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**IMPACT OF URBAN DEVELOPMENT TO THE COMMUNITIES  
IN GEORGE TOWN CONURBATION**

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***Abstract***

Drastic increase of urban population has caused cities to grow towards the fringe areas. This is due to increasing of land demand to accommodate the increasing of urban population. Urban area only covers small portion of country's land area, however the impact of this area is massive mainly due to significant number of population lives within this area. In Malaysia, for example, the size of urban land is less than 10%; however, it accommodates more than 74% of its population. Therefore, it is important to investigate the perception of the community living within affected area. This study used GIS to map the expansion of urban area in the George Town Conurbation, and utilized quantitative method using questionnaire to assess the impact of urban expansion on the communities. Household survey was undertaken in three towns namely Sungai Petani in Kedah, Parit Buntar in Perak and Teluk Kumbar in Pulau Pinang, that has different rate of urbanization. Based on household survey undertaken, it is indicated that different perception was found among communities living within those areas. People who live in less urbanized states welcomed urban development as this was perceived to bring more jobs and economic opportunities into the area. On the other hand, people that had experienced longer period of urbanization were indifferent towards urban development. This is mainly due to congestion and overcrowding caused by urban expansion. It is therefore, important to take into consideration the perceptions of local communities in planning and managing urban spatial growth.

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**Keywords:** Community, Geographic Information System, land use changes, socio-economy, urban expansion.



## 1. Introduction

Many countries especially in developing nations have experienced rapid urbanization. According to the United Nations (2014), the number of urban populations in less developed nations is 2.76 billion in year 2012, increase almost 32% from year 2002. It is expected to raise to 3.33 billion in year 2020. On the other hand, urban areas are relatively small and it is difficult to accommodate a huge number of urban populations. Demographia World Urban Areas (2017) reported that urban population density is approximately 4,000 to 10,000 people per square kilometres where more than half (57%) of the population are in Asia. China and India are two major countries that contribute to the figure and even so, Japan, South Korea and Singapore are classified as most urbanized countries in East Asia in demographic terms (World Bank, 2017). Urban population increased due to migration and growth of population has denser its urban population density with limited urban land. Urbanization brings positive impact to the economy of the country. It boosted countries' economy as urbanization brings many benefits such that it increases trade, investment and commercial activities. Some developing countries manage to seize this opportunity and further develop its major city to become megacity in which it can handle major international commercial activities (Cavallier, 1996). Furthermore, good infrastructures and facilities were developed to attract trade, investment and business to that city. Additionally, urbanization is beneficial to urban population in term of more employment opportunities and modern lifestyles offered in the city (Su, Jiang, Zhang, & Zhang, 2011). However, it is also attracted rural population to migrate into city in order to seek for better job and lifestyle. This phenomenon has created major challenges to local authority in handling increasing number of urban population and providing urban services.

## 2. Problem Statement

Penang along with Kuala Lumpur, Selangor and Johor has experienced rapid urbanization mostly due to the industrial activities since 1970s (Ghazali, 1999; Hadi, Idrus, Shah, & Mohamed, 2010). To date, it has contributed 6.6% of Malaysia's Gross Domestic Product (GDP) in 2015 after Selangor (22.6%), Kuala Lumpur (15.1%), Sarawak (10.0%), Johor (9.3%) and Sabah (6.6%) (Department of Statistics Malaysia, 2016). Penang has numerous industrial and commercial activities in which can boost states economic and have ability to improve public infrastructure that can attract international investors.

**Table 01.** Urban Population Density

State	Estimate Population	Urban Area	Population Density
Penang	1,420,000	298	4,800
Kuching	740,000	181	4,100
Seremban	590,000	155	3,800
Kuala Lumpur	7,590,000	2,124	3,600
Ipoh	760,000	259	2,900
Johor Bharu	1,770,000	816	2,200

These activities provide great employment opportunities that consequently draw rural population to migrate into the Penang state (Samat, Ghazali, Hasni, & Elhadary, 2014). However, Penang built up area is quite small as compare to the Penang rapid urbanization and number of urban population. Analysis

done by Demographia World Urban Areas (2017) stated that Penang has the highest urban population density with 4,800 people per square kilometres in Malaysia (see Table 01). Even though urban population in Kuala Lumpur is the highest in Malaysia, Penang population density is the highest in Malaysia due to its small urban area.

