



UNIVERSITI PUTRA MALAYSIA

**EFFECTS OF DIFFERENT AGED LOGGED-OVER FORESTS ON THE
GREAT ARGUS (*ARGUSIANUS ARGUS*) (LINNAEUS) AT SUNGAI
LALANG FOREST RESERVE, MALAYSIA**

SENGRATH PHIRASACK

FH 2001 17

**EFFECTS OF DIFFERENT AGED LOGGED-OVER FORESTS ON THE
GREAT ARGUS (*ARGUSIANUS ARGUS*) (LINNAEUS) AT SUNGAI LALANG
FOREST RESERVE, MALAYSIA**

By

SENGRATH PHIRASACK

**Thesis Submitted in Fulfilment of the Requirement for the Degree
of Master of Science in Faculty of Forestry
Universiti Putra Malaysia**

January 2001



*To my Wife, Children,
Parents, Sister and Brother*



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

EFFECTS OF DIFFERENT AGED LOGGED-OVER FORESTS ON THE GREAT ARGUS (*ARGUSIANUS ARGUS*) (LINNAEUS) AT SUNGAI LALANG FOREST RESERVE, MALAYSIA

By

SENGRATH PHIRASACK

January 2001

Chairman: Mohamed Zakaria Hussin, Ph.D.

Faculty: Forestry

The Great Argus (*Argusianus argus argus*) is a moderately large size bird compared to other pheasant species. It belongs to the family Phasianidae and subfamily Argusianinae. This subspecies of Great Argus is found in most lowland and hill Dipterocarp forests up to 818 m above sea level, but is absent from heavily disturbed and fragmented forest sites. The species is considered a threatened species even though it is widely distributed throughout Peninsular Malaysia.

An in-depth study of the Great Argus was conducted in three different areas i.e. Virgin Jungle Reserve (VJR), ten-year-old logged forest (C33) and five-year-old logged forest (C18) at Sungai Lalang Forest Reserve, Selangor, Peninsular Malaysia. The purpose of



the study was to examine the distribution of the Great Argus at different elevations, to determine the population density in Virgin Jungle Reserve as well as logged forest and to compare its density in relation to the microclimate, microhabitat and arthropod abundance.

Data was collected from October 1998 until May 1999 using the Line Transect Method (LTM). The distribution and population densities of the Great Argus was conducted by line transect survey. The position of calling males was mapped.

The Great Argus was more abundant in the primary than in the logged forest and was mostly found at elevations of 150 to 400 m a.s.l. The densities in primary forest (VJR) and old logged forest (C33) were 3 birds/km² and 2 birds/km² respectively. In the recently logged forest (C18), the number of observations was too small to estimate the density.

Among the three compartments, the population density was significantly higher in Virgin Jungle Reserve than in either old or recently logged forest ($F = 8.91, P < 0.001$). The results also indicated that the relative abundance of the bird was significantly higher in the Virgin Jungle Forest Reserve (1.19 birds/observation) as compared to recently logged forest (C18) (0.06 birds/observation). There was no significant difference between the old logged forest (0.85 birds/observation) and Virgin Jungle Reserve.



The microhabitat, microclimate and food sources are important factors that relate to the population of Great Argus. The findings showed that the population density declined due to changes in the microhabitat, microclimate and food sources. In terms of microhabitat, there were fewer palms, climbers, less shade and litter cover in logged forest compared to the virgin forest. In terms of microclimate, the study also showed that light intensity and temperature were higher whilst relative humidity was lower in the logged forest. The food sources, namely arthropods, were also lower in the logged forest. Thus, it is recommended that logging activities must take into account factors to minimise the changes in the microhabitat, the microclimate and the food sources so as to prevent the decline in the population of the Great Argus.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**KESAN PERBEZAAN UMUR HUTAN SELEPAS TEBANGAN TERHADAP
KUANG RAYA (*ARGUSIANUS ARGUS*) (LINNAEUS) DI HUTAN SIMPAN
SUNGAILALANG, SELANGOR, SEMENANJUNG MALAYSIA**

