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## Multidisciplinary Approaches for Conservation and Awareness Programme at Langkawi Island

Wan Zaiyana Mohd Yusof<sup>1</sup>, Siti Salwa Isa<sup>1</sup>, Abu Ali<sup>1</sup>, Siti Suriawati Isa<sup>2</sup>

<sup>1</sup> Department of Industrial Design, College of Creative Arts, Universiti Teknologi MARA

<sup>2</sup> Department of Forestry Science and Biodiversity, Faculty of Forestry and Environment, Universiti Putra Malaysia

zaiyana004@uitm.edu.my, sitalisawa@uitm.edu.my, abuali@uitm.edu.my, ssuria4@upm.edu.my  
Tel: +06 55441405

### Abstract

The main objective of this study is to foster awareness among the university students from multiple backgrounds about the importance of preserving ecotourism area for the environment at an ecotourism sites in Langkawi Island. Multidisciplinary approaches were conducted to get rich data set of this study since no proper research had been done at the site before. The result gained, showed that students would be more aware and careful with their behavior once they joined the river awareness and conservation program hence the program will educate and raise more understanding about our environment for visitors and ecotourism stakeholders.

Keywords: awareness; ecotourism; forest conservation; multidisciplinary study.

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### 1.0 Introduction

Langkawi Island is located within the state of Kedah, at the north part of west Malaysia with an area of 478 square kilometres. This island it is the third-largest island by area in Malaysia. The topography varies from flat coastal plains, hilly areas to rugged mountains with tropical humid monsoon climate with a mean annual temperature is about 32 °C (33-24 °C). The average yearly rainfall depth is around 2500 mm (Shamshiry 2011) and its climate is influenced by two wet monsoons in April and May when the monthly rainfall average is over 180mm, and during August and October when the average reaches over 220 mm (Baban and Wan-Yusof 2010). Due to the geographical location of Langkawi close to Thailand, the island has significant similarity with southern Thailand climate and weather. Langkawi Geopark was declared as UNESCO Geopark in May 31, 2006 and it is the first Geopark in Malaysia and in Southeast Asia. Langkawi Geopark is the most northern Archipelago and a popular ecotourism sites for domestic and international tourists. In 2017 the island received 3.5 million of tourists and Langkawi Development Authority (LADA) targeted to make the island as top 10 island and ecotourism destination globally (UNESCO Global Geopark Gazette [UGGG] 2018). Hence, LADA has been actively promoting Langkawi as an ecotourism destination particularly UNESCO Geopark.

Nowadays, ecotourism has become a worldwide trend particularly in developed countries such as, Malaysia. More tourism agencies and operators like to associate their agencies to ecotourism activities or green tourism activities (Isa, Hasbullah and Nasir 2015). Stabler and Goodall (1997) stated that many ecotourism tourists are most likely willing to pay higher prices for environmentally less damaging products. Most scholars use the definition of ecotourism from the person who first coined ecotourism concept that is Ceballos-Lascurain

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in 1983. Later in (1987, pp. 13-14) he defines ecotourism as “travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas”. Nonetheless, some scholars prefer to use other names for ecotourism activities for example; green tourism, nature tourism, responsible tourism or sustainable tourism. The main distinction between these terms is the motives and ethics behind them. The concept may not be new, but this is an alternative tourism product with more enthusiasm than environmental sensitivity caters for a quieter, nature loving minority (Stonehouse 1999) with many different backgrounds. Hence, the primary focus of this article will be on ecotourism sites in Langkawi..

