BULETIN Geospatial SEKTOR AWAM

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Current Status on Activities
of Geographical Names in Malaysia

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in Ayer Hitam Forest Reserve using GIS

Menggalur Masa Depan GIS di Malaysia

Mapping and Analysis of Forest Peatland
with Ground Penetrating Radar

GIS Sana-Sini

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dari meja Ketua Editor

Assalamualaikum dan Salam 1Malaysia

Dalam edisi Buletin Geospatial Sektor Awam kali ini, terdapat beberapa artikel GIS yang menarik untuk tatapan pembaca. Teknologi GIS merupakan salah satu bidang teknologi yang pesat membangun. Ia tidak lagi tertumpu kepada penyelidikan akademik sahaja, malah GIS telah digunakan di bidang pelancongan, ekonomi, perniagaan dan lain-lain. GIS telah pun diterima sebagai satu disiplin yang melengkapkan sistem maklumat yang sedia ada.

Artikel pertama pada edisi ini dimulakan dengan artikel *Geographical Names in Malaysia*. Penamaan nama-nama geografi kini telah sampai ke peringkat memerlukan ketepatan lokasi, penjagaan keaslian nama, pembentukan pangkalan data, piawaian dan polisi sebelum ia digazetkan. Sokongan daripada semua pihak untuk menjayakan aktiviti ini terutama dari segi pengemaskinian. Aplikasi *MyGeoname* sedikit sebanyak dapat membantu dalam ketekalan penggunaan Nama-nama Geografi di Malaysia.

Artikel berikutnya mengenai sistem e-Kampung oleh JPBD Negeri Sembilan bertujuan untuk menyediakan sebuah pangkalan data spatial kampung dan maklumat mengenai profil kampung di seluruh Negeri Sembilan. Sistem ini dibangunkan untuk membuat pemantauan dan menganalisis keperluan pembangunan setiap kampung dengan mengintegrasikan maklumat bukan spatial daripada pelbagai maklumat dan menggunakan pelbagai sistem lain.

Seterusnya artikel mengenai perancangan pengurusan sumber air yang berdasarkan model Hutan Simpan Ayer Hitam, Puchong Selangor. Artikel ini menerangkan kaedah yang digunakan mendapatkan kawasan lembangan-lembangan sungai menggunakan Arc-GIS 9.1 yang berpandukan kontur-kontur daripada peta topografi.

Menggalur Masa Depan GIS di Malaysia merupakan artikel yang mengungkap tahap kematangan dan pencapaian GIS, seiring dengan pembangunan pesat teknologi maklumat di seluruh dunia. Cerita kejayaan dan kegagalan dalam mengendalikan sistem maklumat ini sering menghiasi ruangan majalah dan berita GIS di negara ini sejak sekian lamanya. Selaras dengan proses globalisasi yang berlangsung dengan membuka ruang maklumat agar dapat dikongsi bersama, perkongsian maklumat spatial negara wajar diberikan perhatian sepenuhnya.

Artikel selanjutnya adalah mengenai keupayaan alat Ground Penetrating Radar (GPR) dalam mengenalpasti jenis-jenis tanah dan membantu ahli geologi dalam membuat analisis menggunakan aplikasi GIS. Keupayaan alat GPR dan analisis-analisis yang boleh dilakukan untuk mengetahui jenis dari sampel tanah dapat memberi kebaikan kepada aktiviti geologi.

Dengan adanya teknologi sistem maklumat geografi yang semakin canggih kita dapat membangunkan negara dengan lebih lestari. Memandangkan setiap pembangunan dan prasarana yang dibuat oleh kerajaan akan dinilai oleh rakyat samada ianya memberi manfaat kepada rakyat atau sebaliknya. Tidak ketinggalan juga impak dari aktiviti tersebut dapat mengelakkan dari kemusnahan alam sekitar dan menyelamatkan dunia.

Akhir sekali diharap artikel-artikel pada kali ini akan memberi ilmu yang berguna kepada para pembaca mengenai perkembangan GIS sektor awam di Malaysia.

- Selamat membaca –
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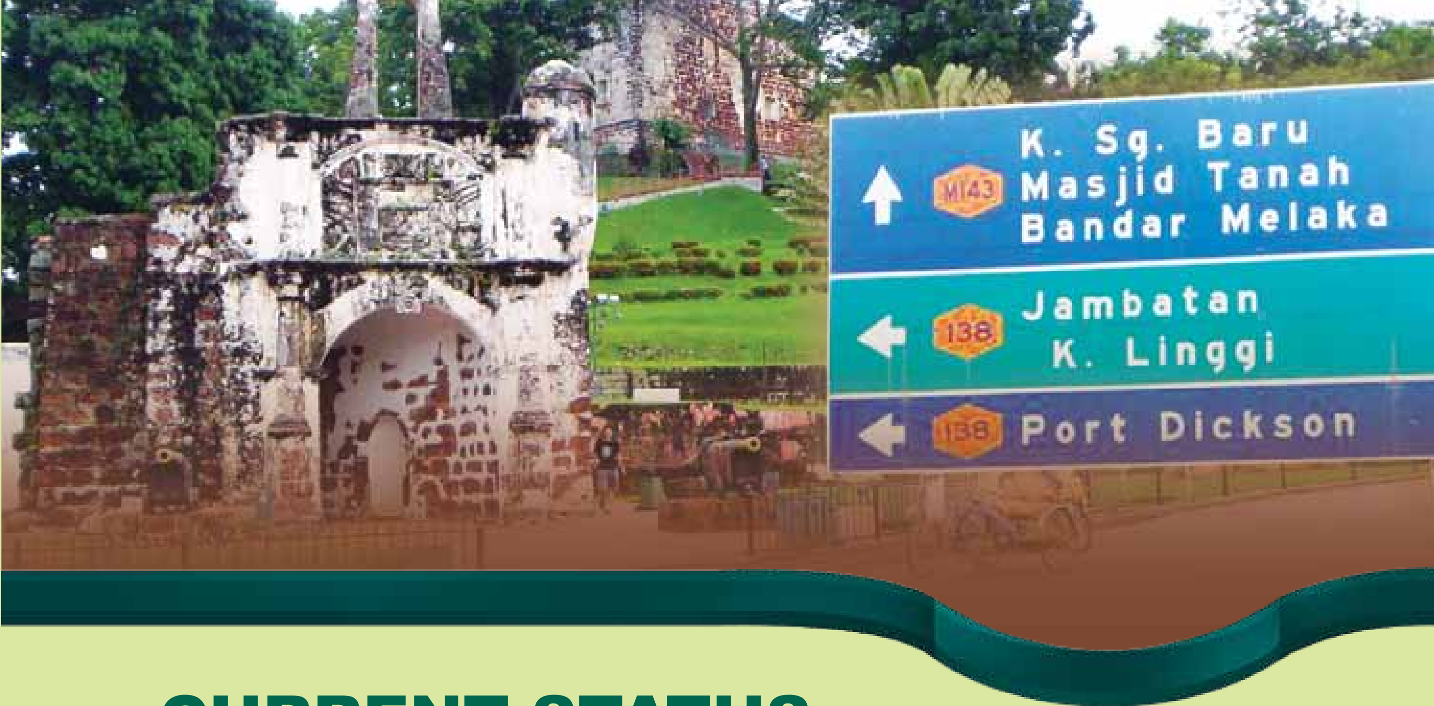


CURRENT STATUS ON ACTIVITIES OF *GEOGRAPHICAL NAMES IN MALAYSIA*

Fuziah Abu Hanifah
Director of Malaysian Centre for Geospatial Data Infrastructure (MaCGDI)

ABSTRACT

Geographical names are used in every day life to describe our surroundings and to tell others where we have been or where we plan to go. It has been widely acknowledged that consistent use of accurate place names is an important element in effective communication worldwide, apart from supporting socio-economic development, conservation and national infrastructure.

Due to the rapid growth in Malaysia, there is an imperative need to develop a comprehensive database containing names of official places that would benefit trade and commerce, population census and national statistics, property right and cadaster, urban and regional planning, environmental management, natural disaster relief, security strategy and peace-keeping operations, maps and atlas production, automatic navigation, tourism, and communication including postal and news services. Therefore, it requires a comprehensive database of geographical names which are consistent and authoritative that can retrieve quickly for the usage by the stakeholders by using the application that can be accessed via internet.

INTRODUCTION

Consistent use of accurate place names is an important element in effective communication worldwide. It also supports socio-economic development, conservation and national infrastructure. Standardization of geographical names has become more important because of reference needs associated with the development of the communications and transport systems, production of high precision charts and maps and others. Standard geographical names can also identify and reflect culture, heritage and landscape.

Malaysia requires a comprehensive database of geographical names which are consistent and authoritative that can be retrieved quickly for the usage by the stakeholders. The current status on activities of geographical names in Malaysia can be described by the participation of three Working Groups within Malaysian National Committee on Geographical Names (MNCGN) which is the key player in the development of geographical names.

The focus of this paper is to inform on the remarkable progress in 2010 is the development of geographical names database using map scale of 1:25,000 and 1:50,000. It also involves updating of geographical names and the development of new modules such as audio, video and arabic (jawi) character in the database. Last but not least, this paper also will touch some implementation issues on activities of geographical names in Malaysia.

BACKGROUND

Malaysian National Committee on Geographical Names (MNCGN) was formed on 11th September 2002 by the Cabinet to coordinate activities for the determination of geographical names in Malaysia.

Responsibilities of this committee encompass the following matters:

(a) formulating national guidelines for determination of geographical names;

(b) developing the National Geographical Names Database and the National Gazetteer;

(c) promoting the use of official names; and

(d) coordinating the input of national nomenclature activities with nomenclature activities at international level, including serving as liaison to the United Nations Group of Experts on Geographical Names (UNGEGN), particularly with the Regional Grouping.

This MNCGN is chaired by the Director-General of the Department of Survey and Mapping Malaysia (JUPEM) with its members consisting of representatives from federal agencies and state governments.

There are one (1) technical committee and three (3) working groups at national level to assist the MNCGN as follows:

(a) National Technical Committee on Geographical Names (NTCGN);

(b) Working Group on Policies and Updating of Geographical Names (new working group which replaced previous working group, called Working Group on Guidelines for Determination of Geographical Names) of Geographical Names;

(a) Working Group on National Geographical Names Database and Gazetteer; and

(b) Working Group on Names of Island and Off-Shore Geographic Entities.

Meanwhile, at the State level, the State Committee on Geographical Names (SCGN) was established to coordinate and implement the guidelines and procedures formulated by MNCGN. This committee is chaired by the State Secretary or the Secretary General of the Federal Territories Ministry (for Federal Territories) and its members comprise of representatives from state or federal agencies. At the state level, the State Technical Committee on Geographical Names (STCGN) was also established to assist the SCGN.

The existing organizational structure of MNCGN is as shown in Figure 1 below:

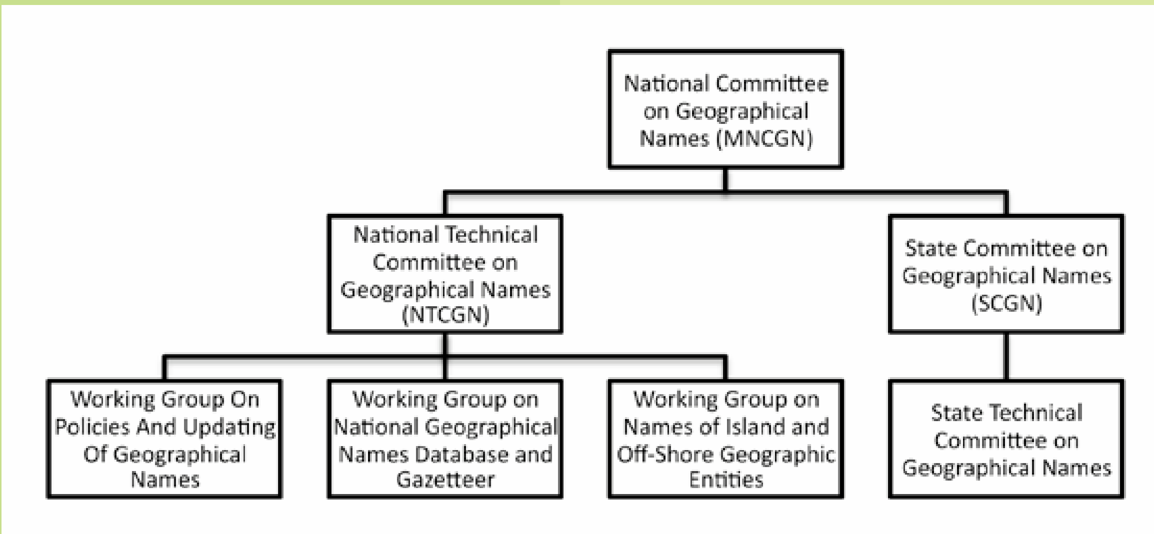


Figure 1: Committees and Working Groups of Geographical Names

ACTIVITIES OF GEOGRAPHICAL NAMES

Publishing of Guidelines for the Determination of Geographical Names

Guidelines for the Determination of Geographical Names has been published by JUPEM in 2005 and has become a Malaysian Standard and known as MS 2256: 2009 Geographic Information - Guidelines for the Determination of Geographical Names, as shown in Figure 2. This guideline was prepared to represent Malaysia's effort to meet such a need and as part of national geospatial data infrastructure development initiative.

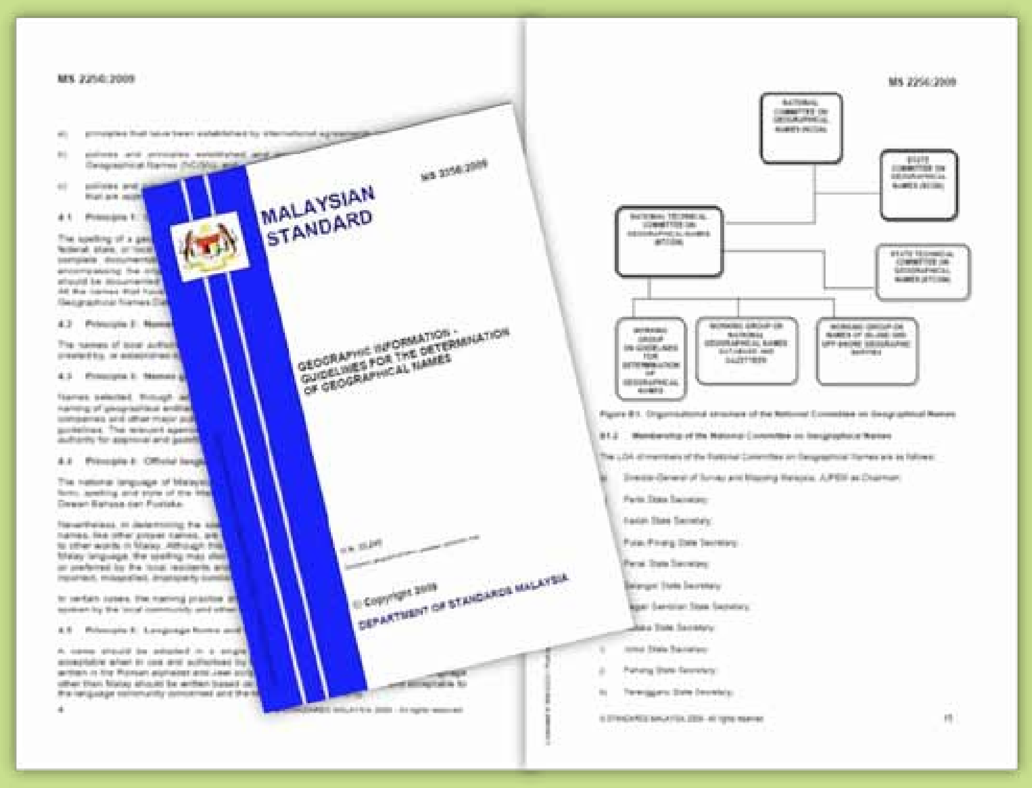


Figure 2: MS 2256: 2009 Geographic Information - Guidelines for the Determination of Geographical Names

There are 21 principles which are intended to serve as guides for the standardisation of geographical naming process in Malaysia towards a more accurate and consistent use of geographical names. In general, the determination of names should adhere to the following principles:

i) Official or approved names
ii) Names under statutory authority
iii) Names given by other agencies
iv) Official language
v) Language forms and translation
vi) Spelling and pronunciation
vii) Forms and character of names
viii) Uniformity in the spelling of names
ix) Names in general public use
x) Use of personal names
xi) Naming a geographical entity based on identified geographical extend
xii) Considerations in naming unnamed geographical entities
xiii) Duplication of names
xiv) Name changes
xv) Use of qualifying elements
xvi) Names of minor geographical entities
xvii) Generic names
xviii) Variant or unofficial names
xix) Names in the forms of abbreviations and numbers
xx) Off-shore geographic entities
xxi) Names of foreign countries

Geographical Names Database and Production of Web Gazetteer

The Malaysian Geographical Names Database consist of amongst others local names, location, historical background and gazette notification that have authoritative records available for government and public use.

