

THE EFFECTS OF STRUCTURE OF ANGENYNA-SOMERATA
FOREST TYPE AT MALA SE-BUK, TOK BALI,
KABUPATEN

DI TERIMA PADA 1991

FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITI TEKNOLOGI MALAYSIA
2006

**THE STAND STRUCTURE OF AVICENNIA-SONNERATIA FOREST TYPE AT
KUALA SEMERAK, TOK BALI, KELANTAN**

By

Catherine anak Chal

**Research Report submitted in partial fulfillment of
the requirements for degree of
Bachelor of Applied Science (Biodiversity Conservation and Management)**

**Department of Biological Sciences
Faculty of Science and Technology
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA
2006**

This project should be as cited as:

Catherine, C. 2006. The stand structure of Avicennia-Sonneratia forest type at Kuala Semerak, Tok Bali, Kelantan. Undergraduate thesis, Bachelor of Applied Science in Biodiversity Conservation and Management, Faculty of Science and Technology, Kolej Universiti Sains dan Teknologi Malaysia, Terengganu. 84p.

No part of this project report may be produced by any mechanical, photographic, or electronic process, or in the form of phonographic recording, nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisor(s) of the project.



JABATAN SAINS BIOLOGI
FAKULTI SAINS DAN TEKNOLOGI
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA

PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: THE STAND STRUCTURE OF AVICENNIA-SONNERATIA FOREST TYPE AT TOK BALI, KELANTAN, oleh Catherine AK. Chal, no. matrik: UK9111 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Biologi sebagai memenuhi sebahagian daripada keperluan memperoleh ijazah Sarjana Muda Sains Gunaan-Pengurusan dan Pemuliharaan Biodiversiti, Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

Disahkan oleh:

Penyelia Utama

Nama:

Cop Rasmi:

Kasawani Ibrahim
Pensyarah
Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Kolej Universiti Sains dan Teknologi Malaysia
21030 Kuala Terengganu.

Tarikh:

30.4.06

Penyelia Kedua (jika ada)

Nama:

Cop Rasmi

PROF. MADYA SULONG BIN IBRAHIM
Fellow
Institut Oseanografi
Kolej Universiti Sains dan Teknologi Malaysia
Mengabang Telipot
21030 Kuala Terengganu.

Tarikh:

04.05.06

Ketua Jabatan Sains Biologi

Nama:

Cop Rasmi:

PROF. MADYA DR. RANIWATI PT. MAT AMIN
Ketua
Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Kolej Universiti Sains dan Teknologi Malaysia
(KUSTEM)
21030 Kuala Terengganu.

Tarikh:

07.05.06

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
LIST OF TABLES	vi
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	ix
LIST OF APPENDICES	x
ABSTRACT	xi
ABSTRAK	xii
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Justification	3
1.3 Objective	3
CHAPTER 2 LITERATURE REVIEW	4
2.1 Mangroves	4
2.2 Geomorphological and Physical Functions	6
2.3 Mangroves Uses	7
2.3.1 Mangroves direct uses	7
2.3.2 Mangrove indirect uses	7
2.4 Threats on Mangroves	8
2.4.1 Pollution	8
2.4.2 Global climate change	9
2.4.3 Natural disaster	10

2.4.4	Human activities	10
2.5	Conservation and Management on Mangroves	10
2.6	Mangroves Distribution	11
2.6.1	Global distribution of mangroves	11
2.6.2	Mangroves forest in Malaysia	12
2.7	Group of Mangrove	13
2.8	<i>Avicennia</i> spp and <i>Sonneratia</i> spp	14
2.9	Studies on Mangroves	16
2.10	Estuary	17
2.11	Estuaries Uses	18
2.12	Forest Composition	19
2.13	Forest Stand Structure	19
2.13.1	Diameter	20
2.13.2	Tree height	20
2.13.3	Basal area	21
2.13.4	Relative density, dominance and frequency	21
CHAPTER 3 METHODOLOGY		22
3.1	Study Area	23
3.2	Sampling Designs	24
3.2.1	Phase I - (i) Stratified sampling plots (circular plots)	25
	- (ii) Transect line plot	26
3.2.2	Phase II - Data analysis	27

CHAPTER 4 RESULT	28
4.1 Existence of Mangroves	28
4.2 Number of Individuals	32
4.3 Species Composition	35
4.4 Species Groups and Frequency Distribution	38
4.5 Community Structure	42
4.5.1 Community structure for trees	42
4.5.2 Community structure for saplings	42
4.5.3 Community structure for seedlings	44
4.6 Summary of Plot Analysis	45
4.7 Basal Area	47
4.8 Gross Volume	51
4.9 Forest Profile	55