Oleh

SENGRATH PHIRASACK

Januari 2001

Pengerusi: Dr. Mohamed Zakaria Hussin

Fakulti: Perhutanan

Kuang raya atau “Malay Great Argus” (*Argusianus argus argus*) adalah sejenis burung kuang besar dibandingkan dengan spesies burung yang lain. Ia termasuk di dalam famili Phasianidae dan subfamili Argusianinae. Kebiasaannya, subspecies burung kuang ini dijumpai di hutan tanah rendah dan hutan dipterokarp bukit sehingga ke kawasan 818 m dari aras laut, tetapi ia tidak dijumpai di kawasan yang mengalami gangguan teruk dan berkelompok. Pada keseluruhannya spesies ini merupakan spesies terancam walaupun ia masih lagi terdapat di seluruh Semenanjung Malaysia.

Satu kajian terperinci terhadap Kuang Raya telah dijalankan pada tiga kawasan terpilih, iaitu hutan primer (VJR), hutan sepuluh tahun selepas tebaran (Kompitmen 33) dan



hutan lima tahun selepas tebangan (Kompitmen 18), di Hutan Simpan Sungai Lalang, Selangor, Semenanjung Malaysia. Matlamat projek ini adalah untuk mengkaji taburan Kuang Raya pada pelbagai altitud, untuk menentukan kepadatan populasi di hutan primer berbanding hutan yang telah dibalok dan untuk mengkaji perbezaan kepadatan populasi serta hubungannya dengan mikroklimat, mikrohabitat dan banyaknya arthropoda.

Kutipan data dijalankan daripada Oktober 1998 hingga Ogos 1999 dengan menggunakan kaedah garis transek (LTM). Taburan dan kepadatan populasi Kuang Raya pula dianggarkan melalui kaedah transek survei. Kedudukan kuang jantan yang berbunyi juga dipetakan.

Kuang Raya lebih banyak dijumpai di hutan primer berbanding dengan hutan yang telah dibalok dan biasa dijumpai pada ketinggian 150 hingga 400 m daripada aras laut. Kepadatan populasi di hutan primer (VJR) dan hutan balok matang (C33) adalah 3 burung/km² dan 2 burung/km² masing-masing. Pada hutan yang baru dibalok (C18), jumlah pemerhatian adalah terlalu rendah untuk membuat anggaran kepadatan.

Di antara ketiga-tiga komitmen, kepadatan populasi secara signifikan lebih tinggi di hutan primer berbanding dengan hutan balok matang atau hutan baru dibalok ($F = 8.91$, $P < 0.001$). Keputusan juga menunjukkan bahawa jumlah relatif Kuang Raya secara

signifikan lebih tinggi di hutan primer (VJR) (1.19 burung/pemerhatian) berbanding hutan baru dibalak (C18) (0.06 burung/pemerhatian). Tiada perbezaan yang signifikan didapati diantara hutan balak matang (C33) (0.085 burung/pemerhatian) dan hutan primer (VJR).

Mikrohabitat, mikroklimat dan sumber makanan adalah faktor-faktor yang penting untuk populasi Kuang Raya. Hasil kajian menunjukkan bahawa kepadatan populasi berkurangan apabila mikrohabitat, mikroklimat dan sumber makanan berubah. Dari segi mikrohabitat, didapati bilangan palma, pemanjat, naungan dan sarap hutan adalah lebih kecil berbanding dengan hutan primer. Dari segi mikroklimat, kajian menunjukkan bahawa intensiti cahaya dan suhu adalah lebih tinggi manakala kelembapan relatif adalah lebih rendah di hutan yang telah dibalak. Sumber makanan, terutamanya arthropod, juga lebih rendah di hutan yang telah dibalak. Oleh yang demikian, dicadangkan agar aktiviti pembalakan mempertimbangkan bagaimana mengurangkan perubahan dalam mikrohabitat, mikroklimat dan sumber makanan yang mana mencegah pengurangan populasi Kuang Raya.

