

FOREST THERAPY AND DESIGN PREFERENCES FOR SENIOR CITIZEN'S HEALTHCARE ENHANCEMENT AT HEATH FOREST, TERENGGANU

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Abstract. Forest therapy also known as Shinrin-Yoku, is also considered as a form of nature therapy. It functions through exposure to natural stimuli that render a state of physiological relaxation. The concept of forest therapy is used to enhance the wellness of the senior citizens by implementing therapeutic recreational elements. The growth of senior citizens is one of the most significant demographic trends all over the world with the global growth of elderly populations, emphasizing the increasing needs of older people in consideration of the public interest presents a novel challenge for developing a park for senior citizens. In Malaysia, the population has quadrