



# INVESTIGATION ON THE SOUNDSCAPE PREFERENCE AND PERCEPTION OF HIGHLANDS ENVIRONMENT: A PRELIMINARY STUDY

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Highland environment is one of the popular tourist destinations because it holds a rich array of natural resources. However, the economic and development growth of highlands gave potential effect of biological wealth and environment surrounding. Noise pollution in developing highland area could intrude the ability to comprehend of natural and environmental sounds. As preliminary, the main objective of this research is to identify factors and elements that characterise the soundscape in three selected green areas on highland environment. The research was carried out through a series of field measurement and audio-visual experiment. At the first stage of the study, the assessment of environmental sounds in three selected landscape areas was conducted. The assessment parameter of  $L_{Aeq, 8h}$  was taken in daytime for six days. The results ascertained that the all selected landscape areas of highland environment is dominated by sound of vehicle. Next, a series of audio-visual test is conducted where subjects listen to original recorded and combination of several stimuli sound samples to examine the preference and perception of acoustic comfort in selected green areas. In results shown that the natural ambient sound elements for combination stimuli sounds attributed more attention on preference and perception of the soundscape in highland environment.

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## 1. Introduction

Numerous studies on soundscape assessment in public spaces including noise assessment have been carried out [1-4] and various analyses on influences from community responses have also been studied [5-6]. The soundscape in public spaces has been researched but limited compared to sound in the context of noise. The perception of sound that direct to the term 'noise', imply negative impression [7]. The action of reduction or elimination of noise is insufficient for the improvement of the urban environment and in turn might create anxiety and other problems [8-9]. The soundscape research acquires a more holistic approach [10], and has started to be discussed in order to improve the quality of city life [11]. Meanwhile, Schafer [12] pointed out that the better quality of life was identified as an effort to view sound in a different dimension for soundscape from the context of 'noise'. In sequence, Nasar [13] identified the environmental assessments and aesthetics factors give major significances on the taste of judgements for community satisfaction.

The study on soundscape interrelates with human involvement through psychological assessment. Previous researches on the relationship between landscape and sound through audio and visual [14-15]. Both researchers used images as the visual stimuli. Carles et al. [14] looked into preferences through combination of different sounds and landscapes. He found out that the congruence of both stimuli influence people's preferences. Viollon et al. [15] research focus on the use of images and sound that differ in the degree of urbanization. The presented images influence the people's judgement towards the sound environments.

Most of soundscapes studies in public spaces are concentrated in urban areas. However, there are less specific studies that have been concentrated on soundscape assessment in highland areas while highland is a natural environment with high level of sensitivity towards development due to its topography and tourism. Hence, the negative impact of rapid development toward the activities in highland area is needed to take into consideration. Considering the rapid expansion of development at highlands area, the landscape areas provided will be the focus of this study on the assessment of soundscape. The aim of this study is to assess the soundscape and landscape in highlands environment and audio-visual stimuli on perception of the environment. Based on the aim, the objectives of the study are:

- i. To investigate the level of sound quality in selected landscape areas.
- ii. To identify the particular preferences of each stimulus into selected landscape value.

## 2. Site Description

There are a few well-known highlands in Malaysia, for instance, Genting Highlands is known as the city of entertainment, while Fraser's Hill and Cameron Highlands are known for its natural atmosphere as an attraction. Cameron Highlands was chosen as a preliminary study for highland's soundscape assessment based on its cultural heritage and nature-based attraction. It is being exploited as hills resort for the needs of socio-economy [16]. Cameron Highlands has led to rapid urbanization especially the township of Tanah Rata and Brinchang as major tourist resort.

Tanah Rata has been selected as the preliminary study area based on its important role as the administrative centre and tourist main attraction. Being the centre of development, the provision of recreational areas is situated in close proximity, with easy access and open to the public. The landscape areas selected were outdoor open spaces that provide recreational activities through its natural and man-made setting that exist in the centre of development. Three landscape areas were selected (see Figure 1 and Table 1).

### 2.1 Site A

Taman Pertabalan is an open public park that consists of seating, picnic table, playground, gazebo and open green area. It is a place where people conduct recreational activities such as picnic, skateboarding, walking, jogging and playing. The uniqueness of Taman Pertabalan features is the landform that makes certain area of the park partly as sunken landscape. This landscape area located near to the primary road as well as the secondary road. Variety of vegetation can be seen throughout the park that includes trees, pines, palms, shrubs and groundcovers.

### 2.2 Site B

Bus Station Pocket Park is a small landscape area where only seating is provided for the purpose of sitting and waiting. The land level of this landscape area has just a minimal difference with the road level. The site location is next to bus and taxi station as well as the primary road. In terms of vegetation, not many were planted due to the size and location as not to block the road view. The vegetation consists of pines and shrubs.

### 2.3 Site C

Site C is a landscape area provided for passive activities, such as people take photos with the giant fruit sculpture, sitting, picnic and viewing. The land characteristic of this landscape area is gradually undulating, whereby the land level is higher than the road. This landscape area is located further from the main road and along the secondary road. The vegetation includes pines and shrubs but more in quantity compared to Site B.



Figure 1: Plan of Tanah Rata

Table 1: Sites Description

Legend	Site	Short Description
Site A	Taman Pertabalan	<ul style="list-style-type: none"> <li>• Sunken Landscape</li> <li>• Active and Passive activities</li> </ul>
Site B	Bus Station Pocket Park	<ul style="list-style-type: none"> <li>• Flat Landscape</li> <li>• Passive activities</li> </ul>
Site C	Undulating Landscape	<ul style="list-style-type: none"> <li>• Undulating Landscape</li> <li>• Passive activities</li> </ul>

## 3. Methodology

### 3.1 Noise Assessment

Noise measurement was performed according to Planning Guidelines for Environmental Noise Limit and Control 2007, using class 1 sound level meter (SLM) Cirrus ‘Optimus Green’. One point of reference was located at each selected landscape areas. SLM attached with wind protector was placed on a tripod stand at a height of 1.2 m above the ground. The parameters measured were  $L_{Aeq}$ ,  $L_{Amax}$  and  $L_{Amin}$  including the observation of soundscape elements at selected landscape areas. However, to provide a compact presentation for the reader, only the results of  $L_{Aeq}$  are presented.

Measurements were taken for daytime from 0900 to 1700 (eight hours) for six days at each location, comprising of three (3) days of holidays i.e. Site  $A_{H, 8h}$ , Site  $B_{H, 8h}$  and Site  $C_{H, 8h}$ , and three (3) days of non-holidays i.e. Site  $A_{NH, 8h}$ , Site  $B_{NH, 8h}$  and Site  $C_{NH, 8h}$ .

The sampling activities were selected on those days in order to analyse the relation of noise traffic level during holiday and non-holiday. In addition, activities occurred, the availability of landscape features and the types as well as numbers of vehicles passing through the areas were also observed, identified and recorded.

### 3.2 Audio Visual Stimulation Test

Three videos (audio-motion image) were recorded nearby measured locations of sound level meter in similar days of measurement as described in previous section with covering natural and activities scenes for representing Sites A, B and C, respectively. Then, sample of video from each site was inserted three types of sound elements i.e. birdsong, water and natural ambience, into original sound using VSDC Free Video Editor ver. 2.2.1.319 as illustrated in Table 2. Each site comprised

four different sounds with similar motion image combinations were created for stimulation test. Total number of sample using for stimulation test is 12 and each sample test took around 30 seconds. Evaluations of sample were carried out through the order of each site in single session, by two to four individuals participating in one session. The participants were placed at same row at a distance two meters from the screen to watch the video sample projected from the projector (EPSON EB-1965) and each participant will be given one monitoring headphone (Shure SRH-840) as depicted in Figure 2. All volume range was fixed at computer (Apple MacMini), video software (VLC Media ver. 2.1.5) and headphones amplifier (Behringer Pro-8 HA8000) to ensure the similar volume will be heard by the participants. The noise level and temperature conditions of the room also were controlled using within the range of  $43 \pm 2$  dBA and  $22 \pm 2$  °C.

Before video sample is projected, the participant is asked to indicate their favourableness for 18 sound elements. Then, during the test, the participant is required to response and rates the subjects given in questionnaire according to each video sample projected. There are five subjects in each sample in term of preferences on a five-scale as presented in Table 3.

