

## KILIM KARST GEOFOREST PARK: THE HIDDEN GEMS OF LANGKAWI UNDER THREAT

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### ABSTRACT

*Tourism is one of the vital contributions to the Malaysian economy. Both tourism and natural resources are significant to the economic growth and human well-being. The tourism activities contribute revenues to the country and inspire humanity to appreciate the natural environment. While, the natural resources contribute to the economy and support the cycle of the natural ecosystem. Nonetheless, the increasing demands for ecotourism and nature-based tourism in recent years have also impacted the natural environment. Globally, air travel and other vehicles meant for travelling, contribute to the increasing causes of greenhouse gas emissions, habitat loss, and degradation of various types of environments, such as coastal areas, mountains, wilderness areas, rural landscape and small islands. The environmental impacts of tourism are also in line with the increasing awareness on environmental issues since 1970's. It is the combination of creating tourism as a form of economic development and simultaneously brings together conservation issues. This paper presents the uniqueness of Kilim Karst Geoforest Park in Langkawi Island as one of valuable natural heritage assets for Malaysia. It identifies eco-tourism features of the site and the threats of tourism activities using various reviews of literature. The needs of the conservation efforts of the site are vital as UNESCO-certified sites in Southeast Asia. Environmental impacts of tourism have to be explored by all parties that involved in tourism activities. Professionals in the built environment such as Landscape Architects and Planners believe that effective design and management, the existence of "symbiosis" between tourism and the environment is possible to reach. The term "ecotourism", that was used since the mid-1980s are created to suggest a symbiotic relationship between tourism development and the natural environment. It is not only possible, but perhaps it also the utmost step in balancing tourism and conserving the natural resources. Balancing tourism and resource conservation are essential in due to support the economic growth and to sustain the natural environment. Therefore, knowledge on the effect of tourism activities towards natural resource is imperative in sustaining the environment.*

Key words: Kilim Karst Geoforest Park; ecotourism; tourism threats; conservation

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### INTRODUCTION

Tourism is one of the vital contributions to the economy in Malaysia. The increasing demands for ecotourism and nature-based tourism in recent years have also created more impacts on the natural environment. Globally, air travel and other vehicles meant for travelling, contribute to the increasing causes of greenhouse gas emissions, habitat loss, and degradation of various types of environments, such as coastal areas, mountains and wilderness areas, rural areas and small islands. Those environmental changes affecting land, air, and water (Wong, 2004). The environmental impacts of tourism spread with the increasing awareness of environmental issues in 1970's. It is the combination of creating tourism as a form of economic development and simultaneously brings conservation issues together (Cole and Scott, 2004). The paper explores the characteristics of a geopark and threats of tourism to Kilim Karst Geoforest Park, Langkawi as one of the natural geological assets that is valuable for conservation in Malaysia. It also identifies the types of threat to the site and proposes steps to be taken in its conservation effort, in particular, using the carrying capacity approach. To obtain the information, reviews of literature were carried out from various online databases using the topics' keywords. The paper presents the reviews into three main topics, namely on characteristics of geoparks, threats and proposal to conserve.

To a large extent, research on the environmental impacts of tourism is still "relatively immature and true multidisciplinary approach to the investigation has yet to be developed" (Holden, 2000). Thus, the opinion of Holden should be agreed as the

environmental impacts of tourism have to be explored by all parties that involved in tourism activities. Professionals in the built environment such as Landscape Architects and Planners have argued that, with effective design and management, the existence of “symbiosis” between tourism and the environment is possible to reach (Cole and Scott, 2004). Further, Crang (2004) added that, such symbiosis are essential to sustain the environment and the concept is known as *sustainable development*. Thereafter, the term *ecotourism* was used in the mid-1980s. Those terms and concepts are created to suggest a symbiotic relationship between tourist and the natural environment. It is not only possible, but perhaps it also the utmost step in balancing tourism and conserving the natural resources. Therefore, both tourism and natural resources are significant to the economic growth and human well-being. The tourism activities contribute revenues to the country and inspire humanity to appreciate the natural environment. While, the natural resources contribute to the economy and support the cycle of the natural ecosystem. Balancing tourism and resource conservation are essential in due to support the economic growth and to sustain the natural environment. Therefore, knowledge on the effect of tourism activities towards natural resource is imperative in sustaining the environment.