### 1.1 Research problem

Limestone karsts (hereafter referred to as karsts) are sedimentary rock outcrops that consist primarily of calcium carbonate. Most karsts were formed millions of years ago by calcium-secreting marine organisms (e.g., corals and brachiopods) before tectonic movements lifted them above sea level (MacKinnon, Hatta, Halim and Mangalik 1996). In Southeast Asia, karst covers an area of around 400,000 square kilometers (km<sup>2</sup>), with geological ages ranging from the Cambrian to Quaternary (Day and Urich 2000). Malaysia contains no fewer than 800 separate limestone outcrops, ranging from hills tens of meters across to plateaus many square kilometers in size (Wilford 1964). Although in Peninsular Malaysia, limestone hills occupy only 0.4 % of land area (Chin 1977), World Wildlife Fund (WWF) Malaysia (2016) reported the areas are estimated at 26,000ha, mostly concentrated in the northern states and 50,000ha in Sabah and Sarawak. A number of these consist of limestone islands in the Langkawi archipelago, with major outcrops in Kelantan, Perlis, Kedah, Perak and northern Pahang. In Langkawi Island, rapid development in ecotourism leads to uncontrolled land conversion including on limestone forest. All these activities result in loss of vegetation cover, increased influx of solar radiation, increased risk of fire, desiccation, and the resulting loss of topsoil (Schilthuisen 2004). The existence of vegetation is important for karst ecosystem for its role in absorbing and supplying water in the area. The absence of vegetation would cause insufficient water supply during the dry season (Satyanti and Wahyu, 2010). Deputy Minister of Energy, Green Technology and Water, Datuk Seri Mahdzir Khalid said Langkawi’s rapid development calls for additional water supply as more hotels, houses and business premises are coming up. This is because Langkawi has inadequate water supply and may face water scarcity by 2020 (The Malay Mail online 2014).

### 1.2 Research objectives

Based on that notion the main objective of this special conservation program is to foster awareness among the public about the importance and uniqueness of limestone Forest Rivers towards our environment. While two specific objectives are;

1. To find out the awareness of limestone river conservation program among visitors at ecotourism sites
2. To observe visitors’ behavior when they participated in limestone river conservation program at ecotourism sites

## 2.0 Literature review

### 2.1 Langkawi Karst

Langkawi is one of the most popular ecotourism destinations in Malaysia since many years ago. This island gained significant popularity in ecotourism sector after Langkawi was awarded UNESCO Global Geopark status in 2007. With most of Langkawi formation is from karst aged 500 million years making the island significantly unique and also sensitive. According to the Langkawi UNESCO Global Geopark Gazette (LUGGG) (2019), karst can be defined as a landscape of limestone elongated hills and island. Limestone karsts (hereafter referred to as karsts) are sedimentary rock outcrops that consist primarily of calcium carbonate. Due to the nature of karst, extra precaution must be taken before any physical development to take place. Unfortunately, the development of Langkawi particularly for tourism activities is too fast and rapid. As a result, Langkawi has started to experience environmental deterioration and other pollution issues for the past ten years such as; flash flood (Osman 2019; New Straits Time 2017; The Star 2020), fresh water supply shortages and insufficient waste management systems (Mayberry 2018).

On one hand, Langkawi natural water reservoir are experiencing unusual dry spell, on the other there has been an increasing high demand of clean water from users (McIntyre 2021) and most of them are from tourism related sectors. This situation is worrying, and it is timely for the island to promote ecotourism activities on the island rather than mass tourism activities. Not only ecotourism requires low impact development but also their activities encourage tourists to take care of the environment (Stonehouse 1999). In addition, the tourism stakeholders in Langkawi should continuously run awareness campaign to encourage local community and tourists to take care of the island’s environment. More edutourism activities should be encouraged and sensitive area in Langkawi should be conserved from heavy development. One of these sensitive areas is Langkawi karst where the limestone forest exists and formed part of the natural clean water resources for the island.

### 2.1 Water Education

Water is a renewable resource; howsoever humankind may waste it or pollute it. Surface water plays an important role in the assimilation of municipal and industrial wastewaters. The surface water quality in an island is of paramount importance as a source of drinking water and upon which many users and the ecosystem are dependent. In islands, the pollution of surface water causes rapid degradation.

Additionally, in most islands, streams collect much of the rainwater that falls on the land and receive pollution that the rain picks up as it runs off the land and drains into the streams (Aris, Praveena, Isa, Lim, Juahir, Yusoff & Mustapha, 2013). Since surface water monitoring and treatment programs are costly, awareness program involving the community is vital to educate and promote the knowledge and