### **3. Research Questions**

Urbanization in Penang is resulted from rapid development that occurs in the George Town city, and has spread its development to the neighbouring regions. George Town city is a capital city for Penang State and also one of major attractions for visitors where George Town has been listed as a UNESCO World Cultural Heritage Site in 2008 (UNESCO, 2018). These factors have escalated nearby areas to develop with better public amenities and services to support George Town city. Business and commercial activities are keen to grow within this area due to increasing demand from population (Mahamud, Samat, & Noor, 2016). Due to better facilities and rapid development, private developers started to explore new potential development area for accommodating the increasing of urban population (Hasni & Samat, 2015)

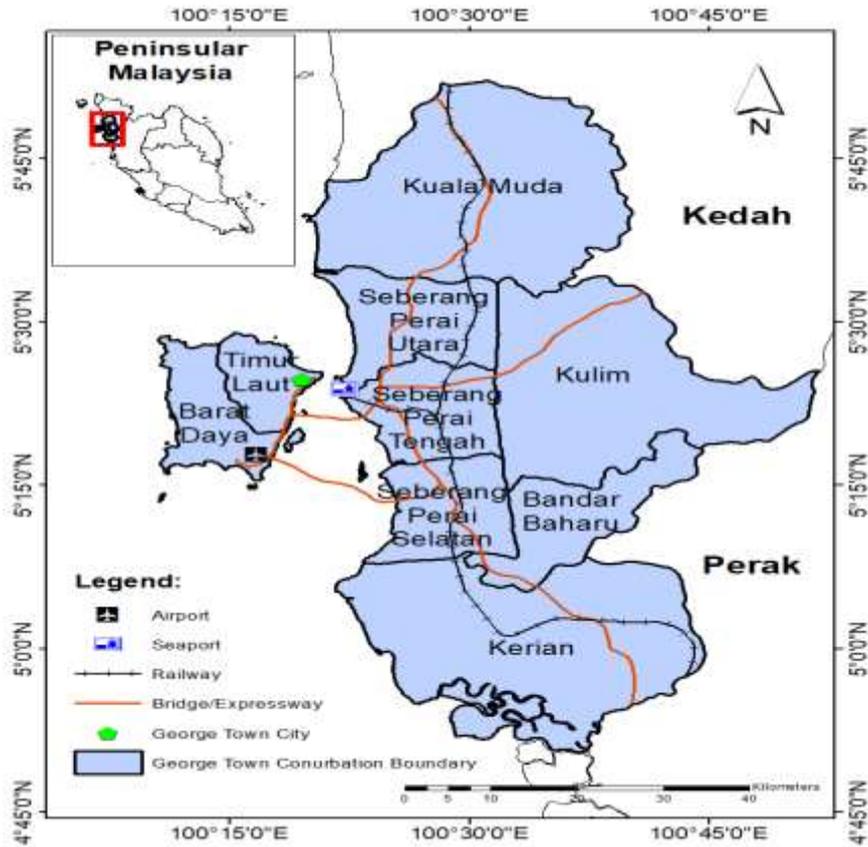
Consequently, Penang Island with good facilities and many employment opportunities have increased land value and housing prices which has made neighbouring regions especially in districts at mainland area become an alternative option for people to live (Hasni & Samat, 2015). People started to look for cheaper developed area and these opportunities have been grab by private developers to venture potential area in mainland districts. The existence of First Penang Bridge and Ferry commuting from George Town to Seberang Perai have increased development in the Northern Penang neighbouring area and Second Penang Bridge has increased development in the Southern Penang neighbouring area. These great road networks have eased people to commute from mainland to island. On the other hand, the existence of North-South Highway and Butterworth-Kulim Highway connecting Penang and neighbouring regions from Kedah and Perak has attracted people to stay in the neighbouring regions and commuted to work on a daily basis. The development in the neighbouring regions will increase rapidly as the demand for housing and public infrastructure raised. New constructions of residential and business units and administrative complex foster the economy with the regions (Deng, Wang, Hong, & Qi, 2009). This development however, brings some consequences to the community living in the regions (Su et al., 2011).

### **4. Purpose of the Study**

Urbanization has been a major challenge in Malaysia due to rapid increasing of urban population in all major urban areas (World Bank, 2017). Major urban areas are Kuala Lumpur, Johor Bharu, and George Town. In order to implement proper plan and manage urban area, Federal Department of Town and Country Planning Malaysia (FDTCP, 2010) has used the term conurbation to describe a boundary comprising of cities and expanded develop areas that have combined and formed a continuous urban area (FDTCP, 2010). Thus, George Town and its neighbouring region was referred as George Town Conurbation. This study, therefore, monitored its expansion and accessed the perception of its community on development and the consequences that arise in their surroundings.

## 5. Research Methods

### 5.1. The Study Area



**Figure 01.** The Study Area

The study was carried out to track urbanization in the George Town Conurbation, Malaysia. Federal Department of Town and Country Planning Malaysia has included Kuala Muda, Kulim, Bandar Baharu (from Kedah), and Kerian (from Perak) into George Town Conurbation boundary together with all districts in Penang (FDTCP, 2010). George Town Conurbation is located in the northwest coast of Peninsular Malaysia, with an area approximately 3,938 square kilometers (see Figure 01). George Town Conurbation has experienced tremendous urban development due to the rapid development from George Town city (FDTCP, 2010). George Town city gives many benefits especially in cooperating with nearby states and regional countries. George Town city has used its strategic location by strengthens its role in the northern region and become major contribution to the development of the country. Consequently, the Northern Region urban conurbation with George Town city in the middle has stretched to Kuala Muda in the north, Kulim in the east and Kerian in the south as shown in Figure 01. ArcGIS 10.1 software was used to map and monitor urban expansion since 2002 extracted from satellite images classified using Erdas Imagine 2014. Household survey using questionnaire was conducted in order to evaluate the perception and views of local communities living near or surrounding developed area. The identified urban areas are Parit Buntar (in Kerian, Perak) and Sungai Petani (in Kuala Muda, Kedah). Communities from Teluk Kumbar (in Bayan Lepas, Penang) are included to evaluate their perspective and to assess the differences of viewpoint between Penang societies and neighbouring (Kedah and Perak) societies.

## 5.2. Data Used in The Study

Raw satellite images of the study areas from Landsat 7 acquired in 2002, 2006, 2010 and from Landsat 8 obtained in 2014 were downloaded from the United States of Geological Survey (USGS) (USGS, 2014). Those satellite images were selected taking into consideration minimum cloud covers. Those images were pre-processed and referenced on UTM-47N with spatial resolution of 30 meter x 30 meter. Landsat images that covers all the George Town Conurbation are from the 128-056 path and row. Erdas Imagine 2014 software was used to pre-processed and reclassified using maximum likelihood supervised classification method. Four types of land cover activities was extracted from those satellite images. Land cover maps were then combined with GIS database using ArcGIS 10.1 software (ESRI, 2012). Quantitative data was acquired through household survey which involved 550 respondents selected using cluster sampling (see Figure 02) and interviewed to investigate perception and experiences of the local community living within urbanized areas. Out of the 550 respondents, 208 (41.6%) were from Parit Buntar, 214 (42.8%) were from Sungai Petani and 128 (25.6%) were from Teluk Kumbar.

