



UNIVERSITI PUTRA MALAYSIA

**LOCATING SUITABLE ZONES FOR BEEKEEPING IN SELANGOR,
MALAYSIA**

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**LOCATING SUITABLE ZONES FOR BEEKEEPING IN SELANGOR,
MALAYSIA**

By

NISFARIZA BT MOHD NOOR

**Thesis submitted to the School of Graduate Studies, Universiti Putra
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Science**

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

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March 2007

Chairman: Professor Shattri b. Mansor, PhD

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Modern beekeeping has been established in Malaysia since 1981 under the collaborative research and development of the Malaysian Beekeeping Research and Development Team (MBDRT), which was funded by International Dutch Research Council (IDRC). During MBDRT research several findings on the of beekeeping implementation in Malaysia have been compiled such as the list of bee plants, prospect ability of the industry and modernisation of beekeeping techniques. Although type of bee plant that supply nectar and pollen which are favourable to honeybees has been identified, the location of the source has not been identified yet and there is no map for suitable beekeeping location or zones especially using GIS and multi-criteria decision analysis technique. This research demonstrates the application of Geographical Information System (GIS) and Multi-Criteria



Decision Analysis (MCDA) technology as a tool to aid decision-making process with particular case study of locating a beekeeping zone in the state of Selangor. In this research land suitability analysis is carried out with respect to the bee's biotic needs and some other important factors in apiary management. The results of the two techniques for AHP with GIS analysis namely refereed VBA Macro in ArcGIS and prominent Weighted Overlay function are presented, compared and discussed with verification of ground truth data. The integration of AHP model with GIS provides zones of Non-Suitable, Most Suitable, Moderately Suitable and Suitable areas for beekeeping activity in Selangor. The total of Non Suitable Area (NS) is 34.73%, leaving the balance of potential areas of 65.27%. The remaining are the Most Suitable Area (S1) 13.72 %, Suitable Area (S2) of 27.24% and Moderately Suitable Area of 24.32 %.

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

MENENTUCARI ZON PERLEBAHAN DI SELANGOR MALAYSIA

Oleh

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Pemeliharaan lebah secara moden telah dimulakan di Malaysia sejak 1981 lagi di bawah kerjasama penyelidikan dan pembangunan Malaysian Beekeeping Research and Development Team (MBDRT), yang ditaja dibawah dana International Dutch Research Council (IDRC). Walaupun penubuhan MBDRT telah menjangkau lebih dari 20 tahun, namun perlebahan moden secara haif berpindah tidak dapat diperhatikan dengan jelas di Malaysia. Ini adalah kerana kekurangan kemahiran dan pengetahuan teknikal di dalam industri perlebahan secara komersil. Semasa kajian oleh MBDRT dijalankan, beberapa penemuan telah diperolehi seperti senarai pokok pakan lebah, prospek industri lebah dan modernisasi teknik-teknik perlebahan. Walaupun jenis pokok-pokok pakan lebah telah diketahui, lokasi sumber tersebut tidak dapat ditentukan dan masih belum ada maklumat tentang zon kesesuaian untuk pemeliharaan lebah, terutamanya dengan

menggunakan GIS dan teknik multi-kriteria. Kajian ini mendemonstrasikan aplikasi Sistem Maklumat Geografi (GIS) dan teknologi Analisa Keputusan Multi-Kriteria (MCDA) sebagai alat bagi membantu proses membuat keputusan khususnya dalam kajian untuk menentukan zon kesesuaian perlembahan di Selangor. Dalam kajian ini analisa kesesuaian tanah dibuat dengan mengambilkira keperluan biotik lebah dan beberapa factor penting dalam pengurusan apiari. Hasil daripada dua teknik analisis GIS dan AHP iaitu VBA Macro untuk ArcGIS dan Weighted Overlay dipersembahkan, dibandingkan dan dibincangkan dengan verifikasi cerapan data di lapangan. Integrasi model AHP dan GIS menghasilkan zon Tidak Sesuai, Paling Sesuai, Sesuai dan Sederhana Sesuai bagi aktiviti perlembahan di Selangor. Jumlah kawasan yang Tidak sesuai (NS) ialah 34.73%, dengan baki kawasan berpotensi sebanyak 65.27% iaitu kawasan Paling Sesuai (S1) sebanyak 13.72 %, Sesuai (S2) sebanyak 27.24% dan Sederhana Sesuai (S3) sebanyak 24.32 %.

DEDICATION

To my parents, Mohd Noor Maris and Zairah Idris this thesis is especially dedicated to you. My beloved and understanding husband, Mohamad Azhan Ismail and children, Mohamad Danish Irfan and Damia Irdina you are my greatest motivation. To all family members and friends who have given full support all the way on this journey.

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I certify that an Examination Committee met on 13 March 2007 to conduct the final examination of Nisfariza Mohd Noor on her Master of Science thesis entitled "Locating Suitable Zones for in Selangor, 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:

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DECLARATION

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.