Table 2: Sample combination for audio-visual test

Site	Legend		Sounds
Site A	A1	•	Original
	A2	•	Original with birdsong
	A3	•	Original with water
	A4	•	Original with natural ambience
Site B	B1	•	Original
	B2	•	Original with birdsong
	B3	•	Original with water
	B4	•	Original with natural ambience
Site C	C1	•	Original
	C2	•	Original with birdsong
	C3	•	Original with water
	C4	•	Original with natural ambience



Figure 2: Photo of condition when conducting audio-visual test

Table 3: Subject preference for evaluation of each sample

		Preference Scale				
		1	2	3	4	5
Subject	Unpleasant					Pleasant
	Uncomfortable					Comfortable
	Chaotic		Slightly	Neutral	Slightly	Calm
	Boring					Exciting
	Unfavourable					Favourable

## 4. Results and Discussions

### 4.1 Noise Assessment

Figure 3 shows the comparison of the total number of vehicles for Sites A, B and C during holidays and non-holidays. From these results, the highest number of vehicles can be found during holiday at Site A, 12,053 units, whereby the highest number of vehicles during non-holidays is 12,508



units for Site B. However, the total number of vehicles for Sites B and C are higher during non-holidays than holidays. The differences are not as significant due to the continuous day between holidays and non-holidays, which suggest the tendency of the people extends their vacation. At this stage, it can be concluded that the number of vehicles for all sites gives similar tendencies of vehicles population despite the day differences during holidays or non-holidays.

The sound levels for three sites during holidays and non-holidays for 8 hours period are shown in Figures 4 and 5, respectively. In general, there is noticeable differences in the dispersion for Site B.  $B_{H,8h}$  can be observed during holidays and non-holidays compared to Sites A and C. During the holidays (Figure 4), the sound level in  $B_{H,8h}$  is around 57 to 73 dBA. The sound level for Site  $A_{H,8h}$  and Site  $C_{H,8h}$  were almost the same that is within the range of 48 to 58 dBA.

The similar basic tendencies as mentioned above also can be observed for all sites during non-holidays whereby the sound level for Site  $B_{NH,8h}$  indicated around 57 to 75 dBA and higher than the other sites (Figure 5). The sound levels for Site  $A_{NH,8h}$ , 48 to 62 dBA and Site  $C_{NH,8h}$ , 47 to 60 dBA.

Even though Site A is near to the primary road, the landscape features of sunken landform act as a barrier to the vehicle sound. Site C that is slightly further from the primary road and has higher landform also expected to give less influence from the vehicle sound. However, the site utilization in surrounding of Site B such as nearby to primary road, secondary road and shops, gives appropriate expected higher influence of the noise levels. At this stage, we conclude that the higher noise level is mainly produced by vehicles.

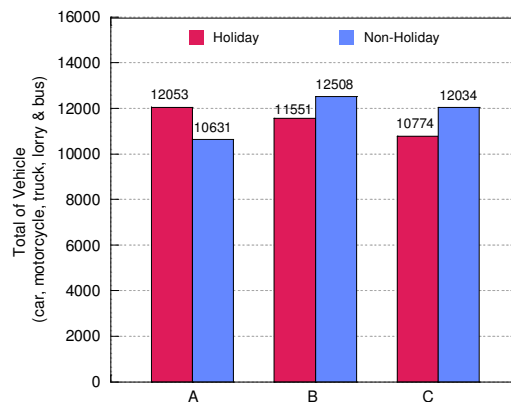


Figure 3: Total number of vehicles during daytime of holidays and non-holidays for all sites.

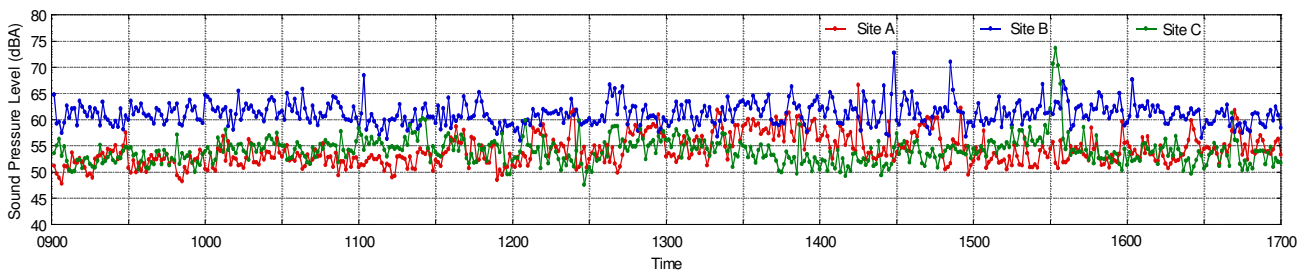


Figure 4: Sound pressure level (dBA) during daytime of holidays at Site A, Site B and Site C.

