Mapping Recreation of FRIM via Social Media

Norliyana Adnan[1*]

[1] *Social Forestry Program, Forest Research Institute Malaysia (FRIM), 52109 Kepong, Selangor*

Recreation and tourism are important components of life in term of tangible and intangible values, such as contribution on the national and international economics, quality of life, sense of place, social connection, physical wellbeing and learning. Among the major and growing-portion of recreation is 'nature-based', involving interaction with or appreciation of the natural environment. Forest Research Institute Malaysia (FRIM) is one of the green areas that serves as a green lung to the urban population of Klang Valley with total area of 544.3 ha. FRIM provide several ecotourism and recreational activities such as Kepong Botanic Garden (KBG), nature trails, wetland area, camping site, arboreta, ethno-botanic garden, research gallery and picnic area. This study seeks to assess and map the recreation using publicly available social media through a proxy for visitation rate of FRIM. The recreation module of Integrating Valuation of Ecosystem Services and Trade-off (InVEST) developed by Natural Capital Project based in Stanford University was used for the assessment. The module estimates the contribution of each attribute to visitation rate in a simple linear regression, with proxy of visitation as photographs geotagged to the website *flickr*. The results showing the map of recreational uses pattern of the FRIM, with highest average user photo days is 2.2. Regression result show that FRIM administrations office where the research gallery located and field have positive relation towards visitation rate. This indicates that these attributes were the drivers of tourism at FRIM assessed by the social media.

Keywords: recreation, social media, photo geotagged, FRIM

I. INTRODUCTION

Recreation and tourism are among the important elements one country have. It contributes to national and international economies alongside the volubility of our quality. In Malaysia, the value of recreation services recorded was RM 20.0 billion in 2015. One of the growing portion of recreation is 'nature-based' recreation involving interaction with or appreciation of the natural environment (Balmford *et al.*, 2009). The places associated with outdoor recreation have always included forests, the coast, lakes and rivers, mountains and other spectacular scenery that is nowadays frequently designated as national park or similarity protected. The nature recreation also known as ecotourism, which connected with nature tourism (TIES, 1991).

The services that natural environments provide as recreation is an example of Cultural Ecosystem Services. Nature conservation should also take recreational co-benefits into

*Corresponding author's e-mail: norliyana@frim.gov.my

account. For allocating resources for nature conservation, it can be important to know how important indicator contribution of recreation to the local economy is the number of visitors (Jones *et al.*, 2003; Bateman *et al.*, 2006). Understanding the important component of ecotourism part, visitors is crucial for assessing the recreation value. The value of outdoor recreation provided by a place is can be measured by the visitation rate to the place.

One of the fastest growing parts of the world is social media. In 2016, the number of social media users were 2.28 billion and expected to reach 3.02 billion monthly active users by 2021. The social media datasets, such as geotagged photographs uploaded inphoto-sharing websites (e.g Flickr) have been successfully used to predict visits to recreation sites and to indicate human preferences and decision making processes (Keeler BL *et al.*, 2015; Wood SA *et al.,* 2013). Geotagged social media can supplement cost and incomplete survey based methods for measuring visitation and for valuing cultural services. The crowd sourced geographic information generated by mobile devices and camera provides a proxy source of visitation rates to the area or across landscapes. The objectives of this study are to map the pattern of recreational use based on the location of natural environments and to assess the drivers of visitation rate in FRIM.

II. EXPERIMENTAL DETAILS

The open source tool, Integrating Ecosystem Services and Tradeoff (InVEST) develop by Natural Capital Project. InVEST module are spatialy-explicit which using maps as information sources producing maps as outputs (Natural Capital). The model assume that current visitation can be approximated by the total number of annual person per days of photographs uploaded to the photo-sharing website flickr. The model also predicts the spread of person -days of recreation and tourism based on the locations of natural habitats, accessibility and built features that factor into people's decisions about where to recreate (Adamowicz *et al.*, 2011).