The Working Group on Geographical Names Database and Gazetteer, chair by the Malaysian Centre for Geospatial Data Infrastructure (MaCGDI) was given the responsibility to develop the Malaysian Geographical Names Database and Web Gazetteer. The roadmap of development of the database and gazetteer and other activities as shown in Table 1 below:

Table 1: Roadmap of Development of the Database and Gazetteer

ACTIVITIES	YEAR
• **Phase 1 -** Development of Geographical Names Database and Gazetteer • Data collection / compilation from the state maps of the Peninsular Malaysia. (Scale of 1:100 000)	July 2004 – July 2005
Validation of Data • The data was sent to the state with the template for validation and updating.	Aug. 2005 – Sept. 2006
Data Testing • To ensure the data fulfilled the specification.	Oct. 2006 – Dec. 2006
• Data collection, validation and data tested for Peninsular Malaysia (Scale of 1:25 000). • Development of the geographical names database and gazetteer for Peninsular Malaysia (Scale of 1:25 000). • Based on topographical maps of Peninsular Malaysia (700 sheets).	Jan 2008 – Aug. 2008
• Development of the Module on Verification of Geographical Names and delivered to every state.	July 2008 - Oct. 2009
• **Phase II -** Data collection, validation and data tested for the state of Sabah and Sarawak. (Scale of 1:50 000 & 1:25 000) • Development of the geographical names database for the state of Sabah and Sarawak (1:50 000 & 1:25 000). • Based on topographical maps of Sabah and Sarawak (Sabah - 218 sheets and Sarawak - 271 sheets)	Sept. 2008 – Dec. 2008
• Data collection, validation and data tested for naming of an island and offshore geographical entities. • Development of the geographical names database for islands and offshore geographical entities. • Data for islands and offshore geographical entities downloaded into MyGeoName by the Working Group on Names of Island and Off-Shore Geographical Entities.	Oct. 2008 - March 2009
• Validation of geographical names from State Committee on Geographical Names (SCGN) before being publish into MyGeoName • SCGN will validate within 3 months after the Module on Verification of Geographical Names being delivered to the state.	Dec. 2008 – Dec. 2010
• Development of Arabic (Jawi) Module • Development of Arabic Module completed. Jawi spelling was then send to National Authority for Linguistics for validation.	Jan 2010 – Dec 2010
• Preparation of Audio Module • Development of audio module for Malay Language and related dialect.	May 2010 – Oct 2010
• Production of State Gazetteer • Production of state gazetteer based on the validation process.	Mei 2010 – Dec 2010
• **Phase III -** Data collection, validation and data tested from Town Maps of Penisular Malaysia, Sabah and Sarawak. (Scale of 1:3 000 – 1:12 500) • Development of the geographical names database for map. (Scale of 1:3 000 – 1:12 500) • Total of 160 sheets.	Jan 2011 – Dec 2011
• **Phase IV -** Data collection, validation and data tested from Klang Valley Maps. (Scale of 1:500) • Development of the geographical names database. (Scale of 1:500) • Depends on availability of the data provided by JUPEM	Jan 2012 – Dec 2012

The Working Group on Geographical Names Database and Gazetteer has appointed a Liaison Officer from each state to verify existing or propose any new names. In conducting this task, reference has to be made to gazettes, gazette plans, and circulars issued by all State Secretaries concerned, as they are the authorities for the naming of the geographic entities within their jurisdictions. In addition, those names will also need to be referred to the National Authority for Linguistics (Dewan Bahasa dan Pustaka) for approval. Finally, geographic names that are proposed to be used must be tabled at the SCGN meeting before being officially approved and adopted.

Naming of Islands and Off-Shore Geographical Entities

The Working Group on Names of Islands and Off-Shore Geographic Entities was established on 20th June 2006 and is chair by the National Hydrography Centre (NHC).

The tasks of this Working Group are as follows:

i) Carrying out surveys and researches as well as identifying and proposing the naming of islands and off-shore geographic entities which has no names. The proposed names will have to relate to the characteristics of hydrographic entities.

ii) Identify and collect all related information of islands and off-shore geographic entities including from charts, gazettes, maps, agreements and related documents;

iii) Documenting and updating the list of islands and geographical entities, the example of volume 1 of the document as shown in Figure 3; and

iv) Propose new names for existing islands and off-shore geographic entities related to the characteristic of geographic entities in accordance with the guidelines for the Standardization of Undersea Feature Names produced by the International Hydrographic Organization (IHO).

Figure 3: Front page document of Names of Island and Off-shore Geographic Entities Volume 1

The status on documentation of Names of Islands and Off-shore Geographic Entities for each state is shown in Table 2 as follows:

Table 2: Status on documentation of Names of Islands and Off-shore Geographic Entities

Status	Document	State
Published	Volume I	Kedah, Johor, Kelantan, Pahang, Terengganu, Labuan and Penang
	Volume II	Selangor, Perak, Melaka, Perlis and Negeri Sembilan
Waiting for State authorities actions	Volume III	Sabah
	Volume IV	Sarawak

Workshop of geographical names

Workshops of geographical names have been carried out as scheduled. The objectives of the workshops are to disseminate information on the Guideline on naming of Geographical Names and to understand the procedure to use Geographical Names Database. The workshops were also intend to help participants understand the importance of coordinated geographical naming and to populate the Geographical Names Database. These efforts are expected to support the implementation of the Malaysian Geospatial Data Infrastructure (MyGDI) initiatives which is undertaken by the Malaysian Centre for Geospatial Data Infrastructure (MaCGDI).

The content of the workshops include presentation from the committees, working groups and agencies related to geographical names as follows:

i) Briefing on National Geographical Names Database and Gazetteer by MaCGDI

ii) Briefing on Guideline for the Determination of Geographical Names by JUPEM

iii) Briefing on Names of Island and Off-Shore Geographic Entities by NHC

iv) Briefing on role of National Archives of Malaysia in development of National Geographical Names Database and Gazetteer by National Archives of Malaysia

v) Briefing of procedures on collection of geographical names in the publication of Topographic map by JUPEM

vi) Demonstration on MyGeoName application

vii) Hands-on training on updating of geographical names using Module on Verification of Geographical Names

Development of Module on Verification of Geographical Names

The module for updating the geographical names was introduced to expedite the verification process. Data Entry to the geographical names database will be done after the verification processes are completed by STCGN.

A few snapshots of the module are shown in Figure 4 to Figure 6.

Figure 4 : Interface of the Module on Verification of Geographical Names

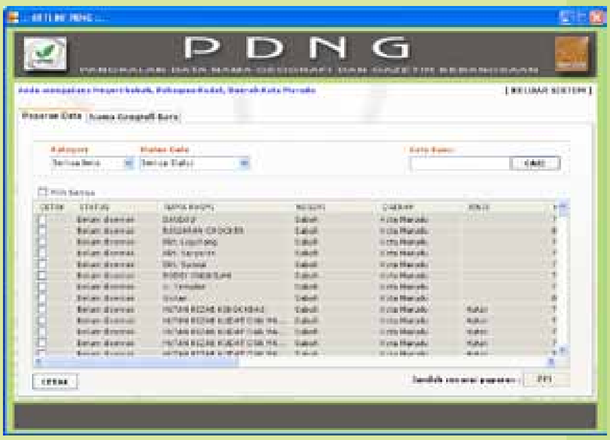


Figure 5 : The list of geographical names to be verified

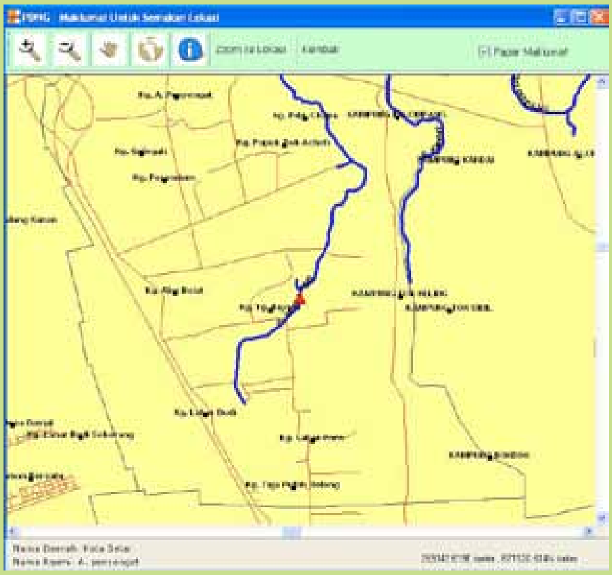


Figure 6 : The location of Geographical Names to be verified

Websites on Geographical Names Activities in Malaysia

a) MNCGN Website

JUPEM has launched the MNCGN Website named "MyGeoName" in July 2006 and the updating of the website is carried out regularly. The latest update was on November 2010 which includes the report on 17th UNGEGN Asia South East and Pacific South West Divisional Meeting in Sydney, Australia on 10th April 2010, and Information Bulletin of UNGEGN 2010. This website can be accessed at URL: http://www.jupem.gov.my/geonames in dual language that is in Malay language and in English language.

Through this website, all information related to geographic naming activities could be accessed and is linked to UNGEGN website and other country websites which are related to the geographical naming such as New Zealand and Canada. This website also include of Frequently Asked Questions (FAQ). A list of liaison officers for each agency is also included for communication purpose. MyGeoName application can be accessed by clicking the related link, via this website.

b) MyGeoName Application

MyGeoName application has been developed by MaCGDI. The interface of MyGeoName Application is as shown in Figure 7. The development for MyGeoName application is still ongoing with a few new additional modules being introduced as follows:

i) Searching Module

This module was developed to make searching on the database. Searching can be made via geographical names, locations, districts or states.

ii) Audio Module

Some communities in the States have their own dialects thus, pronunciation of geographic names can be different and sometimes cannot be determined correctly. On this matter, MNCGN had decided that "Audio File" be developed for all names that appear in the Web Gazetteer and this would in certain ways be able to address this matter and would lead to pronunciation of geographical names being made in a standardised manner.

There are two (2) versions of "Audio File" have been developed to represent its different way of pronunciations. In this regard, first version represents pronunciation using formal Malay language whilst the second version represents dialect pronunciation of each state of the country. Verifications of 'Audio File' are made by representative of NTCGN and secretariat of NCGN.

iii) Arabic (Jawi) Character Module

Arabic Character module is a module developed within the geographical names database. All arabic character for 64,554 geographical names throughout Malaysia including 3,974 foreign names has been submitted to National Authority for Linguistics for verification by related experts appointed.

iv) Administration Module

Administration module consists of data entry, data updating of geographical names and coordinates of the location. It also consists of verification of the spelling of geographical names.

v) Gazetteer Publication Module

This module is to publish and generate an authoritative national and state gazetteer of geographical names which had been verified by the SCGN.

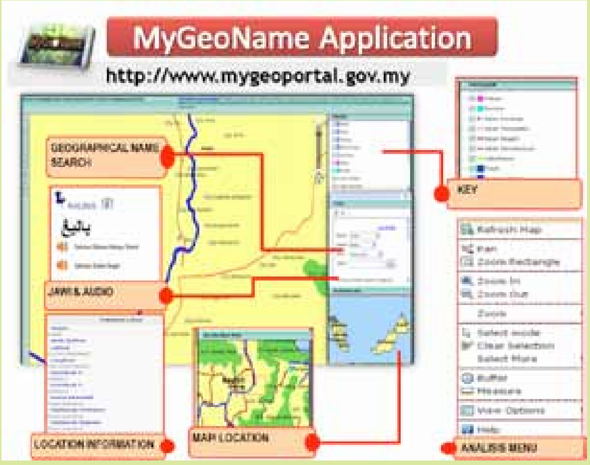


Figure 7 : The interface of MyGeoName Application

Computer Based Training (CBT) for Geographical Naming

The purpose of this CBT is to educate and illustrates the significance of geographic naming in the country for officers from Federal Agencies, State Agencies and Local Authority. The CBT comprises of introduction of the importance aspect of geographic naming (which include a speech from the Chairman of MNCGN), compilation of presentations from workshops given by JUPEM, MaCGDI and National Hydrographic Center, and procedure to update geographic names database in the country. Interface of CBT as shown in Figure 8.

Figure 8 : Interface of CBT

PRODUCTION OF NATIONAL GAZETTEER

The National Gazetteer of Malaysia is the authoritative geographical place names and is the result of the cooperative effort of federal and state governments.The Gazetteer is compiled annually by the Working Group on National Geographical Names Database and Gazetteer within MNCGN, using data provided by the Department of Survey and Mapping Malaysia (JUPEM), National Hydrographic Centre (NHC), Royal Malaysian Navy and State Committee on Geographical Names (SCGN).

This document details amongst others the organizations involved in the production of the gazetteer. It also describes in detail on the gazetteer product, data requirements, metadata, production methodology, associated production issues and quality control procedures.

IMPLEMENTATION ISSUES

In developing and implementing the standardised usage of geographical names throughout the country, there were some issues encountered by MNCGN, amongst which are as follows:

Verification of The Geographical Names

In developing the Malaysian Geographical Names Database and Web Gazetteer, the concerned Working Group only obtained partial commitment from the SCGN, particularly in regards to the verification of geographical names. Some State Liaison Officers appointed to the SCGN were frequently transferred to other positions and this affected the needed continuity on the data verification activities. Since procedures to verify geographical names were not properly documented new officers would face difficulties in carrying out their tasks.

In addressing this situation, State Working Groups had been formed by MaCGDI, whereby members among others comprise of an officer from MaCGDI and the State Liaison Officer. Any problem encountered is solved by State Working Groups collectively and completed work done was documented. In the case of the State Liaison Officer being transferred to another department, the State Working Group will acts as a mediator until a new State Liaison Officer is appointed by SCGN.

Besides that, the Computer Based Training and the Module on Verification of Geographical Names that have been developed will help State Liaison Officer to update the geographical names database. Briefings have been given to each state on how to use the module. During briefing, each district of the state will be given the module to update the geographical names in their district only. Then, the State Liaison Officer will collect the geographical names which have been update from the districts for the validation and send back to the working group within three (3) months after receiving the module.

Awareness On The Importance Of Geographical Names

In Malaysia, awareness of the importance of geographical names is mainly carried out by MNCGN with the cooperation of geographical names committees and working groups especially at the state level which comprises of local authorities as the key players in the geographical naming. Furthermore Local Authorities are encouraged to submit to the state government (SCGN) name changes and new names for unnamed places for consideration as official names.

In this respect the government has encourage the usage of the official names in all levels including government, public sector and the citizen. Besides that, state names authorities also promote throughout state government and the citizens an awareness of the importance and procedures for geographic name standardisation.

Furthermore, briefings and workshops on geographical names held frequently throughout the states to give awareness to the participants on the importance of geographical names. During briefing and workshops, participants were exposed on the importance to adhere the principles in the Guideline for the Determination of Geographical Names. These principles which are intended to serve as guides for the standardisation of geographical naming process in Malaysia towards a standard, accurate and consistent use of geographical names.

Therefore, awareness on the needs of standardization of geographical names is important because confusion, uncertainty, and misunderstanding may occur if more than one name is used for the same place, the same name is applied to different places, or the spelling of a name is inconsistent.

CONCLUSION

Geographical names activities in Malaysia need support, cooperation and commitment of all agencies, particularly at state level in completing works of updating geographical names within the time frame given. Compliance with policies and Guidelines for the Determination of Geographical Names is important so that geographical names used are consistent and authoritative. An effective database of geographical names will be a reference to all parties, significantly in the aspect of national building.

PENINGKATAN GIS9 ONLINE

PEMBANGUNAN SISTEM e-KAMPUNG DI NEGERI SEMBILAN

Unit GIS
Jabatan Perancangan Bandar dan Desa Negeri Sembilan
Emel : gis9@ns.gov.my
Laman web : http://gis9.ns.gov.my

Abstrak

Seiring dengan hasrat kerajaan untuk menyelaras dan memantau pembangunan desa, GIS9 online telah melaksanakan satu program peningkatan untuk membangunkan peta interaktif khusus untuk pengguna eksekutif iaitu Sistem Maklumat Kampung atau ringkasnya e-Kampung. Sistem e-Kampung ini telah dibangunkan oleh Jabatan Perancangan Bandar dan Desa Negeri Sembilan dengan kerjasama Unit Pengurusan Teknologi Maklumat (UPTM), Pejabat Setiausaha Kerajaan Negeri Sembilan dan Pejabat Pembangunan Persekutuan Negeri, Negeri Sembilan (PPN). Sistem ini dibangunkan khusus untuk pengguna eksekutif dalam membuat pemantauan dan menganalisa keperluan pembangunan setiap kampung dengan mengintegrasikan maklumat bukan spatial daripada pelbagai maklumat dari pelbagai sistem lain. Secara umumnya sistem ini juga bertujuan untuk menyediakan sebuah pangkalan data spatial kampung dan maklumat mengenai profil kampung di seluruh Negeri Sembilan.

(kata kunci: e-Kampung, integrasi, pangkalan data, GIS9 online)

Pendahuluan

Pembangunan GIS9 online telah dilancarkan pada tahun 2006 dan telah digunakan oleh banyak agensi, pelajar dan orang awam khusus dalam mencari guna tanah sekitar, lokasi petempatan, kemudahan awam dan lain-lain maklumat. Jabatan Perancangan Bandar dan Desa Negeri Sembilan sebagai pembekal maklumat perancangan, banyak menerima permohonan daripada pelbagai agensi kerajaan, swasta, pelajar dan individu, berkenaan maklumat berbentuk peta lokasi dan peta cadangan sesebuah kawasan. Pada tahun 2009, Jabatan telah melaksanakan satu program iaitu pembangunan sistem maklumat kampung bagi mempertingkatkan maklumat GIS9 sedia ada.

Program Pembangunan Dan Integrasi Maklumat

Pembangunan sistem ini merangkumi beberapa fasa pelaksanaan yang merangkumi penyemakan senarai nama petempatan dalam sistem e-Merah yang dibangunkan Pejabat Pembangunan Persekutuan Negeri, Unit Penyelarasan Pelaksanaan (ICU), Jabatan Perdana Menteri. Proses seterusnya bermula dengan program cerapan kampung di setiap tempat mengikut daerah menggunakan teknologi *Global Positioning System (GPS)* yang berasaskan sistem unjuran WGS84. Ia diikuti dengan program *"Focus Group Discussion (FGD)"* dikalangan pengerusi dan setiausaha setiap Jawatankuasa Kemajuan dan Keselamatan Kampung (JKKK) untuk menyemak dan mengesahkan maklumat yang dicerap beserta soal selidik status kemudahan asas di setiap kampung yang diselia.

> *Secara umumnya sistem ini juga bertujuan untuk menyediakan sebuah pangkalan data spatial kampung dan maklumat mengenai profil kampung di seluruh Negeri Sembilan.*

Antara maklumat kampung yang boleh diakses melalui aplikasi ini ialah :-

a) Lokasi kampung dalam bentuk geospatial, maklumat taburan kampung mengikut kawasan Dewan Undangan Negeri (DUN), Parlimen, Mukim dan Daerah;

b) Taburan kemudahan mengikut kampung dalam bentuk lokasi dan imej foto;

c) Maklumat Pentadbiran Kampung dan Sempadan JKKK; dan

d) Lain-lain maklumat seperti Statistik Penduduk Miskin dan lain-lain yang akan dibangunkan secara berperingkat.

Aplikasi e-Kampung boleh dicapai melalui Portal GIS9 Online http://gis9.ns.gov.my atau http://www.ns.gov.my dan http://ekampung.ns.gov.my.

Program pelaksanaan FGD bagi tahun 2009 mengikut daerah yang telah dilaksana adalah seperti berikut:

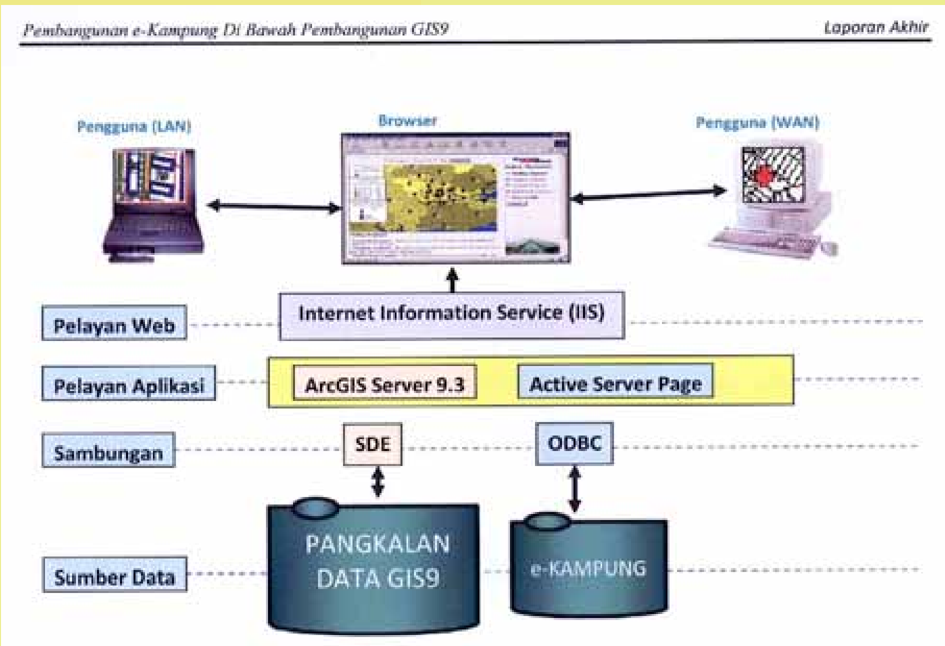
- 30 Jun 2009 – Daerah Port Dickson
- 30 – 31 Julai – Daerah Jempol
- 4 – 5 Ogos – Daerah Seremban
- 6 – 7 Ogos – Daerah Rembau
- 10 Ogos – Daerah kecil Gemas
- 12 Ogos – Daerah Tampin
- 13 – 14 Ogos – Daerah K.Pilah
- 18 – 19 Ogos – Daerah Jelebu

Sistem Dan Rekabentuk

Peringkat seterusnya ialah pembangunan sistem di mana senibina dan rekabentuk sistem e-Kampung dibangunkan menggunakan aplikasi web dalam kerangka *.Net dengan menggunakan kemudahan *Internet Information Services (IIS)* yang terdapat dalam sistem pengoperasian *Microsoft Windows Server 2000 R2* seperti Rajah 1.

Struktur pangkalan data e-Kampung menggunakan 2 jenis perisian iaitu RDBMS MS SQL Server 2000 dan maklumat spatialnya menggunakan *Spatial Database Engine Enterprise (SDE)* sebagai enjin perantaraan antaramuka e-Kampung dan pangkalan data GIS9. Struktur data ini dipecahkan kepada jadual-jadual tertentu yang menyimpan maklumat kampung mengikut kategori seperti maklumat petempatan, kemudahan masyarakat, JKKK dan lain-lain. Kod unik (*primary key*) bagi pangkalan data ini ialah kod kampung contohnya (SER001 = Kampung Sega Hilir) yang menjadi perhubungan dengan jadual-jadual lain seperti maklumat Jaringan Keselamatan Sosial (JKS) dan profil kampung seperti Rajah 2.

Maklumat Jaringan Keselamatan Sosial Negeri Sembilan merupakan salah satu cadangan untuk pengintegrasian maklumat e-kampung dengan lain-lain maklumat yang telah dibangunkan oleh lain-lain agensi Kerajaan Negeri Sembilan.



Rajah 1 : Senibina Rekabentuk Sistem e-Kampung

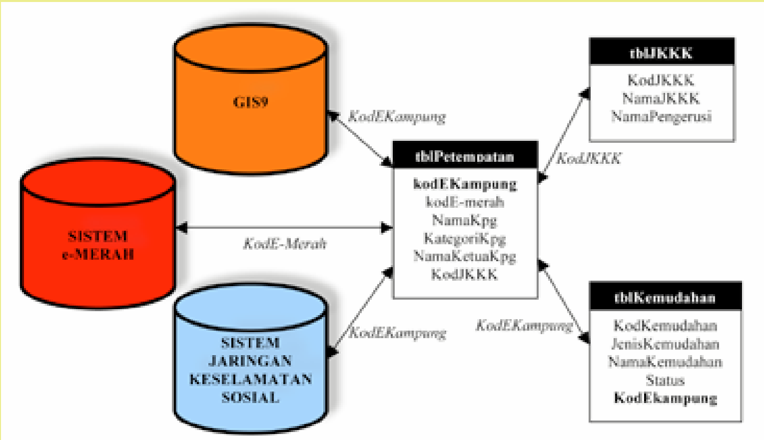
Fungsi utama yang disediakan dalam e-Kampung ini adalah seperti berikut:-

a) Paparan peta lokasi kampung mengikut koordinat x,y;

b) Paparan maklumat kampung yang terperinci beserta dengan gambar tempat-tempat dalam kampung tersebut;

c) Paparan maklumat kemudahan setiap kampung beserta gambar; dan

d) Senarai penerima bantuan bagi setiap kampung (khusus untuk pengguna eksekutif)



Rajah 2 : Kod Kampung sebagai (*Primary Key)* bagi pelbagai jadual dan maklumat

Kategori Pengguna

e-Kampung membenarkan 2 kategori pengguna iaitu pengguna eksekutif dan pengguna awam untuk mendapatkan maklumat yang tertentu.

Pengguna Eksekutif

1. Masukkan Nama Pengguna Dan Kata Laluan.

2. Paparan Peta Lokasi Kampung.

3. Maklumat Terperinci Kampung

4. Maklumat Penerima Bantuan

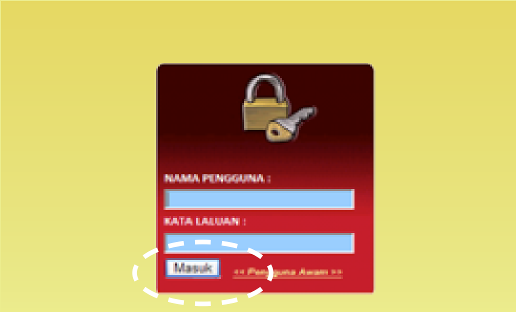
Parlimen	Miskin	Miskin Tegar	Mudah Miskin	Jumlah
Jelebu	1	0	0	1
Jempol	0	1	0	1
Rasah	2	1	0	3
Rembau	8	4	7	19
Seremban	1	4	5	10
Telok Kemang	1	0	0	1
Jumlah	13	10	12	35

*CONTOH

5. Taburan Taraf Kemiskinan Mengikut Kawasan Parlimen

Rajah 3 : Pengguna Eksekutif dan Maklumat Khusus

Pengguna Awam



1. Klik pada “Pengguna Awam”

2. Paparan Peta Lokasi Kampung

3. Taburan Taraf Kemiskinan Mengikut Kawasan Parlimen

Rajah 4 : Pengguna Awam dan Maklumat Umum Kampung

Pengguna eksekutif mempunyai kata nama dan kata laluan untuk mencapai maklumat yang lebih terperinci termasuk senarai penerima bantuan mengikut kampung. Pengguna awam pula hanya dapat melihat lokasi kampung serta rumusan jumlah kampung mengikut daerah seperti Rajah 3 dan Rajah 4.

Aplikasi e-Kampung membenarkan pengguna untuk mencetak peta, laporan dan membuat analisis stastistik data yang ada, yang mana bertujuan untuk membantu pihak pentadbiran tertinggi membuat sesuatu keputusan dan antara maklumat tersebut seperti :

a) Senarai kampung mengikut kawasan DUN dan Parlimen;

b) Senarai kampung mengikut mukim dan daerah;

c) Taburan penerima bantuan mengikut DUN dan Parlimen;

d) Taburan penerima bantuan mengikut mukim dan daerah; dan

e) Statistik kesediaan kemudahan asas bagi kampung mengikut daerah.

Penglibatan Agensi Lain

Jabatan menerima kunjungan dari wakil Kementerian Kemajuan Luar Bandar dan Wilayah (KKLBW) dan membuat sesi taklimat dan perbincangan berkenaan pembangunan e-Kampung dan Sistem Maklumat Kampung Berasaskan GIS oleh KKLBW yang juga dibangunkan khas untuk memantau projek-projek di bawah peruntukan KKLBW.

Penutup

Rumusannya, kesemua usaha yang terlibat dalam pembangunan e-Kampung, secara tidak langsung membantu mempertingkatkan pangkalan data GIS9. Sememangnya komitmen yang tinggi diperlukan terhadap aktiviti pengemaskinian dan penyelenggaraan yang perlu dilaksanakan secara berkala dan berterusan. Justeru itu adalah penting bagi sistem e-Kampung dapat menggunapakai maklumat-maklumat GIS9 sedia ada dan menambahbaik analisis mengikut keperluan semasa seperti integrasi antara sistem dan maklumat lain yang dirasakan penting dalam perancangan dan pembangunan kawasan luar bandar.

Penghargaan

Jabatan mengucapkan jutaan terima kasih kepada Pejabat Setiausaha Kerajaan Negeri, Pejabat Pembangunan Negeri Sembilan, Pejabat-pejabat daerah, Pengerusi dan wakil-wakil Jawatankuasa Kemajuan dan Keselamatan Kampung, dan semua yang terlibat secara langsung dan tidak langsung dalam pembangunan dan pelaksanaan e-Kampung Negeri Sembilan ini.

Focus Group Discussion (FGD) Bersama Wakil Pejabat Daerah, Penghulu Dan Pengerusi JKKK

Sesi taklimat daripada Pengarah JPBDNS dan wakil Pejabat Daerah kepada Penghulu dan Pengerusi JKKK mengikut daerah dalam program *Focus Group Discussion*.

Sesi pengesahan maklumat *info* desa oleh Urus Setia dan perbincangan dengan wakil JKKK.

A Simple Method for **Watershed Delineation** in Ayer Hitam Forest Reserve using GIS

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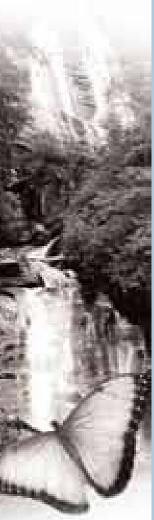
ABSTRACT

Planning of the water resource management is evolving from simple local-scale problems toward complex spatially explicit regional scale. Such problems have to be addressed with distributed models that can compute runoff and erosion at different spatial and temporal scales. In general watershed can range from as little as one hectare to hundreds of thousands of square kilometers. The spatial scale for which a model is designed can influence the specific processes of hydrological cycle. This paper seeks to estimate watershed delineation from topographical map using standard Digital Elevation Model (DEM) in ArcGIS 9.1. A simple automatic delineation technique in computer vision application was carried out at Ayer Hitam Forest Reserve, Selangor. Results showed that by using watershed function in ArcGIS 9.1 watershed delineation for the Ayer Hitam Forest Reserve can be determined. This exercise is mainly a case-study of simple applicability of GIS as a tool of watershed delineation. However, the results obtained is should not be wise to be utilized in other watershed area.



INTRODUCTION

A watershed is an area that drains surface water to a common outlet. Watershed analysis refers to the process of using DEMs (Digital Elevation Models) and raster operations to delineate watersheds and to derive topographic features such as stream networks (Kang, 2008). Previously, watershed delineation was mainly conducted by the method of hand delineation. Therefore water catchments area is determined based on the topographical landscape of the area (William, 2000). The watershed boundary can be determined using contour line map, hydrological regime, by calculation procedure and dot grid by a planimeter. A maps with 1:50,000 or 1: 20,000 standard scales are use to determine the area. In order to successfully delineate the watershed boundary, the evaluator needs to visualize the landscape as represented by each of the contour lines in the map. The steepness of the area which can be determined from the contour interval is related to the water flow.

Nowadays, applying topographical information in digital form is advantage in estimate a watershed area. On the other hand, it enables for accurate representation of stream flow path and contributing areas. It was found that the delineated area from the use of computerised approach is better compared to area determined by the topographical map (Guarav et al., 2002). ArcGIS provide a multipurpose hydrologic analysis system for use by watershed, water resource and land use. The GIS framework is ideally suited for watershed-based analysis or both deriving model input and presenting Model result. The techniques used for delineation of the watershed boundary by surface drainage are ultimately dependent on topographical information generated in a local neighborhood on the DEM. The raster data used in GIS carry spatial information and one of it is the coordinate of the earth surface. With the information of contour lines and river layer, it is enough for the GIS to manipulate it to determined the watershed area and delineate the boundary. Advances in the analysis of flow direction and flow networks from DEMs have led to several automated methods for watershed and stream delineation (Jenson and Domingue, 1988; Tarboton, 1997). The simple rule in this exercise is simplicity where the operation is transparent when an operator can examine its source code and comprehend how it works. It is simple when its operation is sufficiently, uncomplicated that a programmer can visualize with little effort of all the potential situations that it might encounter. This paper provides simple method to estimate watershed delineation automatically from topographical map using standard Digital Elevation Model (DEM) in ArcGIS 9.1.

METHODOLOGY

Study area and data description

The study area is located at Latitude of 2°56'N - 3°16'N and Longitude of 101°30'E - 101°46'E in the state of Selangor, Peninsular Malaysia (Figure 1). Ayer Hitam Forest Reserve is a University Forest that has being allocated as an education and research forest by the Selangor State in June 1994. The Ayer Hitam Forest Reserve covers an area about 1,217.90 hectares. The main rivers here are Sungai Rasau and Sungai Bohol. The geology in this forest contains the igneous rock and the main component of granite. The average temperature is 26.6º C and the relative moisture is 83%. Permatang Kumbang is the highest point in this forest with 233 meters above sea level and slope is 10% - 20%.

The data used are the contour layer which contain the height of each contour line and the river layer. Both layers are represented in shapefile (shp) format, ahcont.shp and sung.shp for contour and river layer respectively. All of the data are projected using the coordinate system Kertau, projection : RSO Malaya (meters).

"With the information of contour lines and river layer, it is enough for the GIS to manipulate it to determined the watershed area and delineate the boundary."

Figure 1: Quickbird Image satellite showing of Ayer Hitam Forest Reserve in Puchong, Selangor

Methods

ArcGIS 9.2 provides the toolbox for hydrology analysis containing some functions: flow analysis, stream analysis and watershed. Watersheds were delineated from a DEM by computing the flow direction or flow accumulation and using it in the Watershed function. The process of extracting hydrological information is showing in Figure 2. Raster data of a flow direction was used to delineate watershed and later on the pour points has to be determined.

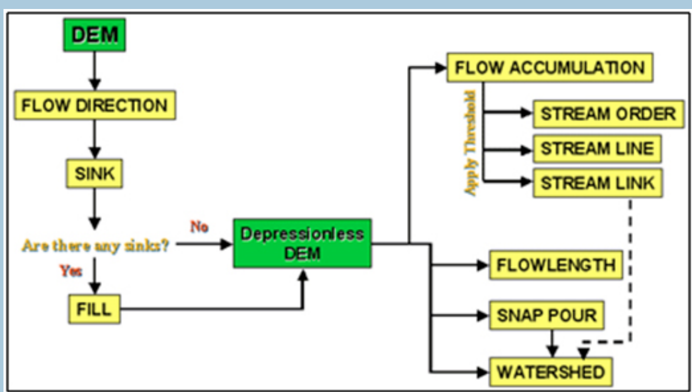
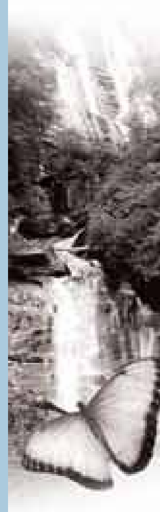


Figure 2: Process of extracting hydrologic information such as watershed boundaries and stream networks, from DEM



There are two input layers in this work: contour and river represented in shp format. The flow chart for producing watershed delineation map is provided in Figure 3. Table 1 show the input data and output for the processes conducted in this work. Below are some steps in constructing the final map for watershed delineation:

1. Create the raster DEM (Digital Elevation Model) format from the layer contour (shp format). We applied the sub menu TopoToRaster in ArcMap included in the menu Interpolation in the feature Spatial Analyst Tools. Some parameters selected in this task:

    - Feature layer: contour (ahcont.shp)
    - Field: contour height (HTMETER)
    - Type: contour

2. Apply the Fill operation in the menu Hydrology in the Spatial Analyst Tools to remove small imperfections the raster layer Contour.

3. Create flow direction layer from the layer Contour using the sub menu Flow Direction in the menu Hydrology in the Spatial Analyst Tools.

4. Calculate the flow accumulation layer from the flow direction layer by applying the sub menu Flow Accumulation in the menu Hydrology in the Spatial Analyst Tools.

5. Create the Pour point which is the discharge water to the reservoir. The pour point layer is created in ArcCatalog. Kertau, projection : RSO Malaya (meters) is selected as the geographic projection for the layer. Then we add XY coordinates to the pour point layer by applying the sub menu Add XY Coordinates in the menu Features in Data Management Tools. The new coordinate obtained from the study area will be added to the Pour point layer. The selected point is the lowest area in the contour line that intersects with the river. The point is drawn using the Drawing Tool. To obtain the coordinate of the point we apply sub menu Location in the menu Properties. By selecting the Editor menu, the location is then inserted to field Point_X and Point_Y in the table of pour point layer. From the table containing point X and point Y, we create a point layer using the sub menu in Make XY Even Layer in Arc Toolbox. Again a Kertau, projection : RSO Malaya (meters) is selected as the geographic projection for the new layer.

6. Create Watershed using the sub menu Watershed in the menu Hydrology in the Spatial Analyst Tools. The inputs are a raster of flow direction and the pour point layer.

7. Convert the Watershed layer in raster format to shp format.

8. Product the final map representing the watershed overlaying with the contour and the river layer. We display the contour and the river layer that are completely within the watershed area.

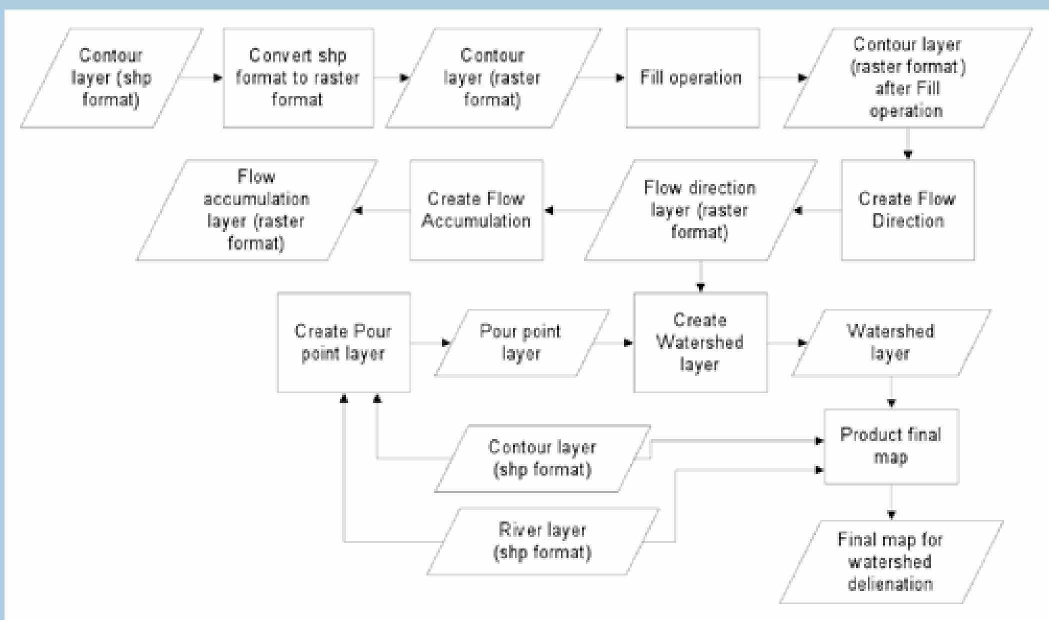


Figure 3: Flow chart for producing watershed delineation map

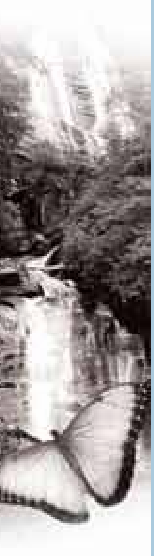


Table 1 show the input data and output for the processes conducted in this work

No	Input	Process	Output
1	Contour layer (shp format)	Create the raster DEM format	Contour layer (raster format), see Figure 4.
2	Contour layer (raster format)	Apply Fill operation	Contour layer (raster format) after the fill operation, see Figure 5.
3	Contour layer (raster format) after the fill operation	Create flow direction layer	Flow direction (raster format), see Figure 6.
4	Flow direction (raster format)	Create Flow Accumulation layer	Flow accumulation (raster format), see Figure 7.
5	Contour and river layer (shp format)	Create pour point layer	Pour point layer (shp format)
6	Flow direction (raster format) and Pour point layer (shp format)	Create watershed layer	Watershed layer (raster format), see Figure 8.
7	Watershed layer (raster format)	Convert Raster to Polygon	Watershed layer (shp format), see Figure 9.
8	Watershed layer (shp format), Contour layer (shp format), River layer (shp format)	Product final map	Final watershed layer (shp format).

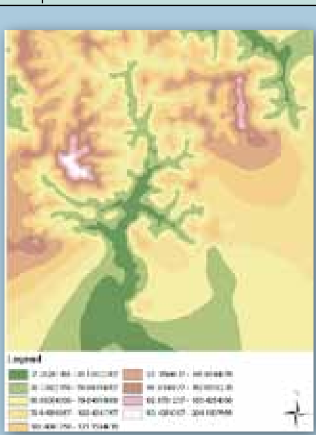


Figure 4: Contour layer in Raster format

Figure 5: Contour layer in Raster format after Fill operation

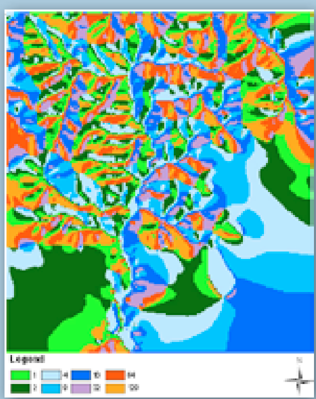


Figure 6: Flow direction

Figure 7: Flow accumulation

Figure 8: Watershed in raster format

Figure 9: Watershed in shp format

RESULTS AND DISCUSSION

This section discusses some important maps related to watershed delineation. The maps are flow direction, flow accumulation, pour point and watershed delineation.

Flow Direction

According to Kang (2008), a flow direction raster shows the direction water which is flow out from each cell of a filled elevation raster. There are eight distinct values in the flow direction raster as illustrated in Figure 10. Each value indicates the direction code showing the direction of flow out of each cell. ArcGIS uses the eight direction (D8) flow model. This method assigns a cell's flow direction to one of its eight surrounding cells that have the steepest distance-weighted gradient. The eight output directions relate to the eight adjacent cells into which flow could travel. As an illustration, in a small part of the study area (indicated in red ellipse in Figure 11) most of cells have the flow direction to neighboring cells located in the west part of the cells. The value of these cells is 16 displayed in dark blue in the map.

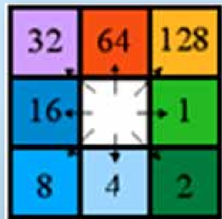


Figure 10: Direction coding

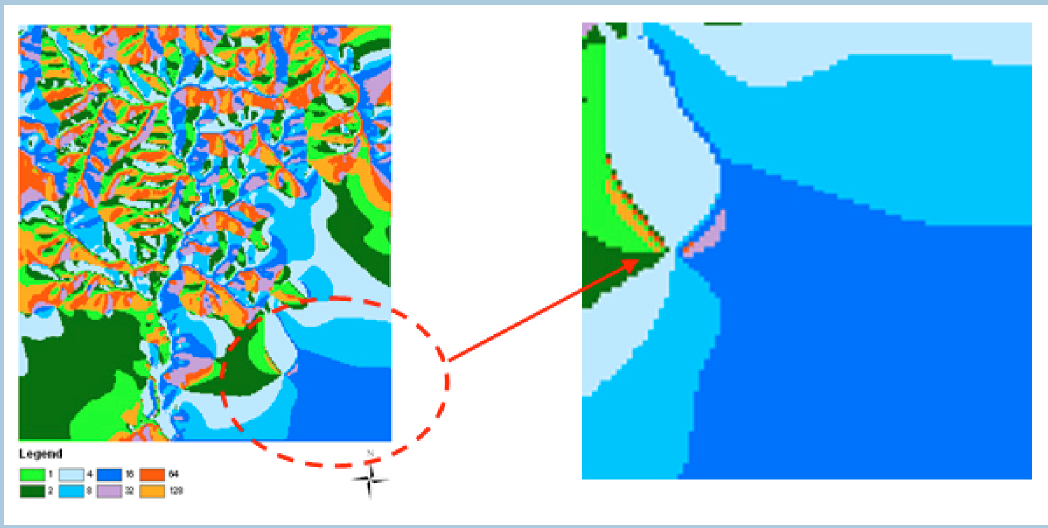


Figure 11: Flow direction in the south east part of the map

Flow Accumulation

A flow accumulation raster tabulates for each cell of the number of cells that will flow to it. A flow accumulation raster can be interpreted in two ways (Kang, 2008):

1. Cells having high accumulation values generally correspond to stream channels, whereas cells having an accumulation value of zero generally correspond to ridge lines.

2. If multiplied by the cell size, the accumulation value equals the drainage area.

In ArcGIS, the Flow Accumulation function calculates accumulated flow as the accumulated weight of all cells flowing into each downslope cell in the output raster (ArcGIS 9.2 Desktop Help). If no weight raster is provided, a weight of one is applied to each cell, and the value of cells in the output raster will be the number of cells that flow into each cell.

Figure 12 shows flow accumulation in a small part of study area indicated in red ellipse. Each cell in dark blue area has high value. For example, the point A indicates a cell having the value 8249. It means there are 8249 cells flow to the point A. We can consider such area as stream channels. This area has low elevation indicated by light blue area in the contour layer. The contour layers are provided in Figure 4 and Figure 5. The water flows from higher point (dark blue) to the lower point (light blue). Point B has the value 2 meaning that only two cells flow to that point. There are no cells that flow to the point C (the value is 0). We can state that this area is a ridge line.

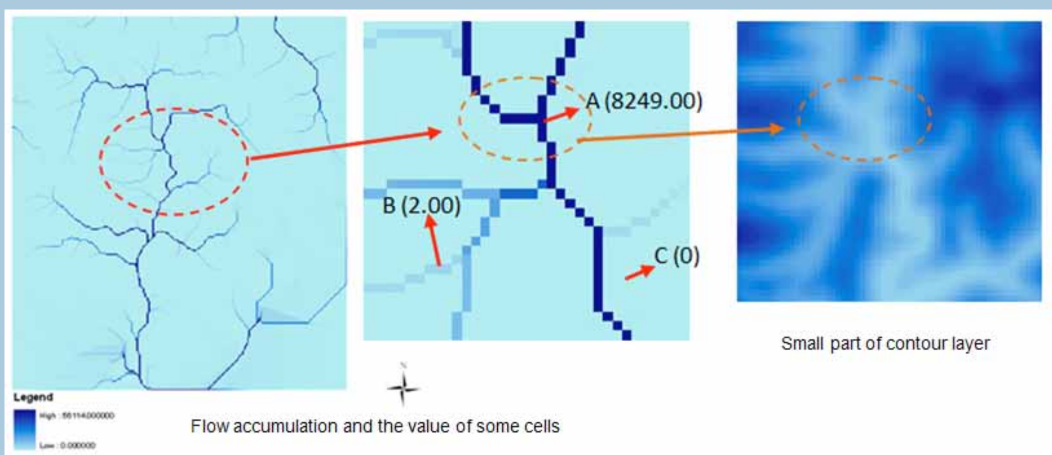


Figure 12: Flow accumulation and a part of contour layer

Pour Point

Delineating watershed was performed based on the points of interest called pour points. A pour point is the point at which water flows out of an area. This point may be a gauge station or a dam. In this work the pour point is a point in the lowest area that intersects with the river. Figure 13 shows the pour points that is located in the area having the elevation 22.5 meters and intersect with the river] (blue line). Water will flow out or discharge from other area to this point.

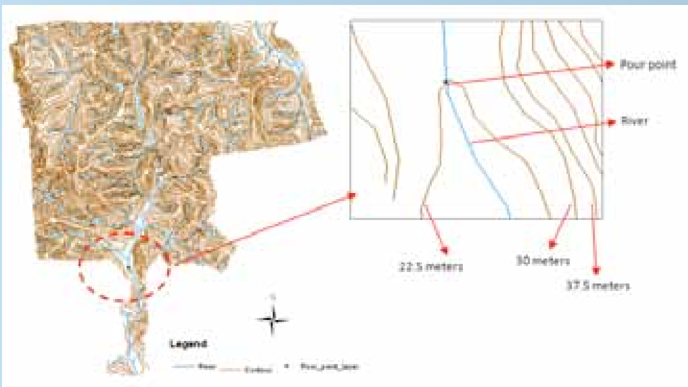


Figure 13: Pour point

Watershed Delineation

The delineation of watershed boundary was created from the total area of flowing accumulation to a given pour point. The watershed map for the Ayer Hitam Forest Reserve that created based on the flow direction raster and a pour point is illustrated in Figure 14. The total area of watershed calculated from watershed layer is about 9,532,076.38386 meter^2

Figure 14: Watershed delineation map

CONCLUSION

As conclusion by using GIS-computerised approach, an area of watershed boundary can be delineated automatically. This paper has concluded several important points in estimation techniques in computer application. Despite its potential advantages, automated generation of watershed boundaries involves several practical challenges. Errors arise because spatial data are numerous and may corrupt by noise. Topographical map rarely align perfectly, especially in moderate to low-relief terrain. Such error can to very different interpretations of watershed flow pathways. Therefore, a simple and rapid estimation is an important though incompletely solved problem in geospatial analysis. This exercise is mainly a case-study of simple applicability of GIS as a tool of watershed delineation. However, the results obtained is only a simple outcome for Ayer Hitam forest Reserve exercise and should not be wise to be utilized in other watershed area.

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Menggalur *Masa Depan GIS Di* MALAYSIA

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Abstrak

Sistem Maklumat Geografi (GIS) telah berada di persada maklumat negara sejak lebih tiga dasawarsa yang lampau. Kewujudannya banyak membantu di dalam memudahkan urusan harian masyarakat yang begitu sibuk dengan pelbagai tugasan yang perlu dilaksanakan. Artikel ini mengungkap dan menggalur masa depan GIS di Malaysia yang sering berhadapan dengan cabaran dan dugaan yang tidak kurang hebatnya sehingga mencapai kemuncaknya kini. Artikel ini juga secara ringkas menelusuri proses pembangunan maklumat di pelbagai peringkat sejak dari zaman kolonial British sehinggalah sekarang yang menuntut kepada pendemokrasian maklumat spatial negara untuk kesejahteraan masyarakat. Di dalam menggalur masa depan GIS di Malaysia, tiga persoalan utama dilontarkan iaitu siapakah penentu kepada peneraju maklumat, sejauh manakah maklumat yang terkumpul mudah untuk diakses oleh pelbagai lapisan masyarakat, serta tanggungjawab dan beban tugas untuk melahirkan wira-wira GIS negara dan selanjutnya menjadikan GIS sebagai rutin dan tugasan harian dalam semua lapisan masyarakat di negara ini.

> **“...tiga persoalan utama dilontarkan iaitu siapakah penentu kepada peneraju maklumat, sejauh manakah maklumat yang terkumpul mudah untuk diakses oleh pelbagai lapisan masyarakat, serta tanggungjawab dan beban tugas untuk melahirkan wira-wira GIS negara...”**

Pengenalan

Sistem Maklumat Geografi (GIS) di Malaysia kini berada di ambang teknologi yang menjadikannya sebagai sebahagian daripada rutin kehidupan harian masyarakat. Saya telah membincangkan metabolisme GIS di Malaysia yang melakarkan peranan dan kepentingan GIS dalam kancah sistem maklumat negara pada masa kini (Shaharudin Idrus et al 2006). Apa yang lebih penting sejak kewujudan GIS di persada maklumat negara ialah mempertahan dan memperteguhkan kedudukannya seiring dengan kepesatan pembangunan negara yang turut melibatkan pembangunan reruang *(spatial)* negara.

Justeru, masa depan GIS perlu diperkasakan dalam suasana sistem maklumat yang semakin mendesak dalam memenuhi tuntutan kehidupan masyarakat dengan menjadikan GIS sebagai rutin hariannya demi untuk memenuhi tuntutan pembangunan lestari negara.

Artikel ini mengungkap dan menggalur masa depan GIS di Malaysia setelah hampir tiga dasawarsa berada di persada persekitaran maklumat negara dan telah berhadapan dengan cabaran dan dugaan yang tidak kurang hebatnya sehingga mencapai kemuncaknya kini. Rata-ratanya, GIS di Malaysia telah mencapai tahap kematangannya seiring dengan pembangunan pesat teknologi maklumat di seluruh dunia. Cerita kejayaan dan kegagalan dalam mengendalikan sistem maklumat ini sama ada di sektor kerajaan, swasta, institusi mahupun orang perseorangan sering menghiasi ruangan makalah dan berita GIS di negara ini sejak sekian lamanya.

Selaras dengan proses globalisasi yang berlangsung dengan membuka ruang maklumat agar dapat dikongsi bersama, pendemokrasian maklumat spatial negara wajar diberikan perhatian sepenuhnya. Hujah yang ingin dibawakan di sini ialah melalui pendemokrasian maklumat spatial yang dimiliki oleh negara akan membawa kepada perencanaan dan penggunaan yang lebih berkesan dalam meneruskan kehidupan harian masyarakatnya dan seterusnya membawa kepada kualiti dan kesejahteraan kehidupan masyarakat pada masa depan.

Pendemokrasian Maklumat Spatial Negara

Pendemokrasian maklumat itu berdiri atas beberapa prinsip utama yang antara lainnya ialah setiap orang adalah berhak untuk memperolehi maklumat yang sewajarnya. Dua perkara penting yang menyentuh tentang pendemokrasian maklumat ini, pertamanya ialah hak dan peluang yang sama rata kepada semua warga untuk mendapatkan maklumat yang diperlukan. Keduanya ialah hak kesampaian kepada maklumat yang diperlukan itu.

Maklumat wajar dan boleh diperolehi secara bebas, tanpa sebarang sekatan-sekatan yang tertentu atau setidak-tidaknya pada peringkat asas dan peringkat dasar. Pendemokrasian maklumat bersabit dengan memberikan peluang seluas-luasnya kepada setiap warga untuk mendapat maklumat yang diperlukan tanpa mengira kelas sosial, kaum dan juga gender. Pendemokrasian maklumat ini akan menjadi asas kepada proses untuk mencapai masyarakat yang bermaklumat serta mampu bersaing pada peringkat global dan sentiasa kemaskini dengan maklumat-maklumat baru yang diperolehi menerusi sistem maklumat yang terbuka.

“Pendemokrasian maklumat itu berdiri atas beberapa prinsip utama yang antara lainnya ialah setiap orang adalah berhak untuk memperolehi maklumat yang sewajarnya.”

Pada zaman penjajahan dahulu, maklumat hanya dimiliki oleh pihak kolonial British sahaja. Maklumat yang diperolehi akan disimpan dalam lingkaran pengetahuan pegawai-pegawai Inggeris terutamanya maklumat yang berkait dengan kedudukan sumber asli negara seperti bijih timah, emas, arang batu dan getah. Maklumat yang diperolehi ini akan digunakan oleh kolonial British untuk terus mengumpul dan memunggah hasil bumi negara ke England untuk menampung kesan Revolusi Industri yang berlaku pada masa tersebut. Pada masa itu juga maklumat yang disampaikan adalah bersifat dari mulut ke mulut atau melalui percakapan seseorang dengan seorang yang lain.

Begitu juga halnya dalam sekitar tahun 1970an, 1980an sehingga akhir 1990an apabila maklumat mengenai kawasan yang ingin dimajukan contohnya hanya diketahui oleh segelintir pentadbir tanah dan pegawai yang lebih rapat dengan kelompok-kelompok tertentu sahaja. Maklumat sebegini tersimpan di kalangan orang perseorangan sahaja tanpa turun ke masyarakat umum. Kesannya, masyarakat umum tidak mendapat peluang untuk memperolehi atau membeli tanah yang pada ketika itu mempunyai nilai harga yang lebih rendah berbanding setelah kawasan tersebut dibangunkan dengan pelbagai infrastruktur fizikal yang cekap.

Namun hari ini, kepesatan teknologi maklumat dan komunikasi (ICT) telah membawa kepada revolusi maklumat yang dapat membawa kepada ilmu pengetahuan yang lebih baik. Maklumat dan perbincangan bersifat ilmiah yang pada ketika dahulu hanya dimonopoli oleh golongan tertentu, kini boleh diakses oleh masyarakat awam yang telah mempunyai darjah celik komputer yang agak baik. Begitu juga maklumat berkenaan dengan aspek pembangunan fizikal yang bakal dijalankan akan dipaparkan dalam ruang maya mahupun yang bercetak untuk tatapan umum. Maklumat sebegini akan memberikan kesan kepada masyarakat jika sekiranya kawasan atau tanah milik mereka akan terlibat dengan proses pembangunan tersebut.

Rakyat yang kini lebih matang pemikirannya akan dapat menilai kesesuaian atau ketidaksesuaiannya pembangunan yang akan dilangsungkan. Bantahan berbentuk tulisan, aduan dan sebagainya akan disalurkan jika difikirkan pembangunan yang bakal dilangsungkan itu tidak menjamin masa depan mereka yang terlibat dengan pembangunan tersebut. Maklumat spatial yang baik dan berkesan boleh menjadi asas kepada perpaduan dan keharmonian kaum di negara ini.

> *"Lantaran, GIS yang perlu diperteguhkan kehadirannya perlu dilihat dalam lingkaran teknologi maklumat yang sedia wujud di persada maya ini."*

Globalisasi dan *Googlelisasi* – Kepentingan Maklumat Dalam Era Digital

Proses globalisasi dan *googlelisasi (googlelisation)* - yang kini sering mendominasi sistem maklumat global dengan kemudahan google maps, menyatukan pangkalan data teks dan peta oleh pembangun perisian berasaskan web, meneliti keadaan guna tanah semasa, email dan pelbagai lagi sarana yang disediakan secara percuma – memudahkan semua pihak yang menginginkan maklumat yang lebih cepat, pantas dan lengkap dalam mengejar suasana kehidupan yang dimampatkan oleh ruang-masa. Maklumat menjadi keperluan kepada semua pihak, tidak mengira peringkat umur, sosio-ekonomi, budaya malahan merentasi sempadan etnik dan kaum telah menggunakan maklumat yang sama dari pangkalan data yang kita sendiri tidak mengetahui dengan tepat di mana data tersebut disimpan. Keterserlahan maklumat yang dimiliki oleh pencetus *google* kini seolah-olah hampir tidak ada satupun pesaing yang mampu menyaingi kudratnya dalam menguasai teknologi maklumat global. Lantaran sinonim perkataan globalisasi maklumat dan *googlelisasi.*

Maklumat yang sahih, tepat dan jitu yang terbina akan menjadi penyalur dan pembangunan budaya dan ilmu, penyalur kemahiran dan ketrampilan, penyalur kepercayaan dan jati diri serta maruah tetapi seharusnya berasaskan pemahaman dan budaya setempat yang dibina secara berterusan dengan sokongan kewangan yang kukuh.

Maklumat yang terbina dalam pangkalan data menjadi sumber penting kepada semua penduduk negara dan dunia. Pelbagai jenis maklumat yang ada dan mempunyai peringkat kepentingan mengikut keperluan individu, institusi dan masyarakat umumnya. Maklumat yang dibina itu adalah berbeza keperluannya kepada individu yang berbeza tetapi menuntut kepada kesampaian yang sama.

Pembangunan maklumat negara perlu seiring dengan pangkalan maklumat yang telah tersedia di pasaran maya. Orang ramai kini lebih mudah dan selesa mendapatkan maklumat berkait dengan perkara yang ingin diketahui dan diselidikinya dari laman maya berbanding dengan yang bersifat bercetak atau yang tersimpan secara fizikal di perpustakaan yang memerlukan pula masa untuk pergi ke tempat tersebut dan perlu mencari tempat meletak kenderaan berbanding dengan masa yang diambil untuk melayari bahtera maya maklumat yang tersedia dengan begitu meluas dan mempunyai darjah kejituan yang tinggi.

Dampaknya yang hadir daripada *googlelisasi* ini ialah merubah seluruh wajah kehidupan masyarakatnya – dari pola pekerjaan, corak pendidikan hinggalah kepada kebiasaan di waktu lapangnya – turut mengalami perubahan yang bukan sedikit kesannya ke atas kehidupan masyarakat seluruhnya. Lantaran, GIS yang perlu diperteguhkan kehadirannya perlu dilihat dalam lingkaran teknologi maklumat yang sedia wujud di persada maya ini.

Menggalur Masa Depan GIS

Selari dengan pendemokrasian maklumat tersebut, tiga perkara utama yang perlu diberikan perhatian di dalam menggalur masa depan GIS di Malaysia, antaranya ialah peranan siapa yang menjadi peneraju sistem maklumat di negara ini. Persoalan ini menuntut jawapan pasti kerana pengalaman menunjukkan bahawasanya kita agak sukar untuk bekerjasama dan berkongsi maklumat terutamanya yang melibatkan jabatan yang menjaga kerahsiaan negara. Jika isu ini tidak ditangani dengan lebih berhati-hati, pemilik data adalah terikat dengan beberapa akta yang melindungi kerahsiaan tersebut. Justeru, kesampaian kepada maklumat yang diperlukan itu terhambat oleh struktur yang terbina tadi. Ini menuntut kepada perubahan struktural jika tidak sekalipun diruntuhkan ikatan-ikatan yang membina struktur tersebut.

Pihak kerajaan dan swasta yang menjadi pemacu dan peneraju di dalam membangunkan sistem maklumat ini perlu seiring dalam menjadikan maklumat yang terkumpul mudah diakses oleh pelbagai pihak yang berkepentingan namun tidak membocorkannya kepada pihak lain yang tidak bertangungjawab kelak akan meletakkan negara di dalam kancah bahaya. Jika tidak nanti, maklumat yang begitu bermanfaat kepada kehidupan manusia tidak ditangani dengan sebaik-baiknya akan meninggalkan kesan dan malapetaka yang besar kepada negara atau ”bencana maklumat yang tidak terhinggakan”.

Salah satu aspek yang penting dalam membentuk pembangunan maklumat spatial negara ini ialah mampu menghasilkan wira GIS yang mampu melonjakkan negara di persada negara dan global. Malangnya kini, wira GIS negara telah hampir tiada. Negara gagal menghasilkan wira yang dapat menonjolkan diri sama ada bersifat individu atau institusi yang dapat menjuarai dan menjaga kepentingan GIS di Malaysia serta mampu menghubungkan Malaysia dalam senarai negara yang mempunyai sistem spatial yang begitu canggih. Beberapa individu yang telah berkecimpung di dalam bidang ini sejak sekian lama telah pergi meninggalkan kita. Sementelahan pula, tidak terdapat sebuah institusi yang dapat mengaitkan kewujudannya dengan keunggulan GIS tersebut. Dalam erti kata lainnya, jika disebut nama institusi tersebut, maka orang akan lebih tertarik dan memahami bahawasanya tugas utamanya ialah terlibat dengan bidang GIS ini.

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“GPS dan GIS telah menjadi sebahagian daripada rutin kehidupan harian penduduk.”

Menjadikan GIS sebagai Rutin dan Tugasan Harian

Sejak akhir-akhir ini, GIS bukan sahaja digunakan dalam urusan yang berkait dengan hartanah, lokasi dan kedudukan sesuatu tempat, tetapi kini, dengan kewujudan Sistem Penentudududukan Sejagat (GPS) yang disekalikan dengan GIS memudahkan para pengguna jalanraya untuk mencari lokasi atau kediaman yang ingin ditujunya. GPS dan GIS telah menjadi sebahagian daripada rutin kehidupan harian penduduk. Agak sukar untuk memandu di dalam kawasan bandar yang sesak tanpa panduan yang sempurna. GPS telah menyediakan kemudahan tersebut dengan harga yang berpatutan serta data yang sentiasa dikemaskini oleh pihak penyedia maklumat tersebut.

Persaingan dengan Pelbagai Perisian yang Berada di Pasaran

Persaingan yang sihat dapat memberikan pilihan kepada pengguna untuk mendapatkan yang terbaik. Aspek aplikasi atau teknikal juga wajar diberikan perhatian. Adakah kita bersedia untuk menjadi pemain utama di bidang teknikal atau hanya sekadar sebagai pengikut kepada perisian yang sedia ada di pasaran? Sebagai contohnya untuk membangunkan pemetaan kemudahterancaman *(vulnerability)* atau dayahuni *(liveability)*, budaya setempat dalam melahirkan konsep-konsep ini perlu diserasi dan diharmonikan dengan pembikinan GIS di peringkat dunia.

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MAPPING AND ANALYSIS OF FOREST PEATLAND WITH GPR

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Abstract

This paper appraised the geographic distribution, economic potentialities and environmental impact of the peatland. It reviewed the various GPR radar image interpretation techniques that lead to the identification of the extent, internal structure and petro physical properties of the peat deposit. The paper also appraised the procedures for moisture and organic content identification as well as hydraulic flow pattern within the deposit from GPR radar image. New techniques are proposed for the qualitative interpretation of radar image leading to the estimations of biogenic gas concentration and accurate radar velocity estimations. The developed radar velocity algorithm was used to estimate the velocity and dielectric constant of a test soil overlying a buried pipe. The proposed techniques provide a useful input needed for precision agricultural practice over a peatland. It also provides information required for forest fire preventive measures and sustainable management of the peatland.

Keywords: Ground Penetrating Radar, peatland, radar velocity, biogenic gas concentration.

Introduction

The most commonly used method in near surface mineral exploration and environmental study is the Ground Penetrating Radar (GPR) (Figure. 1). It provides information about the near subsurface geologic formations by recording continuous graphic profiles of the subsurface interfaces with high degree of accuracy. It is particularly found to be successful in detecting subsurface geologic formations, buried archeological remains, geologic subsurface fracture zones and cavities etc. Primarily, GPR records high frequency electromagnetic waves that have been reflected from subsurface contrasts in dielectric constant. It has the advantage of being non destructive and produce high resolution image. This unique feature enables it to develop extensively for variety of applications in many different fields. The range of application of GPR has been expanding steadily with the development of more sophisticated computing devices. These include: stratigraphic studies of sedimentary formation (Bristow & Jol, 2003), outlining the foundation of building and other engineering structures, (Abbas, et al, 2009), archeological investigation (Negri, Leucci & Mazzone, 2008), location of water table, and characterization of subsurface contamination (Hamzah, Ismail & Samsudin 2009), geomorphic controls of flood-plain and surface subsidence (Poole et al, 2002) road inspection (Loizos & Plati, 2007), mine detection (Bruschini et al, 1998) etc.

The remarkable performance of GPR in geomorphic control of flood indicates its great potentiality in characterizing biophysical attributes of wetlands lands. Knowledge about the extent, composition, vegetation and ecosystem of the forest wetland is vital information for domestic, horticultural and agricultural development of an area. The goal of this work is therefore to appraise the performance of the tool in mapping the most vital component of forest wetland, the peat.

Figure 1: Multi channel IDS DAD fast wave GPR unit

Peatland distribution and its environmental impact

Peat is partially or totally decomposed remains of dead plants which have been accumulated under water for tens of thousands of years (Huat, et al, 2009). It is formed as a result of accumulation and decay of plant materials in marshy areas composed of marshland vegetation, trees, grasses, fungi as well as other type of organic remains under anaerobic condition. The process gradually leads to the disappearance of the physical structure and the transformation of the chemical state forming an ecosystem where the production of organic matter exceeds its decomposition. The accumulation of this organic matter is referred to as the peat, an earliest stage of the formation of coal.

Peatland are found in almost all regions of the earth but are more abundant in the higher latitude regions especially in Eurasia and North America (Objective Corporate Research, 2005). It is the most widespread of all wetlands in the world representing 50% to 70% of all global wetlands (Finlayson & Spiers, 1999). Russia is the country with the largest peatland area in the world, spreading more than 1.4 million square km across the continent. Peatland in Russia cover over 8% of the land area, and together with the paludified lands, they cover more than 20% of country's area (UNEP et al, 2005). There are more than 25 million hectares of peatland in Southeast Asia comprising about 60% of the global tropical peatland resources and roughly one-tenth of the entire extent of global peat resources. The largest deposit of peatland in the Southeast Asia occurs in Indonesia which has over 70% of the total peatland resources of the region (ASEAN, 2008).

Peatland distribution

Peatlands are also available in many parts of Malaysia where it occurs in both highland and lowland. It is however more extensive in low lying poorly drained depression basins of the coastal areas. The total peatland area in Malaysia is approximately 2.4 million hectares, representing 8% of the country's total land area (Mamit, 2009). About 1.6 million hectares of this are found in Sarawak. Peninsula Malaysia and Sabah have peatland areas of 0.7 million and 0.1 million hectares respectively. The largest deposit of peat soil in Peninsula Malaysia is found in the state of Johor (Van-Engelen & Hutting, 2002).

Peat deposit is one of the most significant ecosystems in relation to vegetation, climate and green house gas regulation. Being an accumulation of dead plant, the peat absorbed carbon dioxide and stored it in the form of dead plant material. It has been estimated that over one-third of the world's soil carbon are contained in the peat ecosystem (IMCG and IPS, 2002). About 15% of the global peatland carbon is contained in the tropical peatland alone (Mamit, 2009). The drainage of peatland therefore leads to the oxidation of carbon dioxide which is released into the atmosphere.

Peat soil has a high water retention capacity (Mamit, 2009). The soil stabilizes water level by releasing stored water during dry season and absorbing water during heavy rainfall, thereby releasing water stress and providing drainage for agricultural activities. High carbon content of the peat makes it inflammable that can easily burn under low moisture condition. It is therefore an energy resource that is useful in domestic heat production (Objective Corporate Research, 2005). Peat is harvested as non renewable energy resource and refined as important source of fuel for domestic heat production and other useful form of energy.

Peat extraction is however not without environmental impact. Extraction of peat is associated with great environmental destruction. Repeated harvest of peat soil leads to the lost of the forest cover and destruction of the ecosystem. These cause the plant and animal species in the ecosystem to disappear. Draining of peatland lowers the water table which causes subsidence. Peatland is acidic and draining therefore causes a severe damage to the habitat (Mamit, 2009). A common post-harvest reclamation practice is the aforestation and rewetting of the peatland for agricultural activities (Schilsstra, 2001). This practice diminishes water retention resulting in greater discharge of water from the runoff rather than underground recharge, thus greater risk of downstream flooding (Mamit, 2009). The degradation of South East Asia's peatlands has accelerated in the last 20 years due to large-scale land clearing and drainage linked to agricultural development (ASEAN, 2008). Lowering of water table through drainage also causes further oxidation of the peat, turning the peatland into net carbon emitter. These make peatland more susceptible to fire, induce subsidence and affect the balance of greenhouse gases in the atmosphere.

Problems with Peat Soil

One of the major problems facing Asian countries including Malaysia is the issue of forest fire facilitated by degradation of peatland. Forest fire occurs at many peatland forests such as pineapple plantation in Malaysia since 1970s (Nuruddin, 1998). The most prominent incidence is the 1997/1998 El-nino disaster which affected many countries of the Southeast Asia. El-nino destroyed about 10% of the total peatland areas of Indonesia (UNEP et al, 2005). Four incidences of forest fire were recorded in Peninsula Malaysia during the 1997/1998 El-nino disaster with a total burnt area of 425.27 hectares (Nuruddin, 1998). The Centre for International Forestry Research (CIFOR) in Jakarta, Indonesia, where the fire originated from, reported that the cause of the fire was from unconsolidated peat burning (Rowell & Moore, 2000).

It is in realization of the above mentioned risks of peatland degradation that at the 9th Asian Ministerial Meeting on Haze held on 11th June, 2002, it is agreed that the Asian Peatland Management Initiative (APMI) be established with the goal of promoting sustainable management of peatland in the Asian region (ASEAN 2008). The objective of the initiative is to reduce the incidence of forest fire and its associated haze through the promotion of activities for the promotion of sustainable peatland management and fire prevention. Realization of the above objective depends on the amount and level of accuracy of information available about the resource. APMI initiative needs accurate and comprehensive data bank that contains detailed spatial information about the composition and extent of the peat resource. Accurate mapping of peatland within a forest is necessary for effective understanding of the exchange of carbon within the ecosystem and its impact on sustainable development of the resource. (Objective Corporate Research, 2005).

Objectives

This work is a review and further development of procedures for mapping and assessing the composition, extent and features of the peatland with GPR. The paper reviewed the procedure for the identification of physical features and estimation of the spatial distribution of biogenic gas concentration within the peatland. It also developed algorithm for accurate estimation of velocity information from GPR image based on the least square error minimization of hyperbolic signatures due to point reflector. Mapping and appraisal of the extent, quantity, composition and geographic spread of the peatland will provide vital information necessary for initiating sustainable management policies. The information will go a long way in assessing the economic potentialities of the natural resources and identification of hazardous hotspots.

Peatland Imaging with GPR

The performance of GPR in subsurface boundary delineation and identification of stratigraphic layers within a subsurface formation had been evidently promising. This is influenced by the level of variability in the dielectric properties of the subsurface constituents. A primary factor influencing the dielectric property of a medium is the water content. The suitability of GPR as a geophysical tool is however strongly influenced by the soil electrical conductivity. Soils with high electrical conductivity restrict the depth of penetration by attenuating the radar signal. Variation in electrical conductivity of soil is generally attributed to the grain size, surface area, cation exchange capacity and water holding capacity of the soil (Doolittle et al, 2007). For soil with comparable amount of clay and moisture content, greater depth of penetration can be achieved in a highly weathered zone with greater concentration of low activity clay (Soil Survey Staff, 1999). Peatland is characterized by low magnitude of electrical conductivity due to the presence of highly concentrated inactive and strongly bound organic compounds. Thus

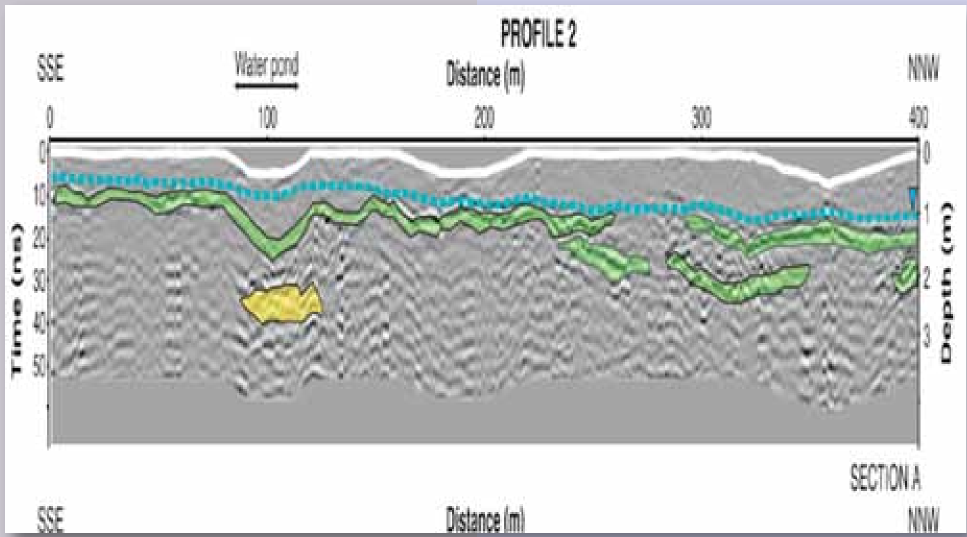

Figure 2: One of the profiles obtained by Gomez-Ortiz et al (2010) at Soto Grannde Grande wetland, showing the correlation between the water table (dash blue line) and the clay deposit (thick green)

peatland appears to be highly suitable for GPR analysis (Pelletier, Davis &. Rossiter,1991). The low level of electrical conductivity enables larger depth of penetration within the peat deposit. Radar signal through the water saturated peat gives a high resolution images to a depth of about 16m (Lowry et al, 2009).

Studies on peatland imaging with GPR have recorded a remarkable achievement in recent time. Pellevier et al (2010) delineated peat boundaries in the Hudson Bay lowlands of Canada using both ground and air-borne GPR data. Better result was obtained from the ground based data as the interface between the peat and the older deeper marine clays were accurately determined due to the conductivity differential between them. They were also able to delineate stratifications within the peat as an indication of denser layers. The stratigrapy in image of the internal peat structure is an indicative of the heterogeneity of the peat deposit. It also reveals the successive variation in the rate of decomposition of organic material content that makes up the peat and hence indicates the possibility of variation in the organic nutrient content. Dallaire et al (2009) used GPR to obtain a continuous representation of the dominant stratigraphic layers of peat and its associated carbon attributes for the estimation of carbon pool in Lac Le Caron peatland, Canada. Stratigaphic layers within the peat were identified from the radargram. Peat core analysis was used to interpolate the stratigraphic changes with the carbon pool and relate it with the fen/ bog transition (transition of the wet marshy area). A parameter of primary concern in GPR exploration is the radar propagation velocity across the medium of investigation. A radar pulse transmitted through a homogeneous medium propagates with a unique characteristic velocity that defines the medium. Velocity information with respect to a particular subsurface structure can be used to estimate the layer thickness, dielectric constant, moisture content, porosity and can also be used to delineate discontinuities between different subsurface structures (Daniel, 2004). It an attempt to obtain accurate GPR signal velocity of a peat soil, Rosa et al (2008) processed GPR radargram with EKKO VIEW DELUXE software together with direct core sample information. Accurate and consistent values of 0.09m/ns and 0.04m/ns were obtained with standard deviation/ns of 0.013m/ns and 0.008m/ns respectively at two different locations in Southern Quebec. These values are not significantly at variance with the values of 0.035m/ns-0.045m/ns obtained at Allequash wetland peat deposit, Wisconsin, USA (Lawry. 2009). This gives real dielectric permittivity values of 40.7-73.5. The electrical conductivity of the Allequash pealand was also determined and found to be within the range of to. These evidently demonstrate the suitability of GPR in peatland mapping and characterization.

Peat Geometry and Biogenic Gas Estimation

Object recognition plays a central role in non destructive testing techniques. Consequently many research works have been carried out toward developing techniques and algorithm with effective object recognition capabilities. Experimental results show that GPR survey over peatland was used to delineate the geometry of the peat deposit and reveal its relationship with the attributes of its adjoining deposits. It has been observed that there is a correlation between the geometry of water table and that of its adjoining clay layer in peatland. Analysis of GPR radargram over a wetland conducted by Gomez-Ortiz et al (2010) indicates a close spacing between the water table and the adjoining clay layers. The image was interpreted with a lithologic data obtained with piezomers fixed at different locations within the study area. Comparison of the piezometric log with the radar image shows that a shallow moderately strong reflector correspond to water table while a strong undulating reflectors appear below which correlates to the geometry of the water table reflection and was identified as the clay deposit (Figure 2).

It is therefore concluded that the clay layer deposit controls the location of the water table and thus influences underground water flow. In GPR radargram, the water table provides a continuous medium amplitude reflection that is easily identifiable across the radar record. This means that a shallow moderately strong reflector correspond to water table.

Highlighting the potential application of GPR in wetland hydrology, Lowry et al (2009) determined the interface geometry and thickness of peat in a groundwater fed wetland of Northern Wisconsin, USA. They observed that groundwater flow in a wetland is controlled by the geometry of the interface between the peat and the sand/gravel interface. Intensive analysis and modeling revealed that formation of a pond in a peatland is due to the increase in peat thickness. Groundwater flows to emerge as spring as a result of the break in slope between the peat and its underlying sand/gravel deposit.

Peat contains significant amount of biogenic gases notably CH4 and CO2, the two most important global warming potential gases that are in some cases emitted to the environment. The frequent cases of forest fire are partly attributed to the accumulation of the flammable components of these gases. One of the forest fire preventive measures is the identification of hotspots related to high concentration of these biogenic gases. Surface GPR test together with moisture probe laboratory analysis were used by Comas, Slater & Reeve (2005) to detect areas of biogenic gas accumulation in a peatland. The aim was to observe the effect of biogenic gas accumulation on GPR signal. Observation showed that areas of higher accumulation of CH4 and CO2 coincide with shadow zones of the radargram while areas with strong signal reflection generally coincide with low biogenic gas accumulation (Figure 3). Higher signal velocity zones were also found to coincide with the shadow zones and are therefore an indicative of higher biogenic gas accumulation.

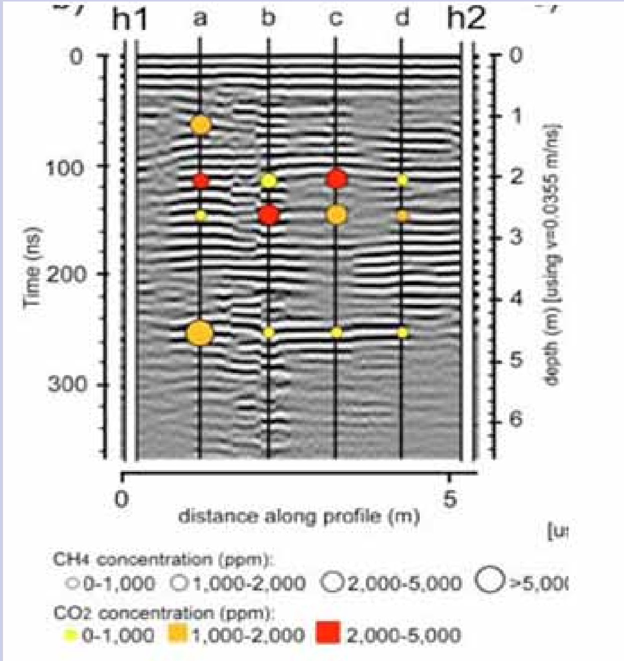

Figure 3 :GPR image indicating shadow zones due to biogenic gas concentration (Comas et al, 2005)

Radar signal velocity can be used to compute the petrophysical parameters of the medium such as dielectric permittivity, water content and porosity. The water content can be estimated using the famous Topp equation relating the dielectric constant of soil formation with its water content given as (Pumpanen & Llvesniemi, 2005)

1

$$\theta = a + b\epsilon_r + c\epsilon_r^2 + d\epsilon_r^3$$

where the parameters a, b, c, and d are constants for many soil materials but differed significantly for organic soil like peat due to the difference in bulk density and surface area. Complex Index Model (CRIM) equation on the other hand relates the dielectric permittivity of a soil formation with its water content and porosity given by Jol (2009) as

2

$$\epsilon_r = [\theta\epsilon_w^a + (1 - Ø)\epsilon_s^a + (Ø - \theta)\epsilon_s^a]^{1/a}$$

where is the fitting parameter depending on the orientation of the electric field relative to the medium geometry.Laboratory measurement of, and for the biogenic gas-free sample of the peat can be used in comparison with the field data to estimate the gas concentration. The basic steps of estimating the moisture content from the field data include EM velocity estimation, dielectric estimation from the velocity information and the application of the petrophysical relationship (Topp and CRIM relation) for the conversion of the dielectric values to moisture content. The Topp's empirical equation is a polynomial relationship whose parameters can be estimated using least square polynomial fitting. Comparison by calibration of three empirical relationship between and, by Pumpanen & Llvesniemi (2005) shows that the Topp's polynomial equation gives the best fitting with least standard error of difference. It however overestimates the water content at higher values of (between 10 to 40). They conclude that due to its high water content, application of Topp equation to peat requires calibration to a much wider range of moisture content.

The spatial distribution of the biogenic gas content of the peatland is the difference between the spatial porosity obtained from the field data and that obtained from the gas-free samples measured in the laboratory. The plot of the spatial distribution of the gas concentration can be used as an indicative of the hotspots and could therefore be used as forest fire hotspot monitoring measure.

Velocity estimation algorithm

The most common technique of velocity estimation from GPR radargram is velocity analysis of common midpoint (CMP) mode whose field technique requires step increment of the separation between the transmitting and receiving antennas. Most of the available GPR equipment are made with fixed separation between the antennas in a single casing. Thus a CMP survey cannot be conducted with such instrument. The most practicable technique for radar velocity estimation is by fitting the hyperbolic signature pattern due to a point reflector (Aitken & Steward, 2004). This involves the fitting of the hyperbolic spread due to the reflector with a mathematical model to determine the model parameters that minimize error criterion (Ristic et al, 2009). It is however observed that the position of the centre of the hyperbola of the reflector changes with the diameter of the reflector (Ristic et al, 2009). This leads to the false assumption that the spread of the hyperbola is caused by higher magnitude of velocity and can consequently lead to an incorrect velocity value.

In an attempt to overcome this limitation, we developed hyperbola-specific algorithm for the estimation of the fitting parameter based on ellipse-specific fitting technique developed by Fitzgibbon, Pitu & Fisher (1999). The optimal values of the fitting parameters a and b were obtained from the general equation of hyperbola by differentiating the sum of squared error with respect to the parameters and equating the differentials to zero.

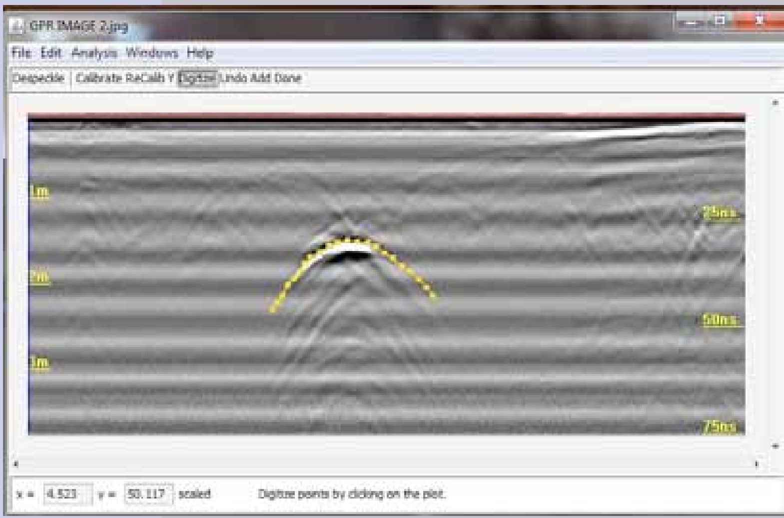

Figure 4, digitized radar scan

This gives the optimal values as:

3

$$a^2 = \frac{\sum_{i=1}^{n} x_i^4 \sum_{i=1}^{n} t_i^4 - \left(\sum_{i=1}^{n} x_i^2 t_i^2\right)^2}{\sum_{i=1}^{n} x_i^4 \sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} x_i^2 t_i^2\right) \sum_{i=1}^{n} x_i^2}$$

4

$$b^2 = \frac{\left(\sum_{i=1}^{n} x_i^2 t_i^2\right) \sum_{i=1}^{n} x_i^4 - \left(\sum_{i=1}^{n} x_i^2 t_i^2\right)^4}{\sum_{i=1}^{n} t_i^2 \sum_{i=1}^{n} x_i^2 t_i^2 - \sum_{i=1}^{n} x_i^2 \sum_{i=1}^{n} x_i^4}$$

Thus the optimum values of the parameters can easily be computed with the coordinates (xi, ti) as inputs.

The algorithm was tested with a field data obtained over a buried pipe along Jalan Tampoi road site in Johor Bahru using a multichannel IDS DAD fast wave radar acquisition unit. The acquired data is preprocessed with GRED IDS 3D software. The coordinates of the two hyperbolic signatures were recorded with a plot digitizer 2.4.1, (Figure 4) a Java program used to digitize scanned plots of functional data developed by Huwaldt (2005).

The algorithm was executed in a MATLAB environment with the following implementation code.

```
function [a,b]=hypfit(x,t)
%Filename: hypfit.m
%Usage: [a,b]=hypfit(x,t)
%Input
% x horizontal distance coordinates (m)
% t vertical time coordinates (ns)
%Output
% a fitting coefficient (a)
% b fitting coefficient (b)
P=sum(x.^2);
Q=sum(t.^2);
R=sum(x.^4);
S=sum(t.^4);
T=sum((x.^2).*(t.^2));
a=sqrt((R.*S-T.^2)/(R.*Q-T.*P));
b=sqrt((T.*R-T.^2)/(Q.*T-P.*S));
end
```

The result yield a numerical values of the parameters a and b as 49.6444ns and 4.3182m respectively. The parameters were used to estimate the velocity (Shihab & Al-Nuaimy, 2005) and a value of 0.174m/ns is obtained, given an dielectric permittivity of 2.973.

Discussion

Peal land is a great resource that is rich in many different natural values. The ever increasing global population growth leads to a pressing need for increase in food production. Being intersected by rivers, deltaic channels and steams in addition to high organic content, peatland is associated with production of various forest plantations such as timber and pineapple. This is one of the major driving forces toward peat utilization. Malaysia has already recorded about 32% level of utilization of peatland in agriculture and forestry activities since 2004 (Radjagukguk, 2004).

The output of this work could be used as input parameters for accurate prediction of crop yield within the land. The most economically viable precision farming technique relied on these information in predicting optimal yield for various types of crops within a farmland. Thus information such as spatial moisture and organic content variation over a peatland will be used to more precisely evaluate optimum sowing density of many crops. It has been established that the suitability of various crop production over a peat soil depends on the peat thickness (Radjagukguk, 2004). The outcomes of this work would therefore serve as tools for precision farming in peatland.

The spatial distribution of biogenic gas concentration over the peatland is a measure of the chemical energy content of the land. Although harvesting of peat as a fuel is not yet put into practice in Malaysia, perhaps due to its environmental impact, quantitative analysis of the fuel content is very vital in assessing the impact of the deposit to biodiversity and the ecosystem. It also serves as useful information for forest fire prevention measures.

The display and analyses of information about the spatial distribution of the extent, internal structure, organic content and biogenic gas concentration of the peatland require effective geographic information package. Geophysical data are usually displayed as thematic map revealing the spatial variation of the subsurface features. GIS package like ArcGIS will serve as an effective tool for visualization and spatial analysis of these subsurface features. The subsurface features can easily be displayed in ArcGIS by formatting the geophysical thematic map into RGB geo TIFF file format. It can then be displayed in a data frame using transparency display function in the ArcGIS environment. Merging of these raster images with each set to different transparency level will reveal the relative spatial variation of the subsurface features. The resulting image will display the spatial relationship between the various subsurface features. It can be used to analyze feature control mechanism between moisture content and porosity, organic content and biogenic gas concentration etc.

Conclusion

This work is a proposal for the justification of the possibility of qualitative and quantitative analysis of peatland with GPR. The work reviewed the economic and environmental impact of peat soil as a reservoir of nutrient, being rich in organic and biogenic gas content. Previous works also showed that mapping the peat with GPR revealed vital information such as thickness, lateral extent, internal stratigraphy and ground water flow pattern within the peatland. Qualitative interpretation of the radar image indicates factors that control the water flow pattern, organic content and biogenic gas concentration. Accurate radar signal velocity estimation algorithm is developed in order to accurately delineate internal boundaries due to variation in dielectric permittivity. The velocity information is a vital factor upon which petrophysical parameters of the peat such as water content and porosity depends. ArcGIS enables the display of the full wealth of information about the subsurface features as a single map. The output information contain necessary parameters for precision agricultural practice on the peatland.

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Lawatan Kerja

Jabatan Ukur BRUNEI ke MaCGDI

Pada 8 Februari 2011 MaCGDI telah dikunjungi oleh delegasi dari Jabatan Ukur Brunei, seramai 12 orang yang di ketuai oleh Penolong Juruukur Agung Brunei, Encik Arefin Hj. Jaya. Tujuan kunjungan delegasi adalah untuk mempelajari lebih dekat berkenaan teknologi geospatial yang digunapakai di Malaysia. Lawatan ini telah di pengerusikan sendiri oleh Puan Pengarah MaCGDI.

Banyak perkara yang dibincangkan dan beberapa isu telah dibangkitkan semasa perbincangan antara kedua belah pihak. Para delegasi telah dibawa melawat ruang kerja MaCGDI dan penerangan menganai proses kerja MaCGDI telah dibuat oleh oleh Encik Hazri Hassan. Pihak MaCGDI amat berbesar hati kerana Jabatan Ukur Brunei telah menjadikan agensi ini sebagai rujukan pembangunan Geospatial di negara berkenaan kelak.

Lawatan Kerja Pelajar

MASTER Dan Ph.D UTM Skudai, Johor

Satu lawatan sambil belajar dari Universiti Teknologi Malaysia telah diadakan pada 22 Februari 2011 bertempat di bilik Mesyuarat Topaz, Wisma Sumber Asli, Putrajaya. Lawatan ini dibuat untuk memantapkan pengetahuan pelajar Universiti Teknologi Malaysia mengenai bidang Sistem Maklumat Geografi. Rombongan lawatan seramai 18 orang tersebut telah diketuai oleh Dr. Alias Abdul Rahman dari Fakulti Kejuruteraan Geomatik. Mereka adalah terdiri daripada pelajar Master dan PhD Sistem Maklumat Geografi (GIS). Lawatan ini telah di pengerusikan oleh Ketua Penolong Pengarah Seksyen R&D, Tuan Haji Anual Aziz.

Seminar Nama Geografi Peringkat Negeri Sabah

Dirasmikan oleh Y.B Tan Sri Datuk Seri Panglima Joseph Kurup, Timbalan Menteri Sumber Asli dan Alam Sekitar pada 11 April 2011 di Hotel Le Meridien Kota Kinabalu Sabah.

Lawatan Teknikal Perserta **SPARRSO BANGLADESH**

15 Mac 2011; Seramai 15 orang pegawai *Bangladesh Space Research and Remote Sensing Organization (SPARRSO)* dari Kolej GEOMATIKA, bertujuan untuk mengetahui aktiviti NSDI yang dijalankan oleh MaCGDI. Lawatan ini telah dipengerusikan oleh En. Ya'cob bin Abas dan taklimat mengenai NSDI dan Projek 3D telah sampaikan kepada para pelawat oleh Puan Mageshwari a/p Valachamy dan Puan Nurul Afzan bt Idris.

Lawatan Teknikal "FRENCH TRADE COMMISSION - EMBASSY Of FRANCE"

8 APRIL 2011; Satu lawatan Teknikal telah diadakan oleh pihak *'French Trade Commission'* melalui kedutaan Perancis di Malaysia. Objektif lawatan tersebut adalah untuk mengetahui pelaksanaan GDI di Malaysia. Lawatan ini telah dipengerusikan oleh Timbalan Pengarah Cawangan Sistem, Puan Mariyam bt Mohamad. Beberapa isu telah dibincangkan dan pengalaman mengenai pelaksanaan GDI antara Perancis dan Malaysia di kongsikan semasa sesi soal jawab antara kedua-dua belah pihak.

MAP MALAYSIA 2011

Anjuran Jabatan Tanah & Ukur Sabah bersama Geospatial Media

SERDANG - Program Geographical Information System (GIS) Day 2011 UPM telah memberi ruang kepada golongan profesional dalam sektor kerajaan, swasta dan akademik untuk berkongsi idea dan tenaga pakar bagi menambah baik sistem GIS.

Penasihat *Malaysian Remote Sensing & GIS Society Student Chapter (MRSGISSC)*, Universiti Putra Malaysia (UPM), Prof. Madya Dr. Abdul Rashid Mohamed Shariff berkata, ia bertujuan mengemaskini aplikasi-aplikasi terbaru dalam sistem GIS untuk dilaksanakan berdasarkan polisi yang bersesuaian.

Antara aktiviti yang diadakan, termasuk syarahan umum bertajuk *'GIS for 1 Malaysia'* oleh Penasihat *Malaysian Remote Sensing & GIS Society Student Chapter (MRSGISSC)* dan *'Role of Private Industries in Nurturing 1 Malaysia Concept'* oleh Pengarah Urusan Teknologi Geomatika, Encik Mohaizi Mohamad. Selain itu, terdapat juga pameran daripada beberapa agensi selaku penganjur bersama untuk program iaitu *Malaysian Agricultural Research and Development Institute* (MARDI), SIRIM Berhad, dan *Hydro Navigation.*

3rd GEOMATICS DAY UiTM

"GENERATING GEOINNOVATIVE GENERATION"

7 March 2011, SAAS Foyer, UiTM Shah Alam Selangor

INNOVATION TOWARDS SUSTAINABILITY

The 11th South East Asian Survey Congress (11th SEASC 2011) and the 13th International Surveyors' Congress (13th ISC 2011), was held during 22 – 24 June 2011 at Putra World Trade Centre, Kuala Lumpur, Malaysia with a theme - "INNOVATION TOWARDS SUSTAINABILITY".

GIS Berita

Lebih Mudah Atasi Jenayah

KUALA LUMPUR: Dalam usaha mengurangkan kadar jenayah, aplikasi Sistem Maklumat Geografi (GIS) digunakan bagi mengenal pasti lokasi berlakunya jenayah sebelum data dihantar kepada Sistem Laporan Polis (PRS) dan pihak berkuasa tempatan (PBT). Itu antara kaedah yang diguna pakai dalam Sistem Pemantauan Bandar Selamat (SPBS) di bawah kendalian Kementerian Perumahan dan Kerajaan Tempatan (KPKT) menerusi Jabatan Perancangan Bandar dan Desa (JPBD).

Majlis Pelancaran SPBS telah diadakan di Kuala Lumpur pada 9 April 2011 oleh Menteri Perumahan dan Kerajaan Tempatan, Datuk Chor Chee Heung. Pihak KPKT mengambil langkah proaktif untuk bekerjasama dengan Polis Diraja Malaysia (PDRM) dan 12 PBT bagi melaksanakan SPBS di empat negeri selaras dengan usaha mewujudkan bandar selamat. Antara yang terbabit adalah 42 balai '*hotspots*' dan 12 majlis bandar raya di sekitar Wilayah Persekutuan Kuala Lumpur, Selangor, Johor dan Pulau Pinang,

SPBS adalah satu sistem yang direka bentuk untuk mengintegrasi data jenayah daripada PRS melalui program bandar selamat dan maklumat guna tanah. Sejurus menerima laporan jenayah berlaku di kawasan '*hotspots*' dan PBT, elemen penandaan lokasi jenayah yang berkoordinat dalam PRS akan dipetakan dan ditandakan ke atas peta digital secara automatik menggunakan GIS. Seterusnya maklumat akan dihantar ke Ibu Pejabat Polis Diraja Malaysia Bukit Aman. Selepas itu data jenayah akan direkodkan dan disimpan dalam SPBS untuk dianalisis untuk urusan pemantauan.

SPBS juga mengenalpasti kawasan mana perlu pasukan PDRM meningkatkan rondaan, mengenal pasti kawasan 'panas', melakukan operasi bersepadu dan menyediakan balai polis bergerak. Manakala antara tanggungjawab PBT bagi mengurangkan jenayah adalah dengan meningkat pencahayaan di kawasan jenayah, mengasingkan laluan pejalan kaki dan laluan bermotor, pemasangan rel penghadang dan sebagainya.

Sumber daripada myMetro
10 April 2011

Mapping The World, One Street At A Time

Between GPS devices on your car's dashboard and digital maps of almost any location in the world on your smartphone or laptop, it's hard to get lost these days.

We may take these 21st-century services for granted. Someone still needs to do the actual field work of mapping these places and making sure the information is accurate.

Meet the people at Tele Atlas, the company that provides so-called "base maps" to such high-profile clients as Google, MapQuest and RIM, the maker of the BlackBerry. Tele Atlas also provides digital-mapping services for its corporate owner, the portable-navigation company TomTom.

"Our ultimate goal would be to map the entire world," says Pat McDevitt, vice president of engineering at Tele Atlas, which is based in the Netherlands and has its U.S. headquarters in Lebanon, New Hampshire.

Base maps are the raw data – highways, streets, stop lights and exit signs – that navigation companies use as a starting point before adding their own applications.

Most of the industrialized world has been base-mapped already. Tele Atlas is constantly updating pre-existing maps to include new roads, traffic signals and buildings.

Source from Jeremy Bradley, CNN

BULETIN GEOSPATIAL SEKTOR AWAM

FORMAT DAN GARIS PANDUAN SUMBANGAN ARTIKEL

Buletin Geospatial Sektor Awam diterbitkan dua (2) kali setahun oleh Pusat Infrastruktur Data Geospatial Negara (MaCGDI). Sidang Pengarang amat mengalu-alukan sumbangan sama ada berbentuk artikel atau laporan bergambar mengenai perkembangan Sistem Maklumat Geografi di Agensi Kerajaan, Badan Berkanun dan Institusi Pengajian Tinggi.

GARIS PANDUAN UNTUK PENULIS

1. Manuskrip boleh ditulis dalam Bahasa Melayu atau Bahasa Inggeris.

2. Setiap artikel perlu mempunyai abstrak dan perlu ditulis dengan huruf condong (italic).

3. Format manuskrip adalah seperti berikut:

Jenis huruf (font)	:	Arial
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Margin	:	Atas, bawah, kiri dan kanan = 2.5 cm
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Lajur (column)	:	Satu lajur setiap mukasurat

4. Sumbangan hendaklah dikemukakan dalam bentuk softcopy dalam format Microsoft Word.

5. Semua imej grafik hendaklah dibekalkan dalam format .tif atau .jpg dengan resolusi tidak kurang daripada 150 d.p.i.

6. Segala pertanyaan dan sumbangan hendaklah dikemukakan kepada :

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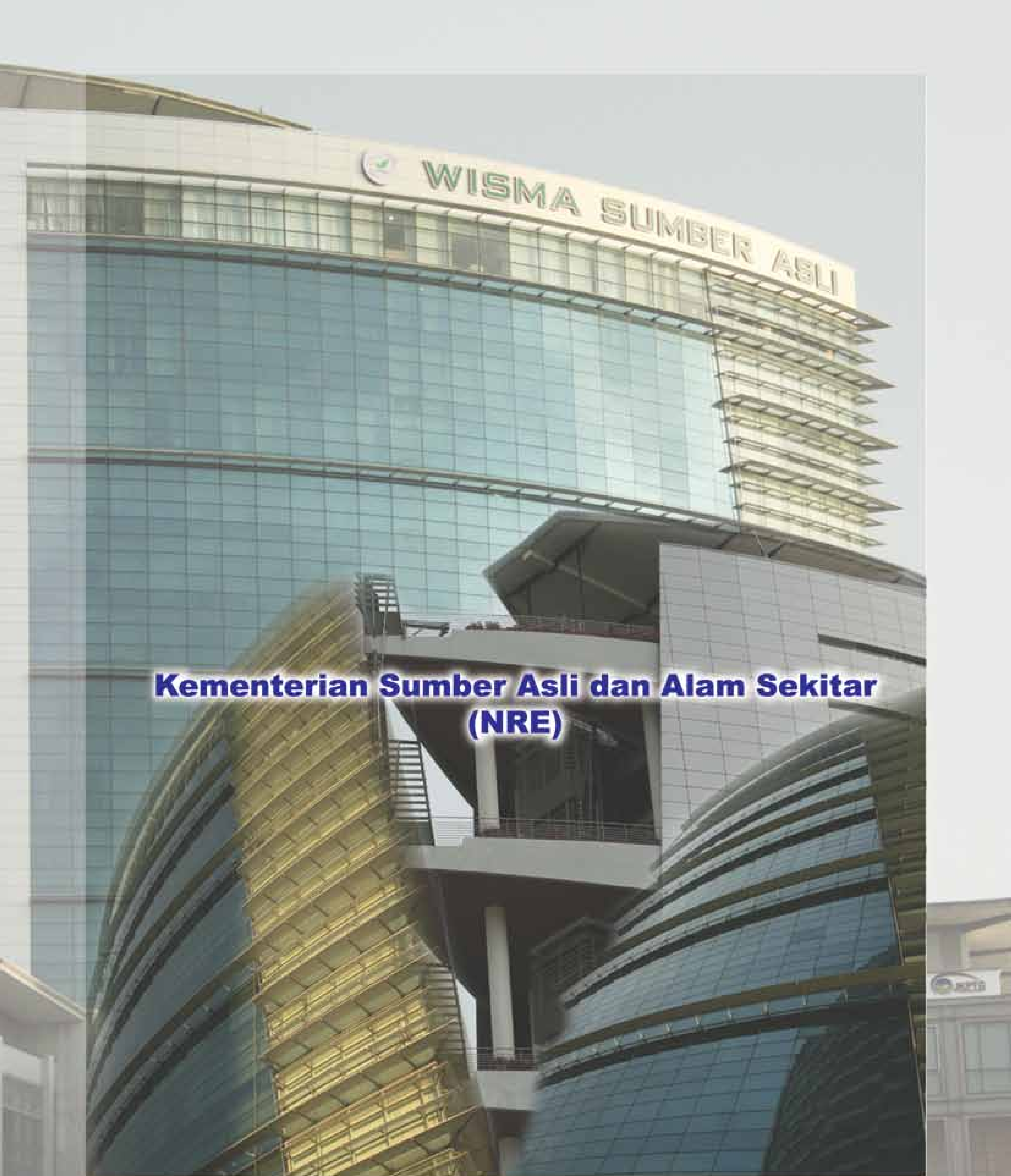

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