sustainable use of water resource (Rabab, Ibrahim and Waled 2019). Hence, there is a high necessity in promoting the real information about forest hydrology specifically in river conservation from basic scientific knowledge, the effect of the disturbance, land use management, catchment areas until the hands-on techniques or skill to manage the resource. This could be done by conducting proper and continuous education and awareness events such as short course, interviews, surveys and mini scientific expeditions by universities or research institutes. These activities are substantially connected to ecotourism and part of edutourism. Although, ecotourism could be categorized as social science but the activities can be from pure science or art in order to give maximum experience to participants or visitors. Beside, multidisciplinary learning is the latest trend in education and research studies too. It empowers participants or students to see tangible correlations across subject matters rather than view each in a silo (Glebe 2020). Nonetheless, more studies should be done to look at the effectiveness of using multidisciplinary approach in education or ecotourism activities. For this program, it is designed in such as a way to combine multidisciplinary approach for the participants to get better awareness and understanding about the conservation program at ecotourism sites in Langkawi.

### 1.3.3 Ecotourism as a tool for conservation program

According to Stronza, Hunt and Fitzgerald (2019), ecotourism is designed to ensure a positive feedback loop between tourism and conservation because both need one another to survive. Since, ecotourism activities are most likely to involve with natural setting ideally, ecotourism should be used as a tool for conservation. However, there are some ecotourism did not play their role in conservation. Perhaps due to their lacked of understanding about the main concept of ecotourism itself. Thus, it is important for policy makers and local authorities to choose the right ecotourism operators at ecotourism destinations. Ecotourism operators should not think of making fast money from their business but instead they must think about non-monetary gain they get from conserving their ecotourism products for the future generation. The tourism industry needs more responsible ecotourism operators and stakeholders to promote conservation program for tourists. Countries such as; Greece, Norway, the United Kingdom and United States are well known to have good conservation program. As a result, these countries have many great historical sites dated thousand years ago and managed to attract substantial number of tourists every year. The tourism income from this historical sites lasted for many generations and help to sustain the local community economy. This is the ultimate goal of conservation program, to sustain one tourism product or destination for many generations in order sustain their livelihood. In addition, ecotourism destinations will gain benefit by being competitive from the protection of quality natural resources (Boley and Green 2019).

## 3.0 Methods

### 3.1 Site study

The location of the study is at Penarak Nature Centre (PNC) Sdn. Bhd. which situated about three kilometers to the east of Kuah Jetty comprise a total land area of 13 hectares, Fig. 1. Since the land area of bedrock bared counted for more than 50 percent of the total area mainly as limestone forest and located close to the Kilim Karst Geoforest Park, this research centre has the same rock formation from Setul Formation. Due to the unique geological characteristics, the forest has the highest elevation about 90 metres a.s.l., where many underground monsoon streams, caves, sinkholes, tufa falls, as well as a rich variety of plants and animals, are found. The size of water catchment area inside PNC is about 2 square kilometers where most of the limestone forest was classified as undisturbed forest by Kedah Forestry Department in 2019. PNC is home to many types of vegetations, bird species, small mammals, insects and aquatic lives.

### 3.2 Data collection process

This study conducted on-site visits to gather the needed data at the PNC site. In order to get a rich data set, a few approaches were used during two days of data collection, which were from 23<sup>th</sup> to 24<sup>th</sup> of December 2019. Firstly, 70 students from Universiti Putra Malaysia (UPM), Queensland University of Technology (QUT) and Universiti Teknologi MARA (UiTM) -with seven lecturers were travelled to Penarak Nature Center (PNC) by speed boat from Penarak jetty. These students were divided into two groups. The first group is the students who have pure sciences background, while the second group is from social sciences backgrounds. They were asked to prepare a report about their experience and opinion upon conducting all activities in the study area. Before the visit, both groups were given a briefing and explanation about limestone forest by PNC, UPM and QUT experts from social science and pure science perspectives. Video documentary produced by LADA was also used to give the students some information about the limestone forest. For the first stage of study, on-site visits to gather the needed data at the PNC site were done in February 2019. Based on the first stage visits a special limestone river conservation program were designed and tested on four key tourism stakeholders in Langkawi. Their comments and suggestion were gathered, and some amendments were done towards the program. This is necessary in order to make sure the program meet the objectives of this study. Then, all students were asked to prepare a report about their experience, opinion and suggestion about the program at the study area. While six students from UPM, six students from UiTM and four from QUT were interviewed to get their feedback about the program. This study also interviewed staff from UPM, UiTM, QUT and key tourism stakeholders in Langkawi about the program.