CHAPTER 5 DISCUSSION	57
CHAPTER 6 CONCLUSION AND RECOMMENDATION	62
REFERENCES	64
APPENDICES	67

ACKNOWLEDGEMENTS

First of all, praise to God for His blessing and kindness love, thus I received strength in completing this study. Here, I wish my deepest appreciation to my supervisor, Mr Kasawani bin Ibrahim for his invaluable guidance, ideas, criticisms and advice throughout this study. Without his guidance, this project might not be accomplished successfully. I also would like to thank Associate Professor Sulong bin Ibrahim as my co-supervisor for his guidance and advice during this project. I also would like to thank to Department of Biology, Faculty of Science and Technology, KUSTEM for their kindness let me to use the facilities during sampling period. Unforgettable, to Mangrove Research Unit (MARU) team especially Mr Razali Salam for his invaluable effort during helping me to identify the species of mangroves. Sincere thank also dedicate to all my friends especially Nancy, Nurun, Feli, Elvy and Lilian who had helped me during sampling time and writing this thesis. To roommates, Ayu, Az and Syidah, I thank you for supporting me and give constructive comments and ideas in order to finish this project. Last but not least, this appreciation also gave to my beloved parents and my siblings for your love, support and encouragement towards this project. Finally, I would like to thank everyone for your helps whether direct or indirect during completing this study.

LIST OF TABLES

Table		Page
3.1	Formula that were used in data analysis	26
4.1	List of mangrove species that exist in Avicennia-Sonneratia forest type at Semerak estuary, Tok Bali, Kelantan	28
4.2	Existing of trees in Avicennia-Sonneratia forest type	30
4.3	Existing of saplings in Avicennia-Sonneratia forest type	30
4.4	Existing of seedlings in Avicennia-Sonneratia forest type	31
4.5	Number of trees in Avicennia-Sonneratia forest type	33
4.6	Number of saplings Avicennia-Sonneratia forest type	33
4.7	Number of seedlings Avicennia-Sonneratia forest type	34
4.8	Species composition and distribution of mangrove trees	36
4.9	Species composition and distribution of mangrove saplings	36
4.10	Species composition and distribution of mangrove seedlings	36
4.11	Species groups and frequency distribution of trees 5 cm dbh and larger in different diameter for each species	39
4.12	Community structure of trees	43
4.13	Community structure of saplings	44
4.14	Community structure of seedlings	45
4.15	Summary of plot analysis	46
4.16	Basal area distribution of trees 5 cm dbh and larger in different diameter for each species	48
4.17	Gross volume distribution of trees 5 cm dbh and larger in different diameter for each species	52

LIST OF FIGURES

Figure		Page
3.1	Flow chart of methodology	21
3.2	Map of mangroves forest type in Tok Bali, Kelantan	22
3.3	Diagram of sampling plot	24
3.4	Diagram of forest profile plot	25
4.1a	Species composition distribution at tree stage	37
4.1b	Species composition distribution at saplings stage	37
4.1c	Species composition distribution at seedlings stage	38
4.2a	Species groups and frequency distribution of <i>Sonneratia alba</i> 5 cm dbh and larger different diameter	40
4.2b	Species groups and frequency distribution of <i>Avicennia alba</i> 5 cm dbh and larger different diameter	40
4.2c	Species groups and frequency distribution of <i>Bruguiera cylindrica</i> 5 cm dbh and larger different diameter	41
4.2d	Species groups and frequency distribution of <i>Rhizophora apiculata</i> 5 cm dbh and larger different diameter	41
4.3a	Basal area distribution of trees 5 cm dbh and larger in different diameter for <i>Sonneratia alba</i>	49
4.3b	Basal area distribution of trees 5 cm dbh and larger in different diameter for <i>Avicennia alba</i>	49
4.3c	Basal area distribution of trees 5 cm dbh and larger in different diameter for <i>Bruguiera cylindrica</i>	50
4.3d	Basal area distribution of trees 5 cm dbh and larger in different diameter for <i>Rhizophora apiculata</i>	50

4.4a	Gross volume distribution of trees 5 cm dbh and larger in different diameter for <i>Sonneratia alba</i>	53
4.4b	Gross volume distribution of trees 5 cm dbh and larger in different diameter for <i>Avicennia alba</i>	53
4.4c	Gross volume distribution of trees 5 cm dbh and larger in different diameter for <i>Bruguiera cylindrica</i>	54
4.4d	Gross volume distribution of trees 5 cm dbh and larger in different diameter for <i>Rhizophora apiculata</i>	54
4.5	Forest profile community in Avicennia-Sonneratia forest type	56