The model displays rate of visitation across landscapes (grid cells) or in discrete areas (polygons) and optionally builds a regression model to estimate the contribution of attributes of the landscape to the visitation rate, using a simple linear regression in Equation 1:

$$y_i = \beta_0 + \beta_1 x_{i1} + \ldots + \beta_p x_{ip} \text{ for } i=1\ldots n, y_i = \beta_0 + \beta_1 x_{i1} + \ldots + \beta_p x_{ip} \text{ for } i=1\ldots n, \quad (1)$$

where $x_{ip} x_{ip}$ is the coverage of each attribute in each cell or polygon, i, within an Area of Interest (AOI) containing nn cells. In the absence of empirical data on visitation for $y_i y_i$, we parameterize the model using a crowd sourced measure of visitation: geotagged photographs posted to the website flickr.

The area of interest, FRIM and possible recreation site of FRIM (Figure 1) were uploaded to the model. The list of predictors of

FRIM were divided into 5 zones (Figure 2) namely, Zone 1 for Sungai Keroh, Zone 2 FRIM event site/ field, Zone 3 is Kepong Botanical Garden (KBG), Zone 4 is the main building of FRIM, and Zone 5 was the canopy walk and crown shyness site. These sites were selected based on its popularity of FRIM's visitors.

Figure 1.   The FRIM boundary

Figure 2.   Five zones of FRIM predictors

III.   RESULT AND DISCUSSION

We found a significant and positive relationship between photos uploaded to the social media site flickr (indicated by person-

user-day) of zone 5, canopy walk and crown shyness sites. Other site, Zone 2 (FRIM's field) also resulted positive and significant impacts by visitation rates. The results in Table 1, show Zone 5 and Zone 2 were most visited in FRIM and indicated as the drivers of the nature based recreation site near the adjacent of Kuala Lumpur.

The other two zones shows significant with negative impacts, Zones 1 and Zone 3. These probably not main attraction of FRIM's visitor compare to Canopy walkway site. Zone 4, main administration building show no significant impacts of visitation rates of FRIM. This might be because this area were usually visited by FRIM's guest such as researchers, students, academicians who do not intent to recreate in FRIM. The purpose of their visits mostly conducting research and academic visits.

Table 1. Predictor results of FRIM

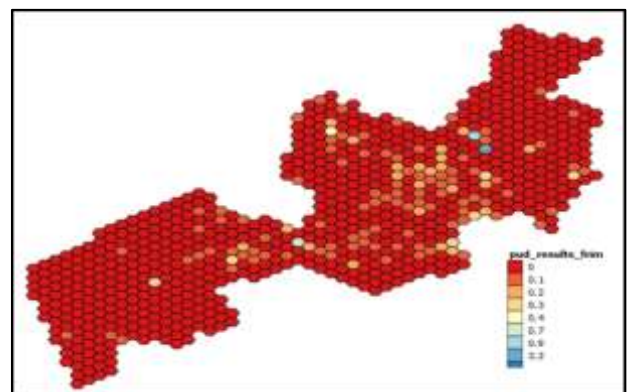| Predictors	Coefficient
Zone 1 (Sg. Kroh)	-2.379 *
Zone 2 (Field)	+7.831*
Zone 3 (KBG)	-7.829 *
Zone4 (Gallery)	+5.608
Zone5 (Canopy Walk)	+2.631 ***

Figure 3. Map of recreation of FRIM

IV. CONCLUSION

The FRIM canopy walk is one of the well-known recreation sites adjacent to Kuala Lumpur. The results of Recreation model of InVEST are align with the visitors data, which recorded canopy walk have highest visitors compared to many of FRIM recreation and visitation sites.

As a conclusion, the combination of data on natural features and built environment is able to explain the majority of spatial variability in the visitation rate estimated by the locations of photographs. The used of the assessment provide new capability of landscape-scale modeling of tourist preferences. This show that social media output can be used as one of the measurement of recreation and tourism especially in large-scale area.

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