

**UNIVERSITI TEKNOLOGI MARA**

**Effect of Vegetation and Built-Up Areas on the  
Spatial Variation of Urban Light Pollution**

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## **ABSTRACT**

Land use changes may impact the convective system development, temperature, and atmospheric circulation which can lead to light pollution. Current technology in Remote Sensing and GIS techniques is the most effective approach to studying and analyzing the geographical effect of light pollution, especially in urban areas. Thus, this study aims to determine The Spatial Variation of Urban Light Pollution Due to Vegetation and Built-Up Areas in The Northern Region of Peninsular Malaysia Between 2014 and 2021 using the satellite Remote Sensing and Geographically Weighted Regression (GWR) approach. The satellite remote sensing images of Visible Infrared Imaging Radiometer Suite Day Night Band (VIIRS DNB), was used to derive light pollution. Then, the Landsat 8 OLI satellite image was used to produce vegetation and built-up indices from Normalized Difference Vegetation Index (NDVI) and Normalized Difference Built-Up Index (NDBI) respectively. Based on the relationships at a global and local stage between light pollution with NDVI and NDBI, It was found that the spatial variation of light pollution was increased due to NDVI and NDBI. Between the years 2014, and 2021, the GWR results ( $r\text{-sq}=0.743$  in 2014 and  $0.692$  in 2021 respectively) also improved the global model of OLS ( $r\text{-sq.}=0.150$  in 2014 and  $0.041$  in 2021). The maps of significant locations of the light pollution spatial variation show that Kulim Kedah and Pinang in 2014 and it expand to other locations in Kedah such as Kota Setar, Sungai Petani, Merbok, and Pokok Sena in Kedah region for 2021. Overall, the satellite RS and GWR approach can be possibly used to determine the changes and spatial variation of light pollution.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Research Background

Land use change is caused by the interaction in place and time between environmental and human factors. According to Chen et al., (2017), land use changes would modify the existing characteristics of land surface atmosphere interactions weather and climate. Changes in the physical environment of cities are caused by increasing human activity Rohman et al., (2016). Nowadays, city is a location where people handle much of their activities, whether social or economic. In general, urbanization has become an irreversible process during the last decades, and it will occupy a certain amount of vegetation cover refers to the percentage of soil that covered by green vegetation, water soil and other physical structures of land Patel et al., (2019).

Even so, a growing population necessitates more urban or built-up areas for human development. Nevertheless, it causes more massive human activities both during the day and night, it will cause human pressure on the environment to evolve spatially and temporally, affecting biodiversity and human economies. The human population has increased by (23%), and the world economy has grown to (53%). The human footprint has increased by just (9%) and still (75%) the planet's land surface is experiencing measurable human pressures Venter et al., (2016). Obviously, populations have been shown to be unevenly distributed around the Earth's surface throughout modern human history. However, the population always grows arithmetically, and population density has been proven to connect with other demographic factors include human activities that have an impact on the environment.

Moreover, studies by (Hidayat et al., 2021; Khorram et al., 2014), this scenario worsens many anthropogenic pollutants, including light pollution. By 2001, the part of the land under skies that were brightened artificially exceeded (10%) in 66 countries. In fact, there will be alterations in many places, such as land conversion to become urban areas and it will lead to environmental issues related to higher consumption of artificial light. The excessive intensity of artificial light at night gave a result in an increase of light pollution. It is so obvious that most night lighting may not be necessary to cause photosynthesis in trees Bedi et al., (2021).