Methods .....	220
19.4 Effects of Logging on the Forest Stand .....	222
19.5 Remaining Trees and Predicting the Next Felling .....	225

<b>20</b>	<b>Effects of Forest Fragmentation on the Behavior of Bornean Gibbons</b>	
	T. OKA, E. ISKANDAR, and D.I. GHOZALI .....	229
20.1	Introduction .....	229
20.2	Forests Inhabited by Gibbons .....	230
20.3	Gibbon Families in the BSEF .....	231
20.4	Gibbon Families in the Isolated Forests .....	234
20.5	Forest Roads as Barriers .....	236
20.6	Isolated Forests as Fragile Sanctuaries .....	237
20.7	Conclusion .....	238
 <b>Part 5: Rehabilitation Techniques and Constraints on Sustainable Forest Management</b>		
<b>21</b>	<b>Treatment to Develop Mycorrhiza Formation on Dipterocarp Seedlings</b>	
	SUHARDI .....	245
21.1	Introduction .....	245
21.2	Shading Effects .....	246
21.3	Effect of Inoculum and Selection of Appropriate Fungi .....	247
21.4	Inoculum, Mulching, and Charcoal Treatments to Enhance Mycorrhizal Infection .....	248
21.5	Conclusion .....	249
 <b>22</b>	 <b>A Convenient Method for Inoculating Dipterocarp Seedlings with the Ectomycorrhizal Fungus, <i>Scleroderma columnare</i></b>	
	S. MORI and MARJENAH .....	251
22.1	Introduction .....	251
22.2	The Inoculation Method and Its Effects .....	252
22.3	Diurnal Changes in Photosynthesis .....	253
22.4	Application of Ectomycorrhizal Fungi in the Field .....	254
22.5	Variation of Affinity Between Different Dipterocarp Species and <i>S. columnare</i> .....	254
22.6	Conclusion .....	255
 <b>23</b>	 <b>Photographic Estimation of Light Environments on Forest Floors and Effects of Light on the Growth of Dipterocarp Seedlings</b>	
	H. YAHATA .....	259
23.1	Introduction .....	259

23.2	Photographic Estimation of Light Intensity on the Forest Floor and Determination of Its Validity .....	260
23.3	Light Intensity and Seedling Growth .....	265
23.4	Conclusion .....	266
<b>24</b>	<b>In Situ Study of the Effects of Elevated Temperature on Photoinhibition in Climax and Pioneer Species</b>	
	A. ISHIDA, T. TOMA, D.I. GHOZALI, and MARJENAH .....	269
24.1	Introduction .....	269
24.2	High-Temperature Treatment .....	270
24.3	Photoinhibition by Elevated Leaf Temperature .....	272
24.4	Possible Niche Partitioning .....	275
24.5	Protective Mechanisms for Photoinhibition in Morphology and Physiology .....	277
24.6	Conclusion .....	278
<b>25</b>	<b>Growth of <i>Ulin</i> (<i>Eusideroxylon zwageri</i>) Seedlings in Relation to Environmental Factors in the Forest Understory</b>	
	HASTANIAH and Y. KIYONO .....	281
25.1	Decrease in the Growing Stock of an Ironwood Species due to Over-Exploitation .....	281
25.2	Seedling Growth in Contrasting Light Environments .....	283
25.3	Growth of Seedlings Seeded Artificially on an Unsuitable Soil .....	285
25.4	Influence of Fire on Seedling Survival and Regeneration .....	285
25.5	Conclusion .....	285
<b>26</b>	<b>Diseases of Dipterocarp Saplings Planted in Bukit Soeharto Education Forest, East Kalimantan</b>	
	D. MARDJI .....	289
26.1	Introduction .....	289
26.2	Notes on Diseases .....	291
26.3	Disease Incidence on Different Dipterocarp Species .....	295
26.4	Conclusion .....	296
<b>27</b>	<b>Participatory Forest Management</b>	
	M. INOUE .....	299
27.1	Introduction .....	299
27.2	The Kenyah's Resource Management Systems and Their Changes ...	300
27.3	Evaluation of the Resource Management System by the Kenyah .....	301
27.4	Basic Course to Introduce Participatory Forest Management .....	303

27.5 National Forest Policy in Terms of Participation .....	304
27.6 Closing Remark .....	306
 <b>28 Overview of the Changing Forest Ecosystems in East Kalimantan</b>	
T. MORI, S. OHTA, A. ISHIDA, T. TOMA, and T. OKA .....	309
28.1 Introduction .....	309
28.2 Implications and Misconceptions Concerning Soil Change.....	309
28.3 Fire and Human Impact on Vegetation Changes .....	311
28.4 Drought and Fire Impact on Forest Functions .....	312
28.5 Fire and Human Impact on Animals .....	314
28.6 Community Forestry and Rehabilitation .....	315
28.7 Concluding Remark .....	316
 Subject Index .....	319
Species Index .....	326