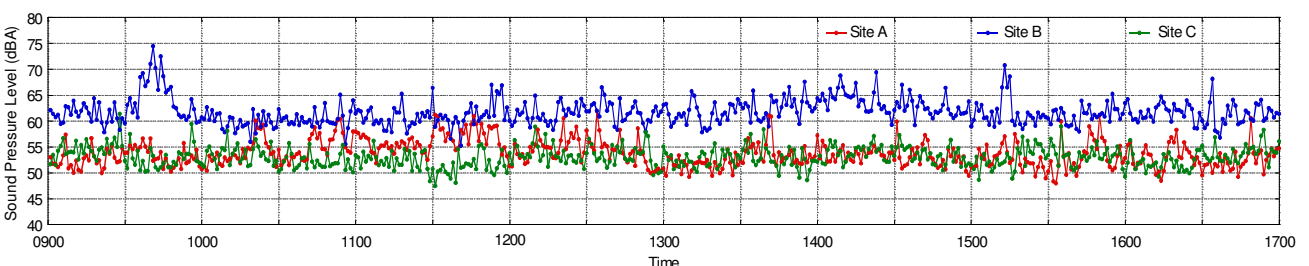


Figure 5: Sound pressure level (dBA) during daytime of non-holidays at Site A, Site B and Site C.

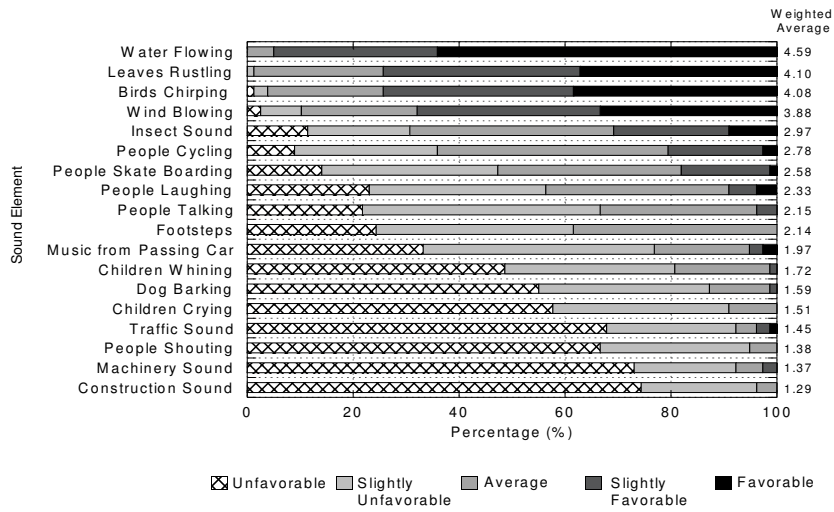


Figure 6: Evaluation on favourableness of 18 sound elements.