## THE ESTABLISHMENT OF GEOPARK

The idea of Geopark concept was established in 1999, six years after the agenda for protection and sustainable development of geological heritage and geo-diversity were brought up in the United Nation Conference. Later, in year 2000, the European Geopark Network was formed, followed by the formation of the United Nations Educational, Scientific and Cultural Organization Global Network (UNESCO) of National Geoparks in 2001 (Leman et.al., 2007). A Geopark is an integrated area with geological, ecological, archeological, historical or cultural value heritage sites that possessed special and significant scientific entities. According to UNESCO, the main concept of the Geopark is to protect the natural environment, to educate people, to aim for sustainable development and to improve the economics of local residents as well as the country. In addition, the establishment of a Geopark should be based on a strong support from local community, community leader, political leader and provision of necessary financial resources.

## CRITERIA OF GEOPARK

The application of gaining the Geopark status can be issued to UNESCO by accomplishing the criteria needed. The endorsement given for four years before it needs to be renewed by maintaining the similar criteria. The main criteria that a Geopark must possess are as follows:

- i. Size and setting  
The site must be scientifically significant either for education or aesthetical purposes.
- ii. Management and local involvement  
The site must have good management system and maintainable financial support as well as strong community support.
- iii. Economic development  
To encourage economic activity within the framework of sustainable development.
- iv. Education  
To provide tools and organized activities related to geoscience, natural environment and local culture in order to educate public.
- v. Protection and conservation  
Entirely protected area and best practice in conserving the geological heritage.

The above five main criteria show that Geopark is not a common natural area, but it is an important space that benefits both local people and tourists in many ways, such as for education, financial support as well as protecting and conserving the geological heritage. There are 111 members of the Global Geopark Network, which was recognized by UNESCO as of September 2014 (UNESCO). China dominated the chart by conserving 23 Global Geoparks as at 2014. Furthermore, China introduced the first eight Global Geoparks in 2004 to the world followed by France, in the same year. Other countries, which in the list are Greece, Germany, Spain, Ireland, Italy, Austria, Rome, United Kingdom, Czech Republic, Portugal, Malaysia, Croatia and Japan.

Study by Azman et al. (2010) indicated that, Geopark is designated with a focus on three main components which are *protection and conservation*, *tourism-related infrastructural development* and *socioeconomic development using a sustainable territorial development strategy*. This concept is consistent with the trend of integrating science and culture whilst recognizing the importance of preserving the uniqueness of the physical landscape. Furthermore, heritage sites within the Kilim Karst Geoforest Park consist of geology, archeology, ecology, history and culture. Therefore, both tourism and resource conservation should be integrated in order to benefit both human and natural resources.

## GEOFOREST PARKS, LANGKAWI, MALAYSIA

Langkawi Island has been recognized as Langkawi Geopark by UNESCO in June 2007. Langkawi Geopark was the first location to be recognized as a Geopark in Southeast Asia by UNESCO. It is situated in the Andaman Sea on the North West Coast of Peninsular Malaysia. The island can be labelled as the ‘Jewel of Kedah’ as it comprises of 99 islands with breathtaking landscape and rich in earth history. According to Langkawi Development Authority (LADA), for over 35 years’ scientist and geologist had studied about Langkawi. They have found out Langkawi had undergone various tectonic plate movements since 550 million years ago and finally were brought back to the surface. Furthermore, they also proclaimed, natural resources in Langkawi possessed high in heritage values. Due to its’ diversity of cultures and rich in earth history, Langkawi Island eventually was

endorsed by Global Geopark Network as ‘Langkawi Geopark’ in Jun 2007. Langkawi Geopark then was publicized to the world through the recognition and become one of the highest tourist destinations in Malaysia.

**Figure 1: Map of Langkawi Geopark**  
Source: Langkawi Development Authority (LADA website)



Langkawi Geopark comprises of three ‘Geoforest Park’ which are:

**i. Kilim Karst Geoforest Park**

Kilim Karst Geoforest Park is situated in the Northeast of Langkawi Island in Malaysia. It covered an area of 500 acres which consists of Kampung Lubuk Mata Kuching, Kampung Pinang Karung, Kampung Tanah Rincik/Longgok, Kampung Bukit Sabar and Kampung Batu Gajah (LADA). There are three types of rivers that flows from the site towards the main sea, which are Sungai Kilim, Sungai Air Hangat and Sungai Kisap. It is developed in Setul Formation, which is the oldest limestone in the region. Tourism activities that occur in Kilim area are boating throughout mangrove and geo-heritage locations such as Pulau Tikus, Pulau Langgun and Bat Cave as well as eagle watching in Eagle Bay.