ACKNOWLEDGEMENTS

All praises be to God whose countless blessings enabled me to accomplish this study. First and foremost, I would like to extend my most sincere and deep appreciation to my supervisor, Dr. Mohamed Zakaria Hussin for his concern, invaluable advice, suggestions, guidance and encouragement throughout the study period. My most sincere thanks and appreciation also go to my co-supervisors Dr. Abdullah Mohd and Associate Prof. Dr. Ahmad Said Sajap for their encouragement, assistance, useful comments and suggestions during the study.

I am greatly thankful to the Lao government, the staff of the Lao Forestry Department, and the Lao-Swedish Forestry Programme, for granting me the scholarship and allowing me to leave and pursue this postgraduate programme in Malaysia.

I would like to take this opportunity to express my thanks to the Dean of the Faculty of Forestry, Universiti Putra Malaysia, for the permission given to undertake this study. My sincere appreciation goes to all lecturers and staff of the Faculty of Forestry for their help during the study period.



My sincere thanks are also due to various individuals who have extended their help and cooperation during my study period, particularly Mr. Rahim Mudin, research assistants and other students working on the project at Sungai Lalang Forest Reserve.

My heartfelt thanks are extended to my brother and sister for their love and support throughout my study. I would like to express my special, deepest thanks and love towards my wife and children, for their inspiration, love, sacrifice, patience, continuous support and encouragement during the entire study period. Lastly, I express my gratitude to my parents, the invisible power, for providing me with the continuous energy to undertake this study.



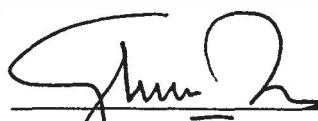
I certify that an Examination Committee met on 19 January 2001 to conduct the final examination of Sengrath Phirasack on his Master of Science thesis entitled “Effects of Different Aged Logged-Over Forests on the Great Argus (*Argusianus argus*) (Linnaeus) at Sungai Lalang Forest Reserve, Malaysia” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations, 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

AHMAD AINUDDIN NURUDIN, D.F
Lecturer
Faculty of Forestry
Universiti Putra Malaysia
(Chairman)

MOHAMED ZAKARIA HUSSIN, Ph.D.
Lecturer
Faculty of Forestry
Universiti Putra Malaysia
(Member)

ABDULLAH MOHD, Ph.D.
Lecturer
Faculty of Forestry
Universiti Putra Malaysia
(Member)

AHMAD SAID SAJAP, Ph.D.
Associate Professor
Faculty of Forestry
Universiti Putra Malaysia
(Member)



MOHD. GHAZALI MOHAYIDIN, Ph.D.
Professor/Deputy Dean of Graduate School,
Universiti Putra Malaysia

Date: 19 MAR 2001



This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science.

MOHD. GHAZALI MOHAYIDIN, Ph.D.
Professor
Deputy Dean of Graduate School
Universiti Putra Malaysia

Date:



I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



SENGRATH PHIRASACK

Date: 16.03.2001

TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
ABSTRAK	vi
ACKNOWLEDGMENTS	ix
APPROVAL SHEETS.....	xi
DECLARATION FORM.....	xii
LIST OF TABLES.....	xvi
LIST OF FIGURES	xix
LIST OF PLATES..	xx
LIST OF ABBREVIATIONS.....	xxi