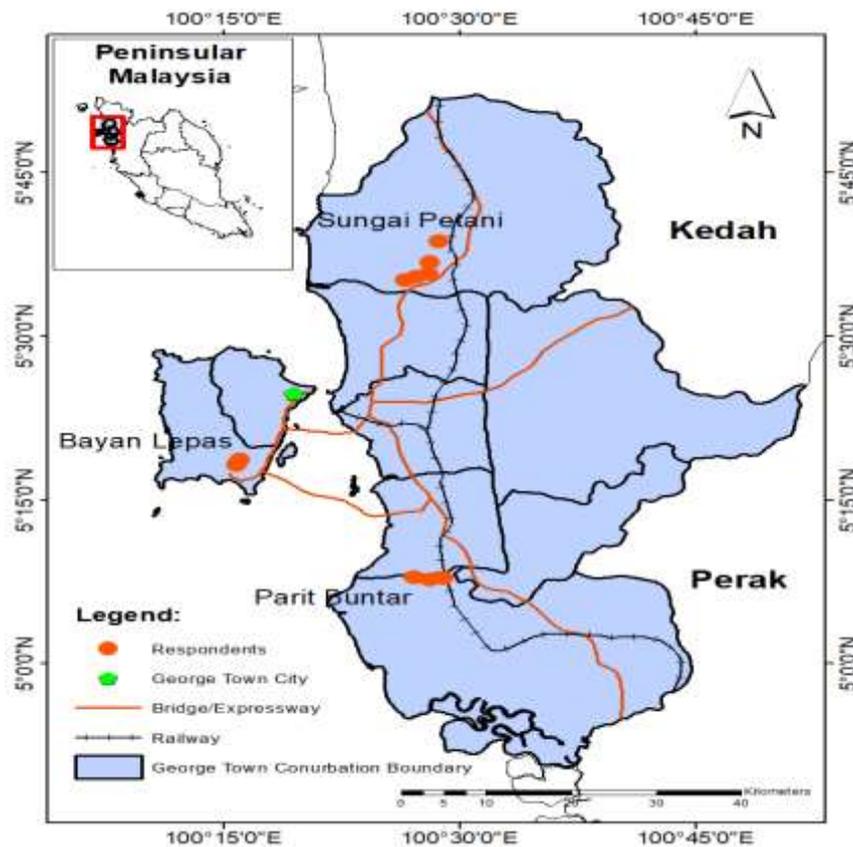


Figure 02. Respondents Distribution

## 5.3. Land Cover Data

Using Erdas Imagine 2014, image enhancement has been applied to all the satellite images to improve images quality for good land cover information extraction. Then, the produced images were classified into four major land cover, which are Agricultural Area, Forest Area, Built-up Area, and Water Body Area. The classified images were validated and assessed its accuracy by comparing it with the land

use datasets obtained from FDTCP together with ground checking. Once the images achieved a satisfied accuracy, the land cover will be extracted for the study.

**Table 02.** Accuracy Assessment for Each Classified Images

Image Classification	Accuracy (%)	Kappa Statistic
2002	82.50	0.7620
2006	83.00	0.7714
2010	88.00	0.8339
2014	80.00	0.7306

Herein, the extracted land cover were evaluated with the reference of land use of year 2002, 2006, 2010, 2014 obtained from Federal Department and Penang State Department of Town and Country Planning (FDTCP, 2015; PSDTCP, 2016), and Google Earth (<http://earth.google.com>) spatial images from multiple years. Classified images for each year are validated by selecting 200 randomly stratified sampling points. Overall accuracy of classified images was 80% and above (Table 02). These images were then processed and imported in ArcMap 10.4 for GIS land cover mapping.