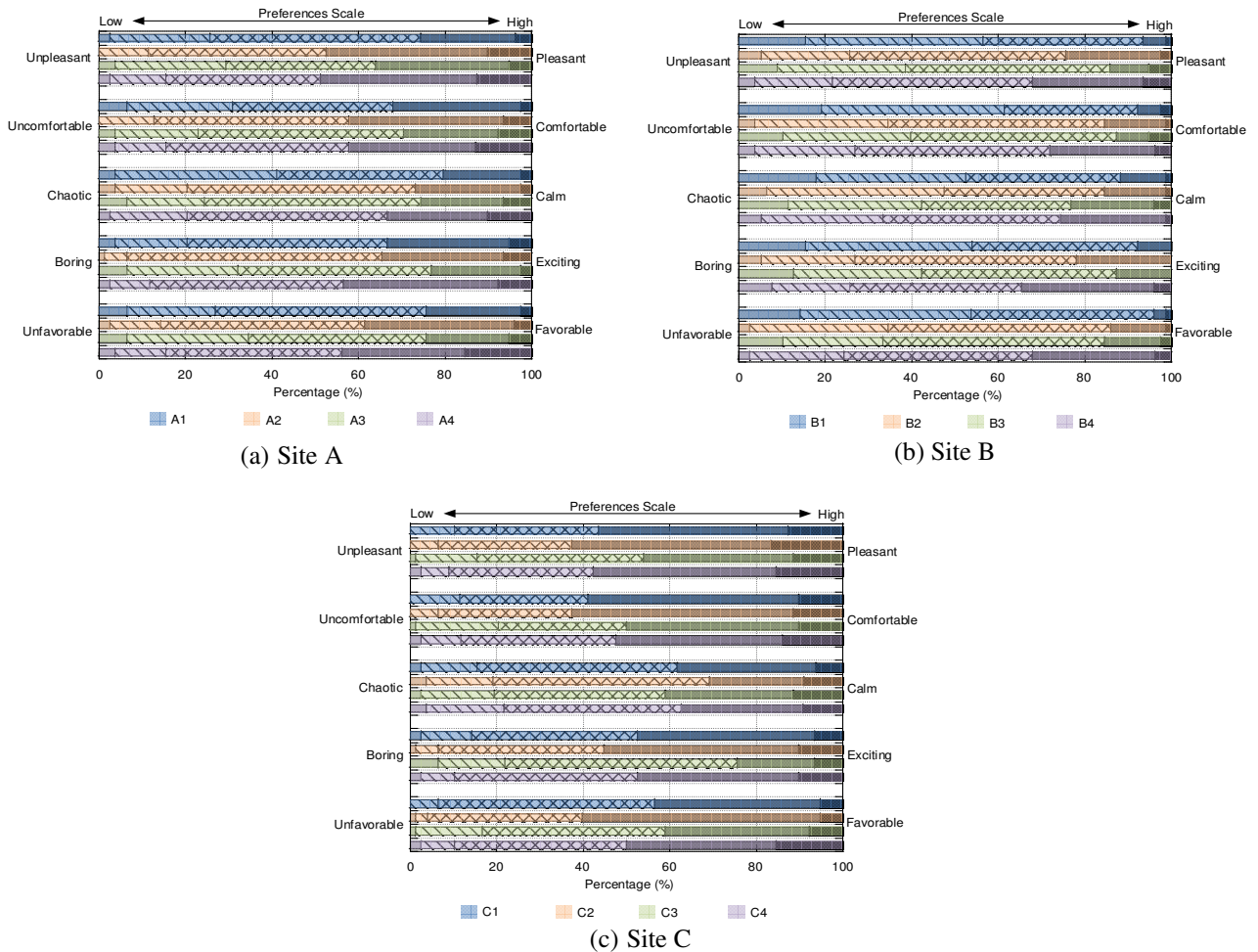


Figure 7: Evaluation on sound preferences for (a) Site A, (b) Site B and (c) Site C.

## 4.2 Audio Visual Stimulation Test

Questionnaires are distributed to a group of students that are age around 20s years old. The number of respondents is 78 undergraduate students participated in 20 sessions for two days. 47% of the

respondents are male and 53% are female participated in the test. In addition, 64% of respondents previously have been to the Tanah Rata, Cameron Highlands.

At first stage, the subject evaluation on favourableness of 18 sound elements was conducted as shown in Figure 6. Water flowing sound element shows highest weighted average with 4.89. In addition, leaves rustling, birds chirping and wind blowing sound elements can be observed as having almost similar weighted average. In contrary, result also shows noticeable tendencies that majority respondents are rated other sound elements below than 3-scale weighted averages which can be considered as less favourable or unfavourable to the subjects.

In general, majority of respondents have highest favourableness with the sound element related to natural sound environment while the sound elements on machinery and human activities have been identified as most significant contributing factor to less favourableness.

Next, the evaluation of audio-visual test has been carried out as shown in Figure 7 of each site. In Figure 7(a), the highest percentages of preferences rating for Site A were A4, which original sound with natural ambient sound element. However, the calmness subject was rated slightly less than others subjects.

Similar tendencies of preferences rating can be observed in Figure 7(b) for Site B. However, the overall subjects slightly lower than Site A by differences around 10%. Original sound in which traffic noise predominate in Site B was one of the expected contributing factor for lower rating percentages. In contrary for Sites A and B, the result of the Site C in Figure 7(c) shows a projection of original sound with birdsong gives highest percentages for all subject preferences. However, calmness subject was still rated slightly less than others subjects following similar tendencies in Sites A and B. Generally, original sounds with water sound elements are rated lower preferences compared to natural ambience and birdsong sound elements for all sites.

The survey results in all sites rated positively for artificial sound element and increase expression of original sound can be enhanced for natural environments settings. The results in Site B also substantiate the measurement results: it can be said that higher traffic noise is apparently tend to influence the human preferences and perception to quality of sound environments.

## 5. Conclusions

This preliminary study has presented both physical and psychological surveys of acoustical environment in landscape area in Tanah Rata, Cameron Highlands. According to the Planning Guidelines for Environmental Noise Limits and Control [17], the permissible sound level allowed for suburban residential (medium density) areas, public spaces, parks, and recreational areas were exceeding over than 55 dBA for all sites during daytime of holidays and non-holidays. Based on the results from questionnaire surveys, it was clearly found the combination of original sound with the selected artificial sound elements give reflected to the total evaluation and preferences of the quality of sound environment in all sites. Further investigations and analysis on highlands' soundscape is now being pursued intensively.

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