**Figure 2: Landmark of Kilim Karst Geoforest Park**



**ii. Machinchang Cambrian Geoforest Park**

It is developed in Machinchang Formation, which is the oldest sandstone in the region. Cable cars are the main attraction for tourist to experience the aerial view of Langkawi Island. Besides, walking on the hilltop bridge also is the activity that most tourists will want to experience. Furthermore, variety of amusement games in the Geopark Oriental Village, which is located at the foothill of Machinchang Cambrian is the happening ambience that increases tourist attractions in the area.

**Figure 3: Scenic view of Machinchang Cambrian**  
Source: LADA website



**iii. Dayang Bunting Marble Geoforest Park**

It is developed in Chuping and Setul Formation, which possessed both marble and limestone. The main tourist attraction to Dayang Bunting is its lake. It is located on top of the hill and possessed a legend story where some people believe that the lake water could increase human fertility. However, many tourists visit Dayang Bunting to experience the enchanting natural view of the area and they can also swim as well as carry out water cycling activity in the lake.

**Figure 4: Entrance view of Dayang Bunting Marble**



**THREATS OF TOURISM ACTIVITIES TO KILIM KARST GEOFOREST PARK**

Tourist arrivals in Langkawi have contributed to RM billions to the economy of the nation. The higher number of tourist arrivals to Langkawi Island is definitely because of the various attractions that have been offered by the island. One of them is the endorsement of the island to a Geopark status by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Jun 2007. Thus, as one of geoforest parks in Langkawi, Kilim Karst Geopark possesses multiple natural assets, which has been continuously attracting thousands of tourists yearly to experience its enchanting ambience.

Generally, tourism activities are mostly influenced by human reaction towards an area with distinct characters, natural or man-made. It is suggested that any massive tourism activities would affect the nature of the site in many ways. Byers et al. (2006) emphasized that human behavior may affect the ecosystem as it is a connection between the ecosystem and social system. For instance, the behaviors of some group of unconcern people in certain communities towards nature would deplete the natural resources. There are a few tourism activities that affected nature. In relation to tourism activities related to the Geo Park, based on its location, recreational boating activities and visit to the multi-geological heritage sites have posed threats to the sites the most.

**i. Recreational boating**

The main threat of recreational boating activities is towards water quality such as hydrocarbon releases, oily and bilge water, sewage and grey water, as well as antifouling paints. In addition, boat wakes inevitably erode the riverbank by numerous boating activities, especially when the boats are with high speed (Lorenz et al., 2013). Furthermore, recreational boating activities in a lowland river affect freshwater and aquatic habitats.

According to Ahmad et al. (2013), boating tour activities in Kilim have attracted more than 10,000 tourists per month. Thus, the core tourism activity in Kilim is boating activity, as it is the main transport which connects to various tourist destinations. In conjunction with that, Page (2006) acknowledged the importance of transportation in recreational activities. Transportations

would increase tourism activities. Nevertheless, Gossling et al. (2005), in his study identified transportations and leisure activities in tourism could cause countless negative impacts to the environment.

Several studies have identified that tourism boat activities in Kilim had affected the natural resources. A study by Shahbudin et al. (2012) stated that wake current from boating activities contribute 6% to mangrove degradation in the Kilim Karst Geoforest Park. The tourism boats had caused erosion of the riverbank along Kilim waterways and disturb the sensitive vegetation within the area. Shahbudin et al. (2012) found that tourism boat activities highly affected the mangrove ecology of Kilim River and affected the water quality through oil spills. The mangrove forest along Kilim waterways is degraded by strong boat wakes.