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Fig. 1: Location of Penarak Nature Center in Langkawi Island

### 3.4 River conservation and awareness program

Three rivers awareness and conservation program were conducted at PNC limestone area. All participants were transported to the area by speed boat from Penarak jetty since there is no access road to go there. The program can be divided into two parts the social science and pure science part as presented below.

#### i. Social science program

All participants were required to collect solid waste at the beaches and rivers at PNC site which is known by the locals as Batu Ayam and Batu Orchid. Most of the solid waste usually were brought from the sea since its location nearby to Kuah town and is a busy waterway for ferries and ships. Also, trashes from participants' lunch and drinking bottle were transferred to dumping area provided by the local authorities at Penarak jetty. The reason for this activity being conducted was to explain to the students about "leave no trace" principle which is significantly important in outdoor recreation ethic. Also, to instill responsibility among the participants to take care of the environment particularly at fragile area.

#### ii. Trekking and interpretation activities along limestone forest trail

Both groups were taken into the limestone forest by forest trail from Batu Ayam Beach (trail head) to a unique tufa fall of Batu Orkid, which located about 300 meters from the trail head. Besides visiting the tufa fall, they were taken around the limestone forest, to the caves, streams, and had been introduced to some features of limestone forest such as; rock formations, sinkholes, vegetation and wildlife, Figure 2. They were accompanied by a few experts in pure and social science fields. An expert in environmental interpretation gave a briefing and explanation to the students during their forest trekking, Figure 3. The interpretation session covered theory and knowledge about the biodiversity's contribution and their role and relationship towards ecotourism in Langkawi Island.



Fig.2: Students from the universities visited small limestone caves formation along the forest trail.



Fig.3: Students from UPM, UiTM and QUT were briefed by a few experts before and after their trekking activities  
i. Pure science program -Water Quality and Groundwater Study

The stream within PNC was observed before being chosen for on-site water sampling and water analysis using multivariable meter and turbidity meter. It was done by the group with pure science background assisted by a few experts. Water quality analysis was conducted on two different zones with stream where each zone (Figure 4 and Figure 5) was further divided into five points along the stream within PNC. The zone was selected based on accessibility and water availability since PNC was affected by two different seasons (dry and wet season). Finally, only one point from each zone was selected based on consideration and suitability for preliminary data collection. Several parameters were tested such as; Electric Conductivity (EC), Temperature (T), Total Dissolved Solid (TDS), Salinity (S), Dissolved Oxygen (DO) using special water quality test devices. While for pH, odour, floatable and taste at the selected points using portable electronic pH meter at the study side. For Total Suspended Solid (TSS) is tested at hydrology lab at Faculty of Forestry, UPM.



Fig.3 and 4: Students from QUT are taking water quality data and collecting water samples for further data analysis from Zone A and Zone B respectively.

## 5.0 Results and discussion

In this section the result and discussion will be presented into two parts. The first part is according to social science and the second part based on pure science field.

### 5.1 Participants hands on experience at study site

Through the visit, at PNC, participants showed that they are highly aware and appreciate more of limestone forest after the visit compared to just listening and watching information about limestone forest. Majority of the participant commented that they think limestone forest at PNC is beautiful and will be able to attract many visitors, especially those who like nature because of its rich biodiversity. While trekking and interpretation activities are good for visitors, it must be limited to a smaller number to make sure the information can be delivered effectively to everyone. From the students' report, they suggested the area to be open to the public. However, strict rules and regulations must be imposed to the visitors due to the sensitivity of limestone forest. They agreed that through the on-site visits to PNC make them realize the importance of limestone forest existence towards the environment and humankind.

They also gained more conservation experiences through cleaning activities nearby the river and beach besides understand that everyone should have their environmental responsibilities towards saving water sources from pollutions. Also, this activity teaches them about "leave no trace" practices and principal in outdoor recreation.