CHAPTER

I	INTRODUCTION.....	1
	Problem Statement.....	2
	Objectives of the Study.....	4
	General Objective.....	4
	Specific Objectives.....	4
	Structure of Thesis.....	5
II	LITERATURE REVIEW.....	6
	Forest Habitat.....	6
	Distribution of Pheasants.....	8
	Distribution of Great Argus.....	14
	Population Density of Great Argus.....	20
	Biology of the Great Argus.....	20
	Effects of Logging on Flora.....	23
	Effects of Logging on bird Populations.....	24
	Effects of Logging on Food Resources.....	26
	Effects of Logging on Microhabitat.....	27
	Effects of Logging on Microclimate.....	29
III	MATERIALS AND METHODS.....	30
	Study Sites.....	30
	Virgin Jungle Forest Reserve	30
	Ten-year Old Logged Forest	35
	Five-year Old Logged Forest.....	36
	Establishment of Permanent Transect Line.....	38
	Bird Survey Methods	38
	Observations on Microhabitat.....	40
	Establishment of Permanent Sample Plots.....	40



	Recording Microclimate	41
	Arthropod Collection.....	43
	Pitfall Traps.....	43
	Data Analyses.....	44
IV	RESULTS.....	45
	Distribution of Great Argus.....	45
	Virgin Jungle Reserve.....	46
	Old Logged Forest	46
	Recently Logged Forest	47
	Population Density.....	52
	Population of Pheasants.....	52
	Density of Pheasants.....	53
	Density of Great Argus	53
	Number of Observations of Pheasant Species at Different Sites.....	54
	Number of Observations of Great Argus at Different Sites.....	55
	Microhabitat Variables at Different Sites.....	56
	Microclimate Variables at Different Sites.....	60
	Arthropods Population at the Different Sites.....	62
V	DISCUSSION.....	66
	Distribution of Great Argus.....	66
	Population Density	67
	Comparison of the Great Argus Population Density and Microhabitat, Microclimate and Arthropod Variables	68
VI	CONCLUSIONS AND RECOMMENDATIONS.....	73
	REFERENCES.....	75
	Appendix A.....	83
	Summary of Field Data.....	83
	Appendix B.....	116
	Summary of Analysis of Variance (ANOVA) and output of Line Transect Method using Distance Version 2.2.....	116
	VIODATA OF AUTHOR	166



LIST OF TABLES

Table	Page
2.1 Forest Habitat Types in Peninsular Malaysia.....	7
2.2 Distribution of High Density Species of Pheasants in Selected Areas of Asia.....	10
2.3 Comparative Altitudinal Distribution of Pheasants in Peninsular Malaysia.....	13
2.4 Distribution of Great Argus throughout Peninsular Malaysia.....	18
2.5 Methods Used to Estimate Population Density of Pheasants.....	21
4.1 Number of Great Argus in Different Study Sites with Respect to Elevation.....	45
4.2 Total Density of Pheasant (all species combined) at Different Sites at Sungai Lalang Forest Reserve (1998-1999).....	53
4.3 Number of Observations of Pheasant at Different Sites (by Audio and Visual).....	53
4.4 Total Density of Great Argus at Different Sites in Sungai Lalang Forest Reserve (1998-1999).....	54
4.5 Result of Dunan's Multiple Range Test on Mean of Pheasants at Different Sites (by Audio and Visual).....	55
4.6 Result of Dunan's Multiple Range Test on Mean of Great Argus at Different Sites (by Audio).....	56
4.7 Result of Dunan's Multiple Range Test on Mean of Microhabitat Variable Records at Different Sites.....	57
4.8 Result of Dunan's Multiple Range Test on Mean Percentage of Microhabitat Variable Records at Different Sites.....	59
4.9 Result of Dunan's Multiple Range Test on Mean Temperature at Different Sites.....	60



