UNIVERSITI PUTRA MALAYSIA

AN EXPERT SYSTEM FOR FOREST RESOURCES MANAGEMENT IN PENINSULAR MALAYSIA

NUR ILYANA MOHD. ZUKKI

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NUR ILYANA MOHD. ZUKKI

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

AN EXPERT SYSTEM FOR FOREST RESOURCES MANAGEMENT

By

NUR ILYANA BINTI MOHD.ZUKKI

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Chairman : Associate Professor Dr. Latifah Abd Manaf, PhD

Faculty : Environmental Studies

Tropical forests are losing capacity to provide basic goods and services that are essentials to human livelihood due to threatened ecosystems by human activities and climate change. A much finer balance in the allocation of forest land for production, protection, conservation and amenity purposes is necessary for forest continuously play its essential economic, social, cultural and aesthetic roles. Hence, every decision involving forest utilization should consider various criteria that are important for sustainable forest management. Making decision about forest resources management often involves balancing conflicting, inadequate and incompatible values of many users and usage of a resource. One of the most difficult tasks is the effective integration of environmental, economic and social values to achieve ecologically sustainable development. This study integrates an Analytical Hierarchy Process and expert system to assist decision makers to select the best main function of forest resources, forest functional class of a forest area and assist in harvesting decision of non-timber forest product. Based on knowledge acquisition from multiple sources,

three levels of hierarchy were developed to select the main forest function of forest area with goal at the highest level, followed by criteria based on Malaysian Criteria and Indicator (2002) as well as alternatives of forest main function at the lowest level. Using this technique, the determination of priority for all the alternatives will be considered. Pairwise comparison matrices are completed by experts using input data for priority ranking of the alternatives. Evaluations of pairwise comparison matrix have to be repeated if the consistency ratios are more than 10% or 0.1. The second and third modules for selecting forest functional class and non-forest timber product harvesting decision respectively are using IF-THEN rules. Verification and validation of FORRM expert system has been done using a case study that is Rotan Tunggal Forest Reserve under management of Forestry Department of Pahang. Sensitivity analyses were conducted to check the impact of change in the input data to the alternatives. The criteria of FORMM expert system evaluation are including user friendliness and system functioning.

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

SISTEM PINTAR UNTUK PENGURUSAN SUMBER HUTAN DI SEMENANJUNG MALAYSIA

Oleh

NUR ILYANA MOHD.ZUKKI

OGOS 2010

Pengerusi : Professor Madya Dr. Latifah Abd Manaf, PhD

Fakulti : Pengajian Alam Sekitar

Hutan tropika semakin kehilangan kapasiti untuk menyediakan keperluan dan perkhidmatan asas yang penting untuk kehidupan manusia disebabkan ekosistem yang terancam oleh aktiviti manusia dan perubahan iklim. Satu keseimbangan yang baik dalam peruntukan tanah hutan untuk pengeluaran, perlindungan, dan pemuliharaan adalah perlu untuk hutan terus memainkan peranan dalam ekonomi, sosial, kebudayaan dan estetik. Oleh itu setiap keputusan yang melibatkan penggunaan hutan perlu menimbangkan pelbagai kriteria yang penting untuk pengurusan hutan mampan. Membuat keputusan tentang pengurusan sumber hutan sering melibatkan keseimbangan konflik, nilai-nilai yang tidak cukup dan tidak sesuai di antara banyak pengguna dan penggunaan sesatu sumber itu. Salah satu tugasan yang paling penting dan sukar adalah integrasi yang efektif antara persekitaran, ekonomi, dan nilai sosial untuk mencapai dan mengekalkan pembangunan ekologi yang mapan. Kajian ini melibatkan integrasi Proses Analisis

Hierarki (PAH) dan sistem pakar untuk membantu pembuat keputusan memilih fungsi utama terbaik sumber hutan, fungsi kelas hutan dan pemilihan penuaian produk hutan bukan kayu. Berdasarkan perolehan ilmu daripada pelbagai sumber, tiga paras hierarki telah dibangunkan untuk memilih fungsi utama sebuah kawasan hutan dengan matlamat di paras tertinggi, diikuti kriteria berdasarkan rakyat Kriteria dan Indikator Malaysia (2002) dan juga alternatif sebagai alternatif-alternatif fungsi utama hutan pada paras terendah. Dengan menggunakan teknik ini, penentuan prioriti untuk semua alternatif akan diambil kira. Matriks perbandingan berpasangan akan dinilai oleh pakar menggunakan data input untuk mendapatkan kedudukan prioriti alternatif. Penilaian matriks perbandingan pasangan perlu diulangi jika nisbah-nisbah konsistensi ialah lebih daripada 10% atau 0.1. Modul kedua dan ketiga masing-masing adalah untuk memilih kelas fungsi hutan dan keputusan menuai produk hutan bukan kayu menggunakan aturan JIKA-KEMUDIAN. Validasi sistem pakar FORRM telah dibuat menggunakan satu kajian kes iaitu Hutan Simpan Rotan Tunggal di bawah pengurusan Jabatan Perhutanan Pahang. Analisis kepekaan telah dibuat untuk melihat impak perubahan input data terhadap alternatif. Penilaian sistem pakar FORMM merangkumi kriteria mesra pengguna dan sistem berfungsi.