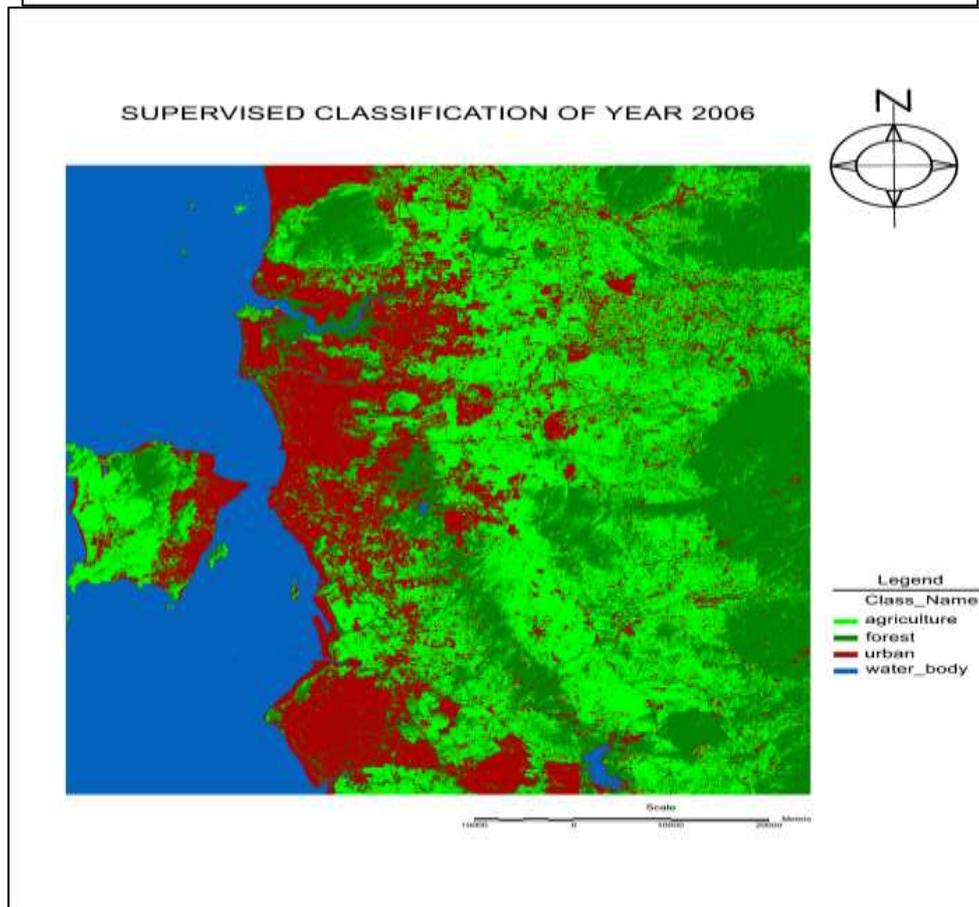
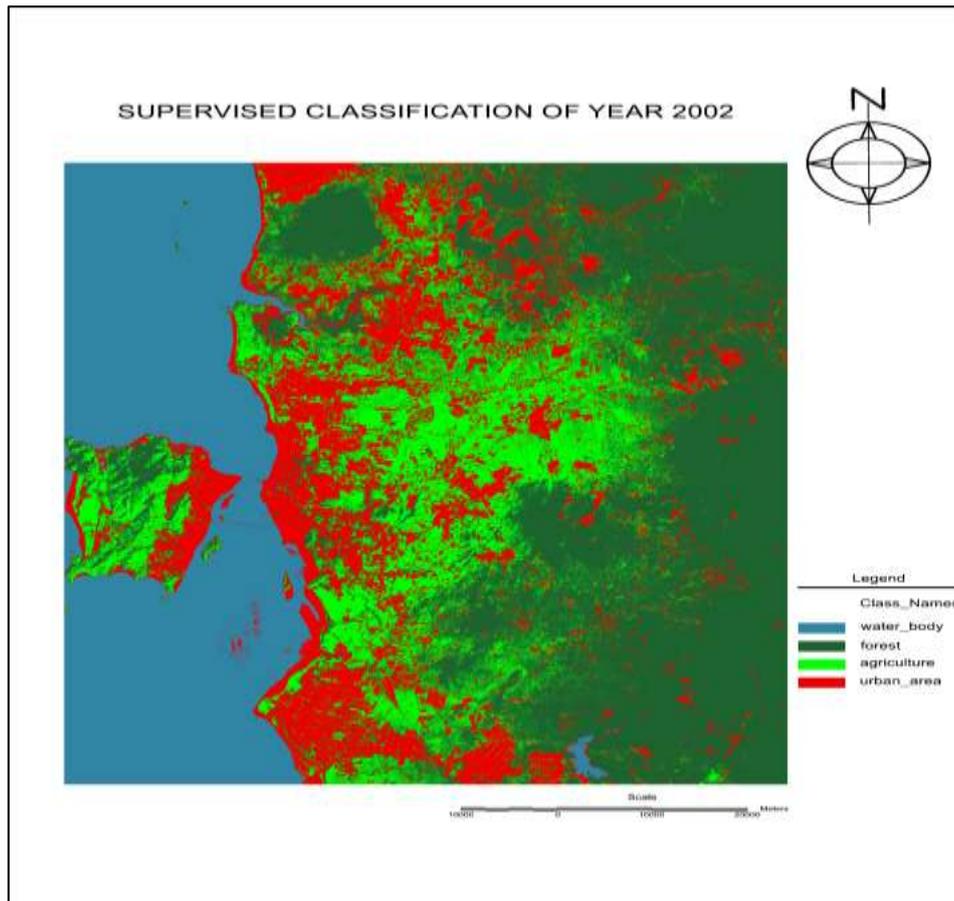
## 6. Findings

