

# CONTENTS

List of plates	xi
List of tables	xi
List of figures	xii
Preface	xiii
1 Whither tropical rain forest?	1
1.1 Tropical rain forest	1
1.1.1 Distribution and change	2
1.1.2 Some attributes of species	3
Diversity	3
Low density	3
Patchiness	4
Rarity	4
Endemism	4
Mutualism	4
Disturbance	4
1.2 Resource utilization and forest conversion	5
1.2.1 Traditional resource-use strategies	5
Hunting and gathering	5
Shifting cultivation	5
Permanent-field farmers	6
Critique	6
1.2.2 Modern resource regimes	7
1.2.3 Tropical moist forest: extent and rate of conversion	8
1.3 The human impact	9
1.3.1 Anthropogenic impact: what are the causes?	9
1.3.2 Some consequences of forest change	11
1.4 Conservation and sustainable development	13
1.4.1 Concepts	13
1.4.2 Conservation and sustainable land use	14
Towards sustainable forestry	15
Towards sustainable agriculture	16
1.4.3 Parks and reserves	17
1.5 Conclusion	18
2 The rain forests of Malaysia	19
2.1 The forests in their regional setting	19
2.1.1 The Malesian floristic region	19
2.1.2 The origin and evolution of the Malesian flora	21
From land bridges to plate tectonics	21
The impact of Quaternary perturbations	22
2.2 The rain forests: formations and variations	23
2.2.1 The forest formations	23
A note on classification	23

The lowland evergreen formation	23
The heath forest formation	25
The montane forest formations	26
The wetland forest formations	27
2.2.2 Intraformation variations	28
Regional variations	28
Local variations	29
2.2.3 On the richness of the flora	30
2.3 The forest fauna	34
2.3.1 The regional context	34
2.3.2 Extant fauna	35
Numbers of species	35
Preferred habitats	36
Coexistence	37
2.4 The forest system	39
2.4.1 Soils and nutrients	39
2.4.2 Forest hydrology and denudation	41
Forest hydrology	41
Denudation	42
2.4.3 The forest growth cycle	43
2.5 Concluding remarks	45
 3 Resource utilization and forest conversion: processes and policies	 46
3.1 Introduction: setting the scene	46
3.2 The Peninsula in the colonial period	48
3.2.1 Introduction	48
3.2.2 Malay peasant agriculture	50
3.2.3 Tin	51
3.2.4 Early plantation agriculture	52
3.2.5 Rubber (and other crops)	54
3.2.6 Forest administration and policy	55
'Envoi'	57
3.3 The Borneo territories in the colonial period	57
3.3.1 Introduction	57
3.3.2 The creation of new political units	58
3.3.3 North Borneo: economic activities and forest conversion	59
3.3.4 Sarawak: economic activities and forest conversion	61
3.3.5 Forest administration and policy	63
'Envoi'	64
3.4 Forest exploitation in the Malaysian period	64
3.4.1 Land development	64
FELDA in the Peninsula	65
Land development in East Malaysia	66
'Envoi'	67
3.4.2 Timber and forest policy	68
Technological change	69
Silviculture	69
Production for export	71

Government policy	72
'Envoi'	73
3.4.3 Shifting cultivation in East Malaysia	73
Shifting cultivation: west and east	73
Estimates	74
Images	76
Land degradation	76
'Envoi'	77
3.5 Conclusion	77
 4 The human impact	 79
4.1 Some concepts	79
4.2 Environmental impact	81
4.2.1 Hydrological changes	82
4.2.2 Erosional changes	83
Erosion of agricultural land	83
Erosion of mining areas	84
Erosion of logged-over areas	84
Road construction and soil losses	85
Cumulative effects	85
4.3 Biological impact	85
4.3.1 Anthropogenic impact on the flora	86
Forest removal	86
Forest alteration	87
Commercial collecting	89
Cumulative impact	90
4.3.2 Anthropogenic impact on the fauna	92
Pre-colonial times	92
The colonial era	92
The post-colonial period	94
Cumulative impact	96
4.4 The impact on humans	97
4.4.1 Introduction	97
4.4.2 Government policy, land, and the Orang Asli	98
4.4.3 Government policy, land, and the native peoples of Sarawak	101
Land and forest laws	101
The impact of logging	102
Social impact	103
4.4.4 Forest change and health hazards	104
Forest conversion and malaria	105
Land development and health hazards	106
4.5 Conclusion	107
 5 Conservation: towards a sustainable future	 108
5.1 Concepts	108
5.1.1 Sustainable development and conservation strategies	108
5.1.2 Environmental management: north and south	109

