UNIVERSITI PUTRA MALAYSIA

CHANGES OF AGRICULTURE LAND USE IN KELANTAN RIVER BASIN FROM 2004 TO 2015 USING TIME SERIES SATELLITE IMAGES

MOHD ZAHRULNAIM NAZRI

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MOHD ZAHRULNAIM BIN NAZRI

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, SELANGOR DARUL EHSAN

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CHANGES OF AGRICULTURE LAND USE IN KELANTAN RIVER BASIN FROM 2004 TO 2015 USING TIME SERIES SATELLITE IMAGES

BY

MOHD ZAHRULNAIM BIN NAZRI

A project report submitted to faculty of Agriculture, Universiti Putra Malaysia, in fulfilment of requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ENDORSEMENT

This project report entitled changes of agriculture land use in Kelantan river basin from 2004 to 2015 using time series satellite images is prepared by Mohd Zahrulnaim Bin Nazri and submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year project) for the award of degree of Bachelor of Agricultural Science.

Student's name Student Signature

Mohd Zahrulnaim Bin Nazri …….

Certified by:

_____

Dr. Farrah Melissa Binti Muharam

Department of Agriculture Technology

Date:

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ABSTRACT

Agriculture is Kelantan's main economic activity while most of fruit farmers are located in Kelantan, with rice, rubber and tobacco is the state's foremost agricultural produces. Besides, fishing and forestry are also major contributors to the economy. However, flood is one of the most common natural disaster in Kelantan. During the monsoon season, Kelantan is likely to face flood problem. From 453,958 ha of agriculture in whole Kelantan, 177,257 ha is susceptible to flood. Flood is major factor that causes losses in socio-economic aspects of human life. The heavy rainfalls increase the water inundation area and affect economic and agriculture sector. Due to the annual flooding events, some of the agricultural areas that are prone to flood may have changed over the years. In 2014, the agriculture sector in Kelantan recorded about RM105 million in losses to the massive floods. Therefore this study is conducted to analyse the changes of agricultural land use as affected by the flood events in the Kelantan River Basin since 2004 to 2015, and also to determine if time series SPOT images can be used to map the changes of agricultural land use. The land use and the land cover between those years were compared. In order to see the changes, the image processing involves several processing steps such as histogram matching / normalization, and classification. As the expected result, we can see the changes agriculture land use in Kelantan River Basin from 2005 to 2015 using the SPOT satellite images because it has the ability to measure reliable spatial and temporal photosynthetic activity and canopy structural variations.

ABSTRAK

Pertanian merupakan ekonomi utama di negeri Kelantan. Sebahagian besar petani buah-buahan datang daripada negeri ini. Selain itu, negeri Kelantan turut menghasilkan pengeluaran padi, getah dan tembakau. Tidak ketinggalan, aktiviti perikanan dan pembalakan turut menjadi ekonomi utama. Walaubagaimanapun, banjir merupakan kejadian biasa berlaku di Kelantan. Negeri ini mengalami masalah banjir semasa musim monsun timur laut. Daripada keluasan 453,985 hektar aktiviti pertanian di seluruh Kelantan, 177,257 hektar adalah kawasan sering dilanda banjir. Banjir adalah faktor utama yang menyebabkan banyak kerosakan dalam aspek sosio-ekonomi dalam kehidupan. Hujan yang lebat meningkatkan paras air dan akan terkesan kepada aktiviti pertanian. Kawasan pertanian yang sering dilanda banjir setiap tahun ini berkemungkinan akan mengalami perubahan. Pada tahun 2014, aktiviti pertanian di Kelantan direkodkan mengalami kerugian sebanyak RM105 juta akibat banjir besar yang melanda. Kajian yang dilakukan adalah untuk menganalisis perubahan tanah pertanian akibat banjir yang terletak di kawasan zon terdedah pada banjir disepanjang Sungai Kelantan, dan juga untuk mengenalpasti adakah imej landsat yang diambil mengikut tahun yang berbeza dapat digunakan untuk mendapatkan perbezaan perubahan tanah di kawasan tersebut. Kawasan yang telah diteroka dan diliputi tumbuhan dikawasan tersebut akan dibandingkan. Bagi mendapatkan perbezaaannya, imej yang diperolehi akan diproses dengan beberapa kaedah seperti ‘histogram matching / normalization’, dan klasifikasi. Keputusan yang dijangkakan adalah, kita boleh melihat perubahan kawasan untuk pertanian dari tahun 2004 hingga 2015 di kawasan yang sering mengalami banjir dengan menggunakan imej SPOT kerana kebolehannya untuk mengukur tenaga spatial, aktiviti fotosintesis dan juga variasi struktur kanopi.