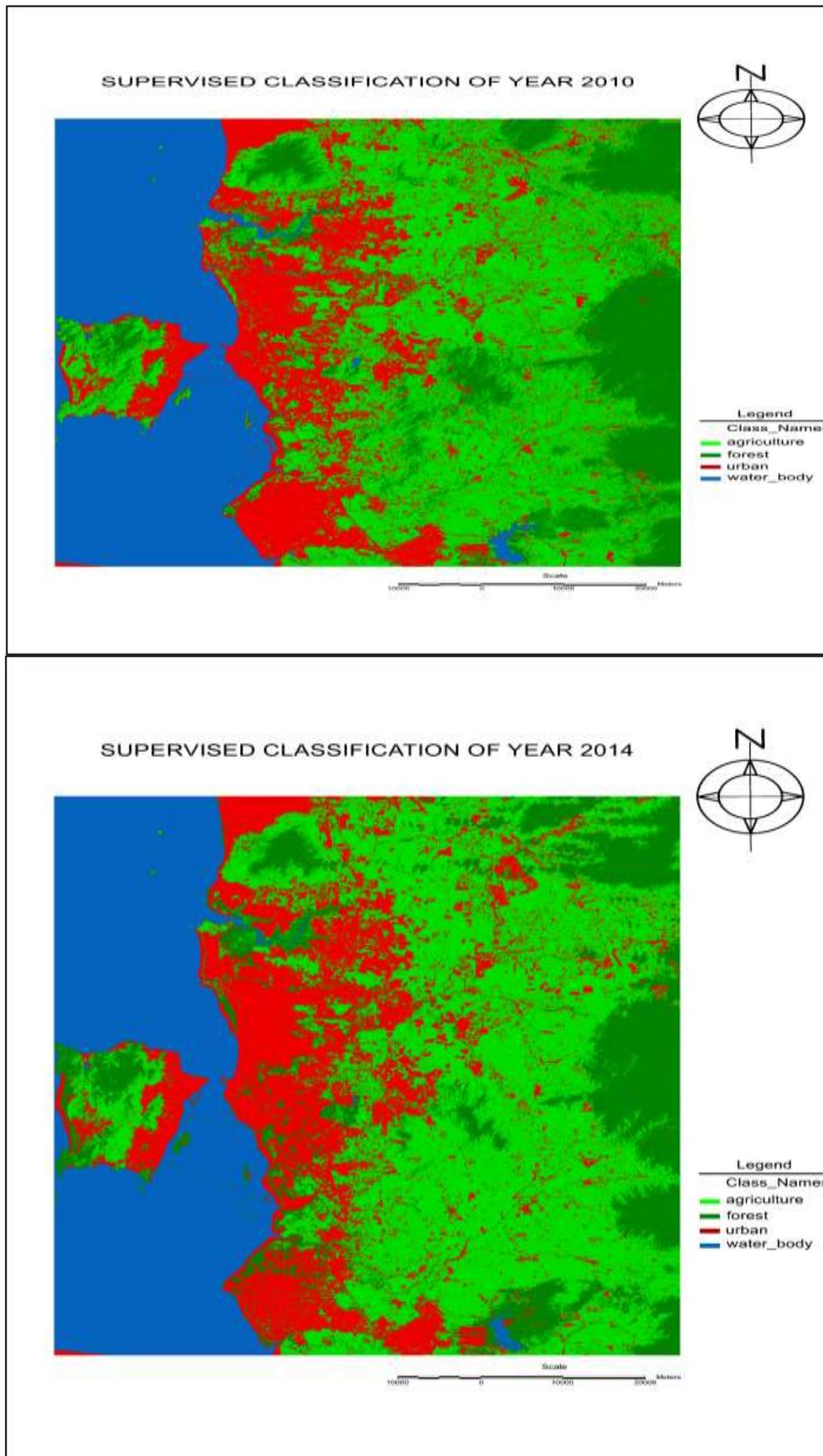
### 6.1. Classified Image

The study obtained four land cover maps as shown in Figure 03 (a-d). Table 03 showed land cover comparison. This table stated that urban area has expanded by 13.4% from year 2010 to 2014 which is the highest contribution to total change of urban area. Urban development in Georgetown conurbation has been growing steadily. As the demand for housing and related services increased, urban areas expanded towards the Bayan Lepas located at south of Georgetown in Penang Island. While in the mainland, the development of Butterworth expanded along North-South Expressway toward Sungai Petani, Kedah in the North and Parit Buntar, Perak in the South. This phenomenon will continue as demand for housing and other activities are increasing. Figure 03(d) also showed that southern part of Penang Mainland especially at Batu Kawan experienced significant increase of new development. The existence of Penang Second Bridge connecting Teluk Kumbar (Penang Island) and Batu Kawan (Penang Mainland), which operated in early 2014, has escalated development in southern part of Penang Mainland. This development, however, has caused forest area to decrease by 7.2% within the year 2010 to 2014 (Refer to Table 03).