4.10	Result of Dunan's Multiple Range Test on Mean Relative Humidity at Different Sites.....	61
4.11	Result of Dunan's Multiple Range Test on Mean Light Intensity at Different Sites.....	62
4.12	Number of Arthropods trapped at Different Sites.....	63
4.13	Result of Dunan's Multiple Range Test on Mean of Coleopterans in Different Sites	64
4.14	Result of Dunan's Multiple Range Test on Mean of Dipterans at Different Sites	65
A1	Summary of Pheasants Species at Different Study Sites.....	83
A2	Number of Visits on Each Line Transect and in Each Compartment at Different Sites in Sungai Lalang Forest Reserve (1998-1999).....	88
A3	Total Number of Observations of Each Species at Different Sites in Sungai Lalang Forest Reserve (1998-1999)	88
A4	Total Percentage of Observations at Different Sites in Sungai Lalang Forest Reserve (1998-1999)	90
A5	Total Number of Observations Based on Audio and Visual at Different Sites in Sungai Lalang Forest Reserve (1998-1999).....	89
A6	Summary of Microhabitat Variables at Different Sites.....	90
A7	Summary of Microclimate Variables at Different Sites.....	98
A8	Arthropod Counts at Different Sites.....	99
B1	Summary of Analysis of Variance on Pheasants observed at Different Sites (by Audio and Visual).....	116
B2	Summary of Analysis of Variance on Great Argus recorded at Different Sites (by Audio).....	116
B3	Summary of Analysis of Variance on Palm at Different Sites.....	116



B4	Summary of Analysis of Variance on Climber at Different Sites.....	117
B5	Summary of Analysis of Variance on Amount of Shade at Different Sites.....	117
B6	Summary of Analysis of Variance on Litter Cover at Different Sites.....	117
B7	Summary of Analysis of Variance on Temperature at Different Sites	118
B8	Summary of Analysis of Variance on Relative Humidity at Different Sites....	118
B9	Summary of Analysis of Variance on Light Intensity at Different Sites.....	118
B10	Summary of Analysis of Variance on Coleoptera at Different Sites.....	119
B11	Summary of Analysis of Variance on Diptera at Different Sites.....	119
B12	Summary of Input and Output Analysis of Pheasant Observations in Primary Forest	120
B13	Summary of Input and Output Analysis of Pheasant Observations in Logged Forest.....	131
B14	Summary of Input and Output Analysis of Great Argus Records in Primary Forest.....	143
B15	Summary of Input and Output Analysis of Great Argus Records in Logged Forest.....	154



LIST OF FIGURES

Figure	Page
2.1	Species-Diversity Map of Pheasant Population in Asia.....12
2.2	Distribution of Bornean Malay and Sumatra races of Great Argus.....16
2.3	Map showing Distribution of Great Argus throughout Peninsular Malaysia.....17
3.1	Map of Peninsular Malaysia showing Study Area at Sungai Lalang Forest Reserve, Selangor,.....31
3.2	Map of Sungai Lalang Forest Reserve showing Recently Logged Forest (C18), Old Logged Forest (C33) and Virgin Jungle Reserve (VJR) Study Sites.....32
3.3	Map of the Virgin Jungle Reserve (VJR) at Sungai Lalang Forest Reserve showing the Location of Transect Lines, Sample Plots of Microhabitat and Pitfall Traps.....33
3.4	Map of the Old Logged Forest (C33) at Sungai Lalang Forest Reserve showing the Location of Transect Lines, Sample Plots of Microhabitat and Pitfall Traps.....36
3.5	Map of the Recently Logged Forest (C18) at Sungai Lalang Forest Reserve showing the Location of Transect Lines, Sample Plots of Microhabitat and Pitfall Traps37
4.1	Map of the Virgin Jungle Reserve (VJR) at Sungai Lalang Forest Reserve showing Distribution of Great Argus.....49
4.2	Map of the Old Logged Forest (C33) at Sungai Lalang Forest Reserve showing Distribution of Great Argus.....50
4.3	Map of the Recently Logged Forest (C18) at Sungai Lalang Forest Reserve showing Distribution of Great Argus.....51



LIST OF PLATES

Plate		Page
3.1	Equipment used in Transect Line Surveys.....	42
3.2	Equipment used to Measure the Weather Conditions.....	42
4.1	The Male captive Great Argus (<i>Argusianus argus</i>).....	48
4.2	A feather of the Great Argus found at the study sites.....	48