CHAPTER 1

INTRODUCTION

1.1 Background to the Study

Studies have shown that there remains only few landscapes on the earth that are still in their natural state. Due to anthropogenic activities, the earth surface is being significantly altered in some manners and man's presence on the earth and his use of land has had a profound effect upon the natural environment thus resulting into an observable pattern in the land use/land cover over time.

The land use/land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority.

Viewing the earth from space is now crucial to the understanding of the influence of man's activities on his natural resource base over time. In situations of rapid and often unrecorded land use change, observations of the earth from space provide objective information of human utilization of the landscape. Over the past years, data from earth sensing satellites has become vital in mapping the earth's features and infrastructures, managing natural resources and studying environmental change.

Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity (Wilkie & Finn, 1996).

Therefore, attempt will be made in this study to map out the status of land use land cover of Kelantan between 2004 and 2015 with a view to detect the agriculture land use changes in Kelantan River basin using both Geographic Information System and Remote Sensing data.

1.2 Statement of the Problem

Flood is a common phenomenon occurs in Kelantan. Due to this event, the area that affected by flood may be changed because of the damage. In 2010, Kelantan have become the largest producer of agricultural products in Malaysia. Between years 2004 to 2014, the state of Kelantan has been hit by numerous flood events, some small and some large. Serious flooding was recorded occurred in 2002, but the largest occurred in 2015. The agricultural areas that most affected by the floods is paddy. Paddy is the third largest sector of agricultural production in Kelantan after oil palms and rubber. Paddy cultivation is done mostly flat and low land area that it is easy to be overwhelmed by the resulting water due to flooding. Using remote sensing and GIS, changes to agricultural activity will be seen.

1.3 Aim and Objectives

1.3.1 Aim

The aim of this study is to produce a land use land cover map of Kelantan at different time series in order to detect the changes that have taken place at Kelantan river basin area.

1.3.2 Objectives

The following specific objectives will be pursued in order to achieve the aim above.

- To create a land use land cover classification scheme
- To identify the changes of agriculture near Kelantan river basin that have likeliness to face flood problem.

1.4 The Study Area

The study area is in Kota Bharu, Gua Musang and Kuala Krai which is located in the state of Kelantan. From the rainfall figure from the JPS (Jabatan Pengairan dan Saliran), these three area have been recorded of high rainfall during the monsoon season. It is located on latitude 5°15′N and 102°0′E 80 31 with an area of about 15,000km square. Being situated in the transitional zone; between the equator zone of Malaysia and monsoon tropical zone of Thailand (South region). Therefore the state of Kelantan suitable for many agricultural farming including plants that suitable for planting in areas that receive less water such as tobacco.

The landscape of the region is relatively hilly and flat area. Rising high on the slopes of Gunung Korbu, the second highest peak in Peninsular Malaysia, there is a river named Nengiri River flows east to merge first with the Galas, and then with the Lebir. The latter born in the wilds of Taman Negara National Park before turning decisively northwards and emptying into the shallow waters of the South China Sea. This means it is located on a plain and is crested by two large rivers, the river ("Gunung Stong State Park" Tourism Malaysia, 2014).

The climate is hot and humid all over the years and is characterized by wet and dry seasons. The wet season begins towards the end of October and ends in January. The rainy season is due to the north-east monsoon which occur every year. There are some areas, especially in northern Kelantan suffers long dry season of March until June.

The temperature is uniformly high throughout the year. The mean monthly temperature of the town for the period of 2004 – 2015 varies between 25 °C and 29 °C. Normally the raining month will having lower temperature.

Kelantan state has a vast forest area, especially in the hilly areas especially Gua Musang, Jeli and Dabong. The main activity in this area are the logging. The logged forests replanted with rubber trees or oil palm new planting area. It also has a chiefly agrarian economy dominated by oil palm, rubber and rice.

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