**Table 03.** Land Cover Area between 2002 and 2014, in square kilometers

YEAR	AGRICULTURAL AREA	FOREST AREA	BUILT-UP AREA	WATER BODY AREA
2002	1,266.65	3,006.08	1,398.12	1,840.67
2006	2,354.18	1,889.49	1,504.61	1,898.01
<b>Change</b>	<b>+1,087.53</b>	<b>-1,116.59</b>	<b>+106.49</b>	<b>+57.34</b>
2006	2,354.18	1,889.49	1,504.61	1,898.01
2010	2,799.28	1,306.01	1,502.74	1,897.38
<b>Change</b>	<b>+445.10</b>	<b>-538.48</b>	<b>-1.87</b>	<b>-0.63</b>
2010	2,799.28	1,306.01	1,502.74	1,897.38
2014	2,815.06	1,212.54	1,704.47	1,815.57
<b>Change</b>	<b>+15.78</b>	<b>-93.47</b>	<b>+201.73</b>	<b>-81.81</b>
<b>Total Change</b>	<b>+1,548.41</b>	<b>-1,793.54</b>	<b>+306.35</b>	<b>-25.10</b>





**Figure 03.** Classified Images of year 2002, 2006, 2010 and 2014

Despite of decreasing of forest area, agricultural area shows a huge increment with 55% in total. This may be due to majority of the local communities are continuing to cultivate on their agriculture land that still have high demand from the country. Sea water has been calculated together with other water bodies. Therefore, the change of the water body area is probably due to the rise or fall of sea tides, and has not been given much attention in this study. This significant finding should provide invaluable information to responsible planners and decision makers, which also can be served as an alert for them to prepare appropriate enforcement in managing newly-developed urban area from encroaching into forest area.

## 6.2. Perception of Local Communities on Urban Development

Based on the result from survey undertaken, communities living in Parit Buntar and Sungai Petani (new developed urban area) have welcomed the urban development around their area where 49% and 49.6% respectively agreed to the question asked (Table 04). In addition, the communities perceives that it will generated more employment opportunities, enhances transportation and road network, improves public amenities, and escalates the living standards of the residents. Urban development also created opportunities for non-agriculture employment, thus enable the local communities to set up another linked local businesses that generates income for living.

However, only 32.1% respondents in Teluk Kumbar (developed urban area) agreed to the urbanization developed around their area. This is probably due to the communities in Teluk Kumbar has experienced some negative consequences such as congestion and rise of residential land at their area. Furthermore, 64.1% of respondents in Teluk Kumbar has agreed that migration of newcomers to their area has occurred and 34.4% agreed that residents have sold their land or house due to the high offer from urban developers.

**Table 04.** Perception of Local Community on Urbanization

			Residents welcome the urbanization around their residence area					Total
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Study Area	Parit Buntar	Count	6	24	76	46	56	208
		Percentage	2.9%	11.5%	36.5%	22.1%	26.9%	100.0%
	Sungai Petani	Count	9	16	83	53	53	214
		Percentage	4.2%	7.5%	38.8%	24.8%	24.8%	100.0%
	Teluk Kumbar	Count	12	31	44	24	17	128
		Percentage	9.4%	24.2%	34.4%	18.8%	13.3%	100.0%
Total		Count	27	71	203	123	126	550
		Percentage	4.9%	12.9%	36.9%	22.4%	22.9%	100.0%

Communities in Sungai Petani were also started to experience congestion due to migration of new dwellers where 57% of respondents agreed when the question was asked. They also agreed to the question where some of local communities started to sell their agriculture land and converted into residential or commercial land due. Despite of all consequences that they have experienced due to rapid urbanization,

communities at all the study area agreed that economic at their area has escalated and communities began to improve their life.

## 7. Conclusion

This study concludes that communities in Parit Buntar and Sungai Petani are still struggling and adapting the spillover of rapid development from Penang compare to the communities in Teluk Kumbar. A more effective policy response to address the circumstances for Kerian and Kuala Muda local authorities should be adopt such as an integrated policy approach done by the City Council of Penang Island and Seberang Perai Municipal Council to manage rapid urban development. This study has shown that physical development within George Town Conurbation has spilled to neighbouring region, thus affected the communities. This finding should be further explored towards policy formulation such that urbanization can be planned and communities are safeguarded.

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