LIST OF ABBREVIATIONS

cm	Centimeter
dbh	Diameter at breast height
ft	Feet
No	Number
h ⁻¹	Per hour
ha ⁻¹	Per hectare
km	Kilometer
m	Meter

LIST OF APPENDICES

Appendix		Page
I	Avicennia-Sonneratia forest type inventory	64
II	Forest profile for Avicennia –Sonneratia forest type	79
III	Classifications of crown form and stem category	80

ABSTRACT

This study was carried out at *Avicennia-Sonneratia* forest type at estuary of Semerak River in Tok bali, Kelantan where it revealed seven species namely *Sonneratia alba*, *Avicennia alba*, *Bruguiera cylindrica*, *Rhizophora apiculata*, *Ceriops decandra*, *Aegiceras corniculatum* and *Finlaysonia obovata*. Using stratified sampling plots method, 20 plots were built in *Avicennia-Sonneratia* forest type to determine the stand structure and species composition. Meanwhile, transect line method were used to described the forest profile. The most dominant species in study area was *Sonneratia alba* where at trees stage it was carried out the highest value for relative density, relative frequency, relative dominance and importance value with 80.38%, 54.05%, 78.79% and 213.22 respectively. Species groups and frequency distribution showed that dbh class of 5.0-<10.0 cm gave the highest stoking with 715 stems ha⁻¹ and the lowest was from dbh class of 25-30.0 cm with 10 stems ha⁻¹. Meanwhile, the highest basal area was from dbh class of 10.0-<15.0 cm with 4.67 m² ha⁻¹ and the lowest was demonstrated by dbh class of 25.0-<30.0 cm with 0.60 m² ha⁻¹. The highest gross volume was found at dbh class of 10.0-<15.0 cm with 24.31 m³ ha⁻¹ while the lowest represent by dbh class of 25.0-<30.0 cm with 4.27 m³ ha⁻¹. *Avicennia-Sonneratia* forest type at estuary of Semerak River also can be considered as young mangrove forest.

KAJIAN STRUKTUR DIRIAN DI HUTAN JENIS AVICENNIA-SONNERATIA DI KUALA SG SEMERAK, TOK BALI KELANTAN

ABSTRAK

Kajian ini telah dijalankan di hutan jenis *Avicennia-Sonneratia* di Kuala Sungai Semerak, Tok Bali Kelantan yang mana menunjukkan tujuh species iaitu *Sonneratia alba*, *Avicennia alba*, *Bruguiera cylindrica*, *Rhizophora apiculata*, *Ceriops decandra*, *Aegiceras corniculatum* dan *Finlaysonia obovata*. Dengan keadah kajian plot jenis 'stratified', 20 plot telah dibina di kawasan hutan jenis *Avicennia-Sonneratia*. Manakala, kaedah garis transek digunakan untuk menggambarkan profil hutan. Species yang paling dominan di kawasan kajian ialah *Sonneratia alba* di mana pada peringkat dewasa (pokok), ia membawa nilai yang tinggi bagi taburan relatif, taburan frekuensi, taburan dominan dan nilai penting sebanyak 80.38%, 54.05%, 78.79% dan 213.22. Taburan kumpulan species dan frekuensinya menunjukkan bahawa kelas dbh 5.0-<10.0 cm memberi kandungan stok yang tinggi iaitu sebanyak 715 pokok ha⁻¹ dan yang paling sedikit diberikan oleh kelas dbh 25-30.0 cm dengan 10 pokok ha⁻¹. Manakala luas pangkal paling tinggi adalah dari kelas dbh 10.0-<15.0 cm dengan 4.67 m² ha⁻¹ dan yang paling rendah ditunjukkan oleh kelas dbh 25.0-<30.0 cm iaitu sebanyak 0.60 m² ha⁻¹. Isipadu kasar tertinggi dijumpai dalam kelas dbh 10.0-<15.0 cm dengan 24.31 m³ ha⁻¹ manakala yang paling rendah diwakili oleh kelas dbh 25.0-<30.0 cm dengan 4.27 m³ ha⁻¹. Hutan jenis *Avicennia-Sonneratia* di Kuala Sungai Semerak juga boleh dikategorikan sebagai hutan paya laut muda.