### 5.2 Water quality and groundwater study

The data showed that the stream flow, water velocity and visibility of the river are almost similar for both days. As this study was carried out during September, the water level for the rivers at Penarak remains the same for both days, which was at 0.28 M. According to climate data from the Department of Irrigation and Drainage (DID) (2019), Langkawi receives moderate to high volumes of precipitation beginning

March to November which indicate wet season with monthly mean rainfall in July is 268.8mm. Nine parameters are measured; temperature, electric conductivity, dissolved oxygen, salinity, pH, total dissolved solid, floatable, odor and taste. Meanwhile several tests for groundwater and minerals content were tested at hydrology laboratory. The data shows differences in electric conductivity for both days at Zone A and Zone B. The high reading of EC in this study area is mainly because of the stream water are from the limestone spring that came out from the fractures of carbonates rocks in Penarak and could be contributed from a high concentration of dissolved solids in the stream. The mineral content release ions into the waters that flow through or over them, where the geology of a certain area will determine the amount and type of ions (Clean Water Team, 2004). These ions include sodium, ( $\text{Na}^+$ ), calcium ( $\text{Ca}^{+2}$ ), potassium ( $\text{K}^+$ ) and magnesium ( $\text{Mg}^{+2}$ ). Further, the rugged and undulating topography in Penarak restricts the human activity such as agriculture or tourism, which could affect the water quality of the stream. Both streams also recorded low dissolved oxygen value for both days. As the river flow source is mainly from groundwater, it naturally low in DO. During summer, the cooler groundwater inflow may come at first lower the DO concentration. However, it also tends to reduce the river temperature, which improves the ability of the water to hold oxygen (MPCA 2009). The temperature of the zones stays almost the same about 26-27 °c which is the mean temperature in this tropical island. Whereas the pH of both streams stayed between 6.5 – 7.0 indicating neutral water (United States Geological Survey [USGS] 2020) due to undisturbed areas and could also be contributed by the seasonal change (dry season), Figure 5. Finally, there were no visible floatable materials or debris or no objectionable odour or no objectionable taste observed at the stream. Based on the pH scale measures the logarithmic concentration of hydrogen and hydroxide ions are in equal concentration which make up neutral water (University of Massachusetts Amherst 2016) and drinkable for human.

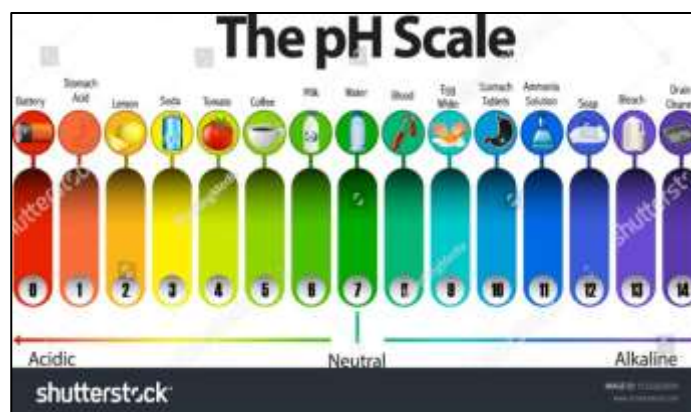


Fig.5: pH diagram scale  
(Source: Shutterstock <https://www.shutterstock.com/image-vector/ph-scale>)

## 6.0 Conclusions

Awareness and conservation programs are much needed at ecotourism sites in order to raise more understanding about our environment. Through, awareness and conservation program can educate visitors and ecotourism stakeholders about the importance of limestone forest. In addition, multidisciplinary approaches can give a good balance in ecotourism program and making it more interesting to take part. This study found that, water quality monitoring activities at the limestone rivers among the visitors make them have better understanding about limestone water system. Also, the importance to take care of limestone forest and its contribution to human being and nature. Due to the nature of ecotourism, multidisciplinary is suitable to be used in all of its activities.

The Penarak Nature Center (PNC) which is located on the tropical island west coast of Peninsular Malaysia is one of the unique limestone forests in terms of its hydrological features, geological formation, vegetation, and communities that still exist until today. With its rich biodiversity features, this area has high potential as a research and ecotourism center particularly relating to awareness and conservation program. Hence, extensive studies relating to this topic apart from conservation and awareness should be done in the future for further understanding about river, particularly at limestone forest area. Again, it shows that it is high time for cross disciplinary research to be encouraged in all aspects including awareness and conservation program at tourism destinations.

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