NISFARIZA MOHD NOOR

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LIST OF ABBREVIATIONS/GLOSSARY OF TERMS

AHP	Analytical Hierarchy Process
CI	Consistency Index
CR	Consistency Ratio
DOA	Department of Agriculture
FAO	Food and Agriculture Organisation
IDRC	International Dutch Research Council
GIS	Geographical Information System
MARDI	Agricultural Research Development Institute
MBRDT	Malaysian Beekeeping and Research and Development Team
MCDA	Multi-Criteria Decision Analysis
MCDM	Multi-Criteria Decision Making
RISDA	Malaysian Industry Small-holders Development Authority
RRIM	Malaysian Rubber Research Institute Malaysia
SAW	Simple Additive Weighting Methods
UPM	Universiti Putra Malaysia
UM	University of Malaya
WLC	Weighted Linear Combination
Apiary	The location of a number of colonies.
Apiculture	The science and art of bees and beekeeping.
Apis	The genus to which honeybees belong.
Apis cerana	An Asian species of honeybee that can be kept inside hives.
<i>Apis dorsata</i>	The giant or rock honeybee, indigenous to Asia.

Apis florea	A species of honeybee indigenous to some parts of Asia and the Middle East. It nests in the open and cannot be kept in- side hives.
Apis mellifera	The honeybee species indigenous to Africa, Europe and the Middle East. European races have been widely introduced to other areas, including the Americas, Asia, Australasia and the Pacific. African races have been introduced to South America and have spread to Central America and the United States.
Beeswax	Wax produced by honeybees, secreted by special glands on the underside of the abdomen, and used to build comb.
Brood	All stages of immature honeybees: eggs, larvae and pupae.
Cell	A single hexagonal wax compartment, the basic unit of a comb. Each honeybee develops in a cell. Honey and pollen are stored in cells.
Colony	Honeybees are social insects; they live only as part of a colony and not individually. Each colony of honeybees contains one queen bee who is the female parent of the colony, a few hundred drone bees and thousands of worker bees.
Comb	The wax structure made of hexagonal cells in which honeybees rear young and store food.
Cross-pollination	The transfer of pollen between flowers of different plants of the same species. Plants that are not self-fertilizing must be cross-pollinated before they can develop seeds. Many crops depend on cross-pollination by insects.
Drone	A male honeybee. Drones undertake no work within the hive: their sole function is to fertilize the queen.
Forage	Flowering plants that provide nectar and pollen for bees.
Forager	A worker honeybee that collects pollen, nectar, water or propolis for the colony.
Hive	Any container provided by people within which bees can build their nest.
Honey	Nectar or plant sap ingested by bees, concentrated by them and stored in combs.

Honeybees	Species of bees belonging to the genus <i>Apis</i> . All are social bees that store significant quantities of honey.
Movable-frame hive	A hive containing frames.
Nectar	A sweet liquid secreted by flowers. It is a watery solution of various sugars.
Pollen	The fine dust-like substances that are the male reproductive cells of flowering plants. Collected by bees as a food source.
Pollination	The transfer of pollen from the anther of a flower to the stigma of the flower, or the stigma of another flower.
Pollination agent	Bees act as pollination agents when they transfer pollen from one flower to another. Apart from insects, other agents that may bring about the transfer of pollen are wind, gravity, nectar-seeking birds and bats.
Propolis	Plant resins collected by honeybees and used by them to seal cracks and gaps in the hive.
Queen	The female parent of the colony; the only sexually developed female.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs - as defined by the Rio Declaration on Environment and Development at the 1992 United Nations Earth Summit.
Traditional hive	This usually means a hive made according to local tradition. Most traditional hives are fixed-comb hives.

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CHAPTER 1

INTRODUCTION

1.1 Background

Beekeeping is an important component of agriculture and rural development programmes in many Asian countries. Honeybees are natives to the IndoMalaya region where diverse floral sources are available throughout the year. The role of beekeeping in providing nutritional, economic and ecological security to rural communities in Asia cannot be overlooked as it has always be linked with their cultural and natural heritage (Matsuka, 1998).

Gentry (1982) stated that beekeeping is an activity that fits well with the concept of small-scale agricultural development. It is a labour-intensive undertaking, which can be easily integrated into larger, agricultural or forestry projects. Bees not only aid in the pollination of some crops used in such projects, but they make use of otherwise unused resources - nectar and pollen.

Bees play a key role in the functioning of agricultural ecosystems as pollinators of crops and flowers. Malaysian Ministry of Agriculture & Agro-Based Industry have started the '*Honeybee Project*' to encourage the honeybee industry in the farmers' family as a main/side income exploiting the existing resources of main plantation. The honeybee industry is expanding and profitable for commercial industry and side income for farmers. Prospect



to expand this industry is bright in Malaysia considering the request of the bee product in our country and worldwide has increased.

Mardan (2006) and Atim et. al (1981) explained that beekeeping applies usually in the agricultural areas which have a supply of nectar and pollen such as coconut, palm oil, rubber, durian, gelam (mangrove), star fruit, acacia, banana, mango, papaya, rambutan and others.

The potential areas for beekeeping in Malaysia which consists of potential bee plants as identified by the Malaysian Ministry of Agriculture & Agro-Based Industry are in Selangor (Tanjong Karang, Kuala Selangor & Sabak Bernam), Johor (Pontian dan Batu Pahat), Perak (Bagan Datok), Melaka (Merlimau), Trengganu (Kuala Trengganu, Marang & Besut), Negeri Sembilan & Kelantan.

Beekeeping is high revenue agricultural industries for the commercial practitioners. Malaysia being located in the tropics offers highly suitable conditions for beekeeping with the tropical climate that promote varieties of flowers and plants that supplies pollen and nectar ready to be foraged.