Research by the National Hydraulic Research Institute of Malaysia (NAHRIM, 2015) regarding boat trips from Kilim Jetty suggests that boat trips that reach 200 times daily took approximately 2 to 4 minutes to reach at the Bat Cave which is 1 kilometer from Kilim Jetty (Fauzi et al. 2017). The report from NAHRIM stated that the boat speed was high and should be reduced. The research institute also stated in their report that the higher number of passengers and boat speed level, the stronger wake current would be produced by the boat. Therefore, NAHRIM suggested for a smaller boat to be used to carry tourists with a lower engine power in reducing high wake current, which might affect the natural resources in the more years to come.

Meanwhile, a study by Nasher et al. (2013), identified that one of the most significant polluting components of petroleum from boating in Langkawi is *polycyclic aromatic hydrocarbons (PAH)*. The samples gathered from the study exceeded the maximum admissible concentrations of PAHs (0.20 g L<sup>-1</sup>) according to the water standard of the European Union and may cause toxicity to certain exposed organisms. Thus, the seawater in Langkawi Island is considered as acidic and contains toxic as a result from spilled oil from boating activities.

**Figure 5: High speed of tourism boat in Kilim waterways**



## ii. Water pollution and poor waste management

Nonetheless, water pollution within the mangrove area originates from waste disposal along Kilim waterways and other tourism activities too, therefore the recreational boating activity cannot be solely pointed out as the main source of pollution in Kilim. Wong (2002) stated four types of pollutions produced by tourism activities are air pollution, untreated wastewater, solid waste disposal and noise pollution. However, the level of environmental impacts depends on the usage rates, type of recreational activities and climatic factors (Sun and Walsh, 1998). In terms of natural resources, a report from Air (2005) mentioned that the water quality in Kilim River is not in a good condition and need to undergo conventional treatments for sensitive aquatic life. According to Shamshiry et al. (2011), the natural characteristics of local ecosystems with coral reefs, sand beaches, and mangrove in Langkawi Geopark are affected from threat by poor waste management. In addition to the existing conditions, boats which are the vital tourist transportation system throughout Langkawi Geopark, have worsened the situation by affecting the natural resources such as mangrove depletion and erosion of the riverbank by wake current produced by the boat engines.

## iii. Other impacts from human activities

Other impacts in the Geoforest are associated with the implication to the mangrove ecosystem of the area. A study conducted by Ahmad et al. (2013) found, 176.83 out of 2153.07 hectares of mangrove area were destructed in Kilim River due to human activities such as mangrove clearing (38%) and construction development (40%). In addition, it shows that the existing human activities and the increasing of tourism development highly affect the mangrove ecology of the Kilim River. At the same time, the conditions also affect wildlife habitat such as dolphins, eagles and bats. The unhealthy food served as feeding activity of tourists has implication to aerial habitats such as eagles, for instance, their eggs become more fragile and fewer chicks are surviving. Besides, the birds also are getting obese and the young will lose their hunting skill. Their ability is diminished due to dependency, from the feeding activities. Thus, it is foreseen that boost in tourism industry would significantly affect the natural resources and wildlife habitat in the Kilim Karst Geoforest Park and Langkawi Geopark as a whole.

## TOURISM CARRYING CAPACITY IN KILIM GEOFOREST PARK

Tourism carrying capacity is a calculation method used to measure the number of tourist arrivals in tourism area without causing depletion towards the natural environment. World Tourism Organization (WTO) defines Tourism Carrying Capacity as the maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction. Whereas, Middleton and Hawkins (1998) define it as the level of human activity in an area that can accommodate visitors without deteriorating or affecting the quality of their experience.

A study conducted by Mohamad et al. (2014), described Tourism Carrying Capacity as capacities that were reached when visitors perceived the location as crowded. Thus, Attallah (2015) listed four forms of tourism carrying capacity which are:

- i. **Physical Carrying Capacity**  
It is the maximum number of tourist arrivals that can be accommodated by a tourism area. Besides, tourists also will be able to stay at the site at any given time as well as they can move comfortably within the area.
- ii. **Economic Carrying Capacity**  
It is a level of acceptable change within the local economy and tourist arrival, whereby, local economy can cater the tourist needs without the loss of local economic activities.
- iii. **Social Carrying Capacity**  
It is the level when both visitor enjoyment and crime rate are equal. For instance, if the visitor enjoyment is reduced and the crime rate is increased, this indicates the social carrying capacity has been exceeded.
- iv. **Biophysical Carrying Capacity**  
It is when the natural environment is capable to endure from tourist interference. This carrying capacity is defined as exceeding the limit when the natural destruction destroyed natural habitats for living things to survive.