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I certify that an Examination Committee has met on 25 August 2010 to conduct the final examination of Nur Ilyana Mohd. Zukki on her thesis entitled "Expert System for Forest Resources Management in Peninsular Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Mohammad Firuz bin Ramli, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Chairman)

Ahmad Makmom Hj Abdullah, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Internal Examiner)

Ahmad Zaharin Aris, PhD
Faculty of Environmental Studies
Universiti Putra Malaysia
(Internal Examiner)

Abdul Latiff Mohamad, PhD
Professor Emeritus
Fakulti Sains & Teknologi
Universiti Kebangsaan Malaysia
(External Examiner)

BUJANG KIM HUAT, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date :

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Latifah Abd Manaf, PhD
Associate Professor
Faculty of Environmental Studies
University Putra Malaysia
(Chairman)

Mohd Kamil Yusoff, PhD
Associate Professor
Faculty of Environmental Studies
University Putra Malaysia
(Member)

Abdul Rashid Mat Amin
Adjunct Professor
Faculty of Environmental Studies
University Putra Malaysia
(Member)

HASANAH MOHD. GHAZALI, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

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

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NUR ILYANA MOHD. ZUKKI

Date: 25 August 2010

TABLE OF CONTENTS

		Page
ABSTRACT		ii
ABSTRAK		iv
ACKNOWLEDGEMENTS		vi
APPROVAL		viii
DECLARATION		x
LIST OF TABLES		xi
LIST OF FIGURES		xvi
LIST OF ABBREVIATIONS		xviii
CHAPTER		
1	**INTRODUCTION**	
	1.1 Background	1
	1.2 Problem Statement	3
	1.3 Expert System as a Solution	7
	1.4 Objective of Study	8
	1.5 Scope of Study	9
	1.6 Thesis Organization	10
2	**LITERATURE REVIEW**	
	2.1 Introduction	12
	2.2 Forest Types in Malaysia	12
	2.3 Forest Resources	16
	2.4 Forest Resources in Peninsular Malaysia	19
	2.5 Forest Management in Malaysia	20
	2.6 Institutions Involved in Forests Management	23
	2.6.1 Forestry Department of Peninsular Malaysia	23
	2.6.2 State Forestry Departments	23
	2.6.3 Forest Research Institute of Malaysia	24
	2.6.4 Malaysian Timber Industry Board	26
	2.6.5 Malaysian Timber Certification Council	27
	2.7 Sustainable Forest Management	27
	2.7.1 UNCED And The Forest Principles	29
	2.7.2 Criteria And Indicators And Malaysian Criteria and Indicators (2002) For Sustainable Forest Management	30
	2.8 National Forest Policy	34
	2.9 Decision Making In Forest Resources Management	37
	2.9.1 Analytical Hierarchy Process	39
	2.9.2 AHP Application in Sustainable Forest Resources Management	42
	2.10 Integration of Expert System with Forest Management	46
	2.10.1 Components of Expert System	49
	2.10.2 Expert System Development Stages	51
	2.10.3 Expert System Application	54

3 **METHODOLOGY**

3.1	Introduction		56
3.2	Task Analysis		59
3.3	Knowledge Acquisition		61
3.4	Development of Hierarchy Structure Using AHP		62
	3.4.1	Step I: Decompose of The Problem into Hierarchy Structure	62
	3.4.2	Step II: Pairwise Comparison Matrix (PCM)	70
	3.4.3	Step III: Synthesis of Priority	73
	3.4.4	Example of Calculation of Pairwise Comparison Matrix (PCM)	74
3.5	Development of Prototype Expert System		83
	3.5.1	Sources of Expertise	84
3.6	Knowledge Acquisition Process		87
	3.6.1	Text Analysis	88
	3.6.2	Interview with The Experts	89
3.7	Expert System Development Tools		91
	3.7.1	Macromedia Dreamweaver	91
	3.7.2	PHP	96
	3.7.3	MySQL	98
3.8	Database Design Phase		99
	3.8.1	Conceptual Database Design	100
	3.8.2	Logical Database Design	104

4 **RESULTS AND DISCUSSIONS**

4.1	Introduction		106
4.2	Architecture of FORRM Expert System		107
4.3	Module of Selecting Main Forest Function		110
	4.3.1	AHP Model and Saaty Ratio Scale	113
	4.3.2	Consultation Process	114
	4.3.3	Priority Model	116
	4.3.4	Consistency Ratio Test	117
4.4	Module of Selecting Forest Functional Class		119
4.5	Module of NTFP Harvesting Decision		124
4.6	Validation and Verification Process		128
	4.6.1	AHP Analysis From Expert's Input Data	129
	4.6.2	Case Study for FORRMes Validation: Forest Department Of Pahang	129
4.7	User Friendly of The Interface		147
4.8	Advantages of FORRM Expert System		149
4.9	Targeted End User		150
4.10	Overall Effectiveness Of The Prototype		151

5 **CONCLUSIONS AND RECOMMENDATIONS**

5.1	Conclusions		152
5.2	Expert System Technology		152
5.3	Knowledge Acquisition		153

5.4 Expert System Development Process 153
5.5 Analytical Hierarchy Process 154
5.6 Prototype Development Tools 155
5.7 Recommendations 156

REFERENCES 159
APPENDICES 169
BIODATA OF STUDENT 179
LIST OF PUBLICATIONS 180