LIST OF ABBREVIATIONS

a.s.l.	Above see level
ANOVA	Analysis of Variance
EBA	Endemic Bird Area
C	Compartment
DF	Degrees of Freedom
km	Kilometre
km ²	Kilometre square
m	Metre
mm	Millimetre
MS	Mean Square
SE	Standard error
SS	Sum of Squares
UKM	Universiti Kebangsaan Malaysia
VJR	Virgin Jungle Reserve or Compartment VJR
C33	Old Logged Forest or Compartment 33
C18	Recently Logged Forest or Compartment 18
DMRT	Duncan's Multiple Range Test



CHAPTER I

INTRODUCTION

The most recent review of the world's birds estimates that 1,029 species are now globally threatened (Collar and Andrew 1988). Of the 256 species of Galliformes currently described, 68 species are now considered to be globally threatened and 39 (58 percent) of these species are found in Asia (Collar and Andrew 1988). Within Asia, 43 species of Galliforms were identified as being restricted range species; including 28 species that are considered globally threatened. Amongst the 39 globally threatened species of Galliforms occurring in Asia, 82 percent occur in at least one Endemic Bird Area (EBA) and only five globally threatened non-restricted range Galliforms are not found in an EBA (Eames and Rands, 1992).

All pheasants are totally protected under the Wildlife Protection Act, 1972 amended in 1976 (Siti Hawa, 1992). Keeping, possessing and trading them are offences against this legislation, unless a special permit is held from the Minister of Science and Environment.

Many tropical countries, especially in Southeast Asia, are concerned with the effects of selective logging on fauna and flora. Logging practices have caused reduction in of forest areas and problems to wildlife conservation, particularly, the wildlife population of birds such as Great Argus. Loss of habitat greatly affects wildlife

resources in tropical forests. The tropical forest is an extremely valuable economic resource for the South-east Asian countries. Unfortunately, the area of such forest under any type of protection is less than 5% of the total forested area worldwide (Skorupa, 1986; John, 1992).

Selective timber logging affects the avifauna in many ways (Zakaria and Nordin, 1998). Most bird communities are adversely affected by logging. Terrestrial species and understorey insectivores are among the most deleteriously affected. The decrease in species diversity suggests that forest disturbance may favour generalist over specialist terrestrial birds (Zakaria and Nordin, 1998).

Zainudin (1996) reported that the terrestrial birds were the worst affected after logging. Johns (1983) suggested that terrestrial birds were less able to cope with the harsher environmental changes in the understorey of logged forest and the limited availability of suitable foraging ground and vegetative cover.

Problem Statement

Logging in dipterocarp forests of South-east Asia has considerably changed the forest, both as a result of initial felling damage and alteration of forest growth dynamics (Johns, 1988 and Whitmore, 1991). Such activity has increasingly affected the population density, microclimate, microhabitat and food resources of the Great Argus.



McGowan and Garson (1995) defined habitat loss as all forms of modification to habitat structure that lead to a reduction in the extent or quality of habitat available for a particular taxon. The causes of habitat loss range from felling of large blocks of forest through selective logging, to habitat degradation resulting from the excessive impact of domestic stock grazing, to urban development.

Although pheasants occur in some of the least studied terrestrial environments, they are among the most seriously impacted of all major bird groups as a result of human exploitation and habitat destruction (Johnsgard, 1986).

The precise population and distribution status of the Great Argus has not been well documented. To understand the importance of logged forest areas in the future survival of the species or to develop any type of management plan would require advanced knowledge and understanding of the species distribution, population density and recovery of the species in the logged forest.

There is little information on the ecology, especially in terms of food resources and environmental requirements, of the Great Argus in Malaysia. Information on the food and feeding preferences is useful in analysing the animal dispersal as well as distribution. It is also important in formulating sound and appropriate management or conservation strategies.