Kostopoulou and Kyritsis (2006), Lagmoj et al. (2013), Kurhade (2013) and Rajan et al. (2013) agreed all of the above mentioned are different forms of carrying capacity that have been referred to in tourism. According to Zhang (2017), a geologist that studied on Geoparks in China highlighted that, the main issue of most Geoparks in China are facing is pertaining to carrying capacity. The number of tourists received at China Geoparks is very high. Thus, as one of them, Hong Kong Global Geopark needs to control this issue from being prolonged in the years to come. Extreme carrying capacity from boat tours might cause water pollution and affect aquatic life habitat. Furthermore, extreme land excursion activities might damage the natural resources as well as distracting the wildlife habitat. According to Azizan et al. (2014), tourist arrivals in Kilim is considered as high and should be planned accordingly to avoid congestion. In addition, they also suggested responsible body to create tourists' awareness to overcome tourist overflowed issue. Therefore, it can be said that the numbers of tourist to the Kilim Geoforest Park have high carrying capacity and should be controlled to a considerable amount if measures to be taken for its conservation.

Thus, it is clear that all Global Geopark throughout the world should constantly embrace on the main aim of the establishment of Global Geopark is to build a sustainable development which would benefit both human and nature. Even though the Geopark is open for public but the frequency of the activities was controlled in order to prevent damages. In the meantime, tourists still able to enjoy with the activities provided.

## CONCLUSION

Kilim Karst Geoforest Park is one of the Geoforest Parks in Langkawi Geopark that possesses the most natural heritage site for tourists along with Machinchang Cambrian Geoforest Park and Dayang Bunting Marble Geoforest Park (Langkawi Development Authority-LADA). Every four years, the 'Geopark Status' is renewed and endorsed by the UNESCO (United Nations, Educational, Scientific and Cultural Organization). One of the major criteria of retaining the Geopark Status is the protection and conservation of the geological heritage of the site. Langkawi Geopark manages to retain the Geopark status in year 2015 from UNESCO after the hard upgrading work which have been done by LADA and all the Geopark team.

In order to retain the geological and natural heritage of Langkawi Geopark, conservation works need to be done continuously without fail. Although the tourist arrival is beneficial to local residents as well as to the country in economic ways, conservation effort should not be neglected. Excessive and inappropriate tourism activities in the Kilim Karst Geoforest Park as discussed in the paper had affected various natural resources and wildlife habitat within the area. Massive boating activities have contributed to various environmental issues such as water quality, mangrove depletion and habitat extinction. For example, feeding approach to eagle by tourists should be reduced as it might weaken their hunting ability. Responsible bodies should be aware of the slight effect that might have been overlooked, in order to retain the Geopark Status in the future as well as to protect the nature for future generations. The awareness of the threats to the site may be seen as the wake-up call to the local authority, conservationists, the built environment expertise and others move forwards for its protection from excessive tourism activities. There is a limitation to this paper. Hence, further studies on the impacts of tourism activities need to be explored, since the paper is limited to reviews of various sources regarding the threats and implications to the site.

Carrying capacity is the maximum, the equilibrium number of organisms of a particular species that can be supported indefinitely in a given environment (Seaton, 2005). The amounts of resources available in the ecosystem, the size of the population as well as the amount of resources each individual is consuming are very important in balancing the carrying capacity. Exceeded population could cause destructions towards the resources. Degradation of natural resources indirectly would distract the natural symbiosis of the ecosystem. Therefore, the Tourism Carrying Capacity approach needs to be monitored in

order to retain the Geopark status by conserving the natural resources of the area. For that reason, tourist arrivals in Kilim need to be controlled, which simultaneously will control the cause of nature depletion in the Kilim Karst Geoforest Park, Langkawi. Hence, when natural environment areas are open to public for tourist attraction, number of tourists' arrival can to be controlled to promote stability and sustainability. Frequency and density of tourist arrivals need to be controlled in order to conserve the natural resources for future needs. Besides, degradation of resources could distract the area from being a favorite tourist destination in more years to come. Consequently, tourism activities need to be executed in a less extreme manner, but at the same time providing various attractive tourist destinations.

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