5.1.3	Conservation	110
5.1.4	Justifications for conservation	111
5.2	From abundance to decline: conservation in the colonial period	112
5.2.1	The Peninsula	112
	Forest protection	112
	Wildlife conservation	113
5.2.2	North Borneo and Sarawak	116
	Forest protection	116
	Wildlife conservation	116
5.3	Conservation in the Malaysian period	118
5.3.1	Forests, conservation, and the federal government	118
	National plans	119
	Legislation	119
	Vacillation	120
5.3.2	NGOs and environmental awareness	121
5.3.3	Land-use conflicts: forests, logging, and dams	122
	Endau–Rompin	122
	Baram–Limbang	124
	Sungai Tembeling	126
	Bakun	127
	The disputes: a concluding note	128
5.4	Recent developments: too little, too late?	129
5.4.1	Parks, reserves, and sanctuaries	129
	Peninsular Malaysia	129
	Sabah and Sarawak	131
5.4.2	Planning and management	134
	State conservation strategies	134
	Integrated forest management	134
	Regional and international co-operation	135
5.5	Transitions: towards a more sustainable future	135
5.5.1	An information transition	135
5.5.2	A demographic transition	136
5.5.3	An institutional transition	137
5.5.4	A social and participatory transition	137
5.5.5	An economic transition	138
5.6	Conclusion	140
6	Epilogue	141
6.1	An essay by way of conclusion	141
	Notes to the text	147
	References	154
	Index	185

# PLATES

*Plates section appears between pages 54 and 55.*

- Plate 1. Lowland evergreen rain forest
- Plate 2. Heath forest
- Plate 3. Upper montane rain forest
- Plate 4. Seladang (*Bos gaurus*) or gaur
- Plate 5. FELDA-sponsored rural development
- Plate 6. Shifting cultivation along the Melinau River
- Plate 7. Abandoned tin mine
- Plate 8. Cutting in deep regolith and weathered bedrock
- Plate 9. Genting Highlands hill station
- Plate 10. Log landing area
- Plate 11. Fallen two-horned Sumatran rhinoceros
- Plate 12. Great hornbill
- Plate 13. Orang Asli 'pattern settlement'
- Plate 14. Sumatran rhinoceros: symbol of the 'Save Endau-Rompin National Park' campaign

# TABLES

Table 1.1.	Estimates of the extent of tropical moist forest	9
Table 1.2.	Annual rates of tropical deforestation in selected countries	11
Table 2.1.	Species richness among trees in Malaysia	31
Table 2.2.	Hypotheses concerning high species diversity in the tropics	32
Table 2.3.	Assessment of evidence in support of various mechanisms proposed to account for high tropical diversity	33
Table 2.4.	Current and former distribution of some large mammals in Sundaland	35
Table 3.1.	Land development by FELDA, 1956–1990	66
Table 3.2.	Log production (million m <sup>3</sup> ) in Malaysia, 1960–1989	68
Table 3.3.	Distribution and extent of major forest types in Malaysia, 1989 (million ha)	69
Table 3.4.	Proposed permanent forest estate in Malaysia (million ha)	70
Table 4.1.	Malaysia's most endangered plant species	91
Table 4.2.	Malaysia's ten most endangered animals	97
Table 5.1.	Wildlife reserves and parks in the Peninsula, c 1964	114
Table 5.2.	National parks, wildlife reserves, and sanctuaries in Malaysia, c 1990	130
Table 5.3.	Peninsular Malaysia: proposed parks and wildlife reserves	132
Table 5.4.	Sarawak: proposed national parks and wildlife sanctuaries	133

# FIGURES

Fig. 1.1.	Distribution of tropical rain forest	2
Fig. 2.1.	The Malesian floristic region and numbers of dipterocarp species	20
Fig. 2.2.	Malaysia: forest formations	24
Fig. 2.3.	Altitudinal zonation of vegetation in Peninsular Malaysia	25
Fig. 3.1.	British rule in the Malay Peninsula	49
Fig. 3.2.	Growth of the Sarawak Raj, 1841–1905	59
Fig. 5.1.	Malaysia's national parks, wildlife reserves, and sanctuaries, c. 1990	117