



**GIS AND REMOTE SENSING TECHNIQUES IN LAND  
USE PLANNING FOR CONSERVATION OF HERITAGE  
SITE IN LEMBAH BUJANG, KEDAH**

**BY**

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the degree of Master of Urban and Regional Planning**

**Kulliyyah of Architecture and Environmental Design  
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## **ABSTRACT**

Heritage site in Malaysia, specifically in Lembah Bujang, Kuala Muda, Kedah defines a high significance in the history timeline, which not only holds the history of local area but to the earliest civilization in southeast Asia. The study on preservation and conservation of heritage site in Bujang Valley was triggered by the unfortunate event of the demolition of Site 11 in Planning Block Bujang due to lack of land use planning guidelines in the area. The research focuses on the analysis of current land use or land cover condition, is land cover changes happen around the area and the impact of land use or land cover changes over time within the area of three Planning Block of Bujang, Merbok and Bukit Meriam. In order to achieve the objectives of the study, the application of GIS and remote sensing are used to monitor the changes of land cover of study area through time period, classified land use changes and analyze the development pattern in and around the study area. The data were processed with ERDAS IMAGINE 2014 and MapInfo Professional 11. The results indicated that not all areas consists of shrines were protected by the existing law and the current law only cover the areas with physical evidences but not the whole surrounding local area. Therefore, some suggestions were proposed to protect the area such as identification of the core zone of heritage sites, setting up buffer zones, drafting physical guidelines in protecting the heritage sites and revitalize the heritage sites in term of physical restoration in order to gain financial support from UNESCO that will have an impact to the physical conservation of the area.

## ملخص البحث

موقع التراث في ماليزيا، خاصة في لمبه بوجانج، كوالا مودا، قدح لها شأن كبير في تسلسل الأحداث الزمنية التاريخية ليس لتاريخ المنطقة المحلية فحسب بل للحضارة الأولية في جنوب شرق آسيا. إن هذه الدراسة تهدف إلى الحفاظ على موقع التراث في لمبه بوجانج منبثقة من حدث شقي ألا وهو تدمير الموقع 11 من كتلة بوجانج للتخطيط نظرا لعجز توجيهات تخطيط استعمالات الأراضي في المنطقة. ويركز هذا البحث على تحليل استعمالات الأراضي الحالية أو أحوال الغطاء الأرضي، هل وقع التغيير في الغطاء الأرضي في المنطقة وتأثير استعمالات الأراضي وتغيير الغطاء الأرضي عبر الزمان خلال مناطق الكتل الثلاث للتخطيط وهي بوجانج، مربوك وبوكيت مريام. لكي تتم الأغراض من هذه الدراسة، تم استخدام نظام المعلومات الجغرافية وتقنية الاستشعار عن بعد لمراقبة التغييرات في الغطاء الأرضي في المنطقة المدروسة خلال الفترة الزمنية المحددة، ثم تصنيف تغييرات استعمالات الأراضي وتحليل شكل التطوير في المنطقة المدروسة وحوها. ومن ثم، يتم معالجة البيانات باستخدام برنامج إيراداس إيماجين 2014 (ERDAS IMAGINE 2014) وبرنامج ماب إنفو بروفيشنال 11 (MapInfo Professional 11). وتشير النتائج إلى أن ليس كل المنطقة المتضمنة من الأضرحة تخضع لاختصاص القانون الحالي وحتى القانون الحالي نافذ للمناطق بالآثار الفيزيائية فقط وليس للمنطقة المحلية كلها. لذلك، تم تقديم بعض الاقتراحات لحماية المنطقة منها تعيين المنطقة الجوهرية لمواقع التراث وإقامة المناطق العازلة ووضع التوجيهات الفيزيائية للمحافظة على موقع التراث وإحياء مواقع التراث من حيث الترميم الفيزيائي للحصول على الدعم المالي من منظمة الأمم المتحدة للتربية والتعليم والثقافة (UNESCO) حتى يؤثر تأثيرا كبيرا في الحفاظ على المنطقة فيزيائيا.

## APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Urban and Regional Planning.

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## DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Intan Siti Zulaikha Binti Mastor

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PLANNING FOR CONSERVATION OF HERITAGE SITE IN  
LEMBAH BUJANG, KEDAH.**

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*In the Name of Allah, the Most Beneficent, the Most Merciful*

*This dissertation is dedicated to my beloved parents;*

*Ibu & Ayah*

*My supportive brothers;*

*And the one who awaits,*

*with patience and faith.*

*“Because there will always be another mountain. I’m going to make it move. It will always be an uphill battle. Sometimes I have to lose. It’s not about how fast I get there. Not about what’s waiting on the other side.*

*It’s the climb.”*

*-Cyrus, D. Hope-*

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## LIST OF ABBREVIATION

<b>ABUAER</b>	Annual Built-up Area Expansion Rate
<b>ARSM</b>	Agensi Remote Sensing Malaysia
<b>DU</b>	Dasar Utama (General Policy)
<b>DK</b>	Dasar Khusus (Specific Policy)
<b>DS</b>	Dasar Strategik (Strategic Policy)
<b>ESA</b>	Environmental Sensitive Area
<b>GIS</b>	Geophysical Information System
<b>GPR</b>	Ground Penetrating Radar
<b>ICOMOS</b>	International Council on Monuments and Sites
<b>JPBD</b>	Jabatan Perancangan Bandar dan Desa
<b>LP</b>	Local Plan (Rancangan Tempatan)
<b>MPSPK</b>	Majlis Perbandaran Sungai Petani Kedah
<b>PB</b>	Planning Block
<b>RS</b>	Remote Sensing
<b>UNESCO</b>	United Nation Educational, Scientific and Cultural Organization
<b>VHR</b>	Very High Resolution

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

Lembah Bujang is the oldest historical site in southeast Asia dated back to 2 million years ago as starting point of civilization of Kedah Tua Kingdom (Erna, Zulkepli, Halim, Albert, & Nurul Shahida, 2013; M.Mokhtar, Jaffrey, Jalil, & Azman, 2008). Recently the issues of Sungai Batu shrines in Site 11 have been cleared for development project triggered questions on status of land use and jurisdiction over gazetted heritage site (Mok, 2013; Lai and Chua, 2013; Yong, 2013; Ihsan, 2013). This case is considered complex, considering the fact that there are no law acts or planning guideline mentioning to set up buffer zones for potential site containing physical heritage evidence that yet to be found as a method of conserving heritage site. Thus, exposes the adjacent surrounding site vulnerable in the future and incompatible adjacent land use as effects of development pressure as discussed by Lasaponara and Masini (2011).

The aim of this study is to identify the core area and appropriate buffer zones of the heritage area. A profound study need to be conducted to identify the site of the shrine complexes and analyse land use and land cover changes of surrounding area and built-up land use pattern to predict future developments in the area (Qiu, Lijun, Hongbo, Changao, Junhai and Chengfa, 2006; Ruman and Prashant, 2013; Pranita, Devashree, Prabodhachandra, and Arun, 2013). As it is somewhat impossible to impose all land that consist of shrine as heritage site, so the best method is to conduct supervised land classification techniques to identify the land cover changes and land use converted into built-up area and have the possibility for development to encroach into the area

(Bassani, Cavalli, Goffredo, Palombo, Pascucci and Pignatti, 2009). Identifying the land use and land cover of the site is important to impose heritage area reserve and setting up buffer zones. Therefore, the absence of a strong and doubtless techniques and criteria of the buffer zones are need to be define to ensure that there will be no land containing heritage evidence sacrificed in term of development in the future.

## **1.2 BACKGROUND STUDY**

According to International Council on Monuments and Sites (ICOMOS), Cultural Heritage is an expression of the ways of living developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values. Cultural Heritage is often expressed as either Intangible or Tangible Cultural Heritage (ICOMOS, 2002). Cultural heritage, as in this study the shrines complexes, is important to preserve as it gives people a connection to social values, beliefs, religions and customs of the people in the area and even to the Southeast Asia region. It allows the people to identify with others of similar mind-sets and backgrounds. Cultural heritage can provide an automatic sense of unity and belonging within a group or community and allow to better understanding of previous generations and the history of civilization.

Cultural heritage is made up of many things such as building, townscapes and even in the context of this study, archaeological remains. Culture can be perceived through natural sources as well: the agriculture and landscapes associated with the site. The Heritage Cycle from Simon Thurley (2005), explain the process of finding and incorporating culture into life begins with understanding the culture then begin to value.

From there, learn to care for a culture and eventually enjoy it. With more enjoyment, the community will want to learn and understand more as the cycle goes.

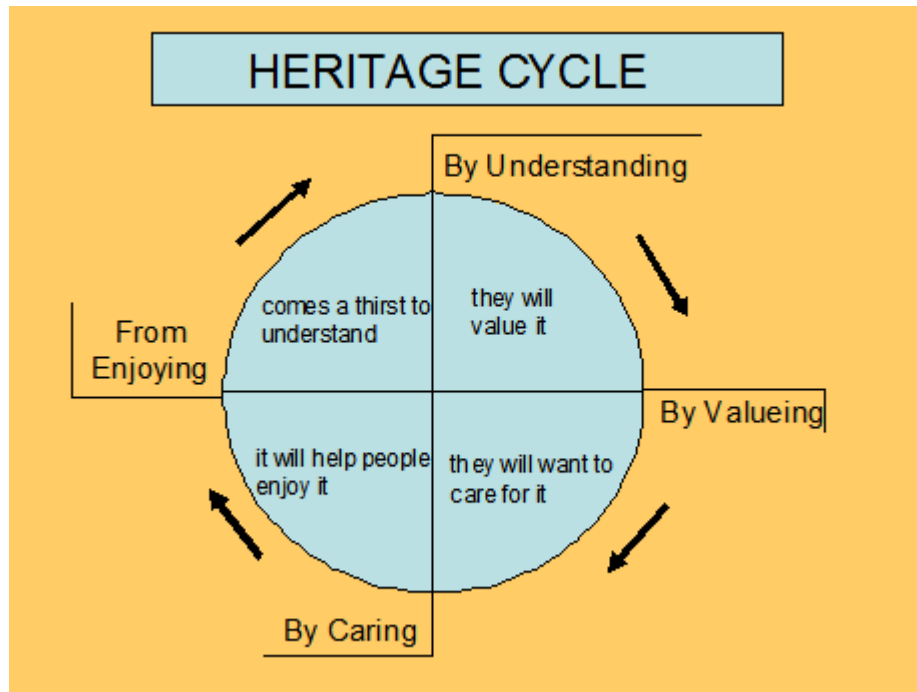


Figure 1.1: The Heritage Cycle  
(Source: cultureindevelopment.nl)

Historically significant building and heritage sites contribute to cultural and economic well-beings especially in educational and tourism aspects. Heritage sites if successfully planned and managed are able to trigger as capital assets and projecting side effects of and preserving the heritage values are potential to attract attention of funding organizations specializing in conservation and preservation of heritage site and buildings (Pranita et al., 2014; Kinsey, Batty, Chapman, Gearey, and Ainsworth, 2014). As United Nation Educational, Scientific and Cultural Organization (UNESCO), the organization have the criteria for selection of World Heritage Site. The nomination of heritage site must first, physical heritage assets preserved and the surrounding area

properly managed by the local authority by setting up the buffer zones and physical conservation. The advantage of being UNESCO World Heritage Site is UNESCO will be funding the conservation and preservation project of the site and professionals curators and archaeology experts will be helping the local authority to preserve the evidences to it utmost conditions.

The usage of technology as a tool for documenting and mapping the heritage sites is quite common nowadays. The manipulation of technology works not only in repairing the current physical condition of the heritage relics, but also in preserving the surrounding area for future study. According to Erna et al. (2010), new-fangled documentation technologies have been evaluated and analysed by researchers for the application of architectural and archaeological projects. Meanwhile, Hemeda (2012) used the integration of digital photo geometry and GIS in solving the requirement of 3D models with texture mapping that gives researcher the ability to map the heritage area. Hemeda (2012) also mentioned that the resulting products can serve as a foundation for archaeological analysis.

The first comprehensive use of GIS system in European archaeology was cited by Erna et al. (2013), which used in documenting the analysis process and to monitor archaeological found. Within archaeology, GIS can be deployed for three levels which is cited by Erna et al. (2013) as follow:

- i. As a trial and error tool, used to receive answers to research questions
- ii. Within heritage offices as making data management more effective
- iii. To visualize and popularize effects of inquiry.

The collection and manipulation of data can be conducted by using a useful tool which is the internet technology. Branches of technology, science and social sciences are broadly used in land use planning. Whenever the archaeologist discovered historical

objects, a chemist can use chemistry in order to determine the age and material, the botanist and zoologist can offer data of surroundings where it originates. Based on the data of the findings, urban planner and other built environment practitioners can assist the local authority in determining development plan around the area, generating development buffer zones around the area and other mitigation measures to ensure the preservation and conservation of the heritage sites can be sustained. Through this comprehensive extends of upholding the same believes of the immeasurable values of the heritage site, the significant findings can be overall protected.

### **1.2.1 Geographical Information System (GIS) and Remote Sensing (RS) Application for Heritage Studies**

GIS application is widely used as a tool in archaeological as prediction the location and the extension of the relics and other physical remains (Goodchild, Yuan and Cova, 2007; Esnard, 2010; Appollonio, Gaiani and Benedetti, 2012; ). Site catchment analysis is one of the examples that are used in estimating the extension of the heritage sites that are based on the environmental and physical characteristic of the area (Narimah, 2013; Lasaponara and Masini, 2011; Papadopoulos, Sarris, Salvi and Dederix, 2012). It provides the integration of information from various sources, format and time periods. Even though the scope is for excavation of archaeological remains, the same method can be applied in determining the extension on future study site and buffering the area based on the spreads of development in Kuala Muda (Cano, Garzon and Sanchez-Soto, 2013; Colosi, Fangi, Gabrielli, Orazi, Angelini and Bozzi, 2009).

Remote sensing (RS) application has been used in archaeological detection since the past decade through their spectral characteristics which are able to detect based on land cover changes that indicates the previous activity (Miller, 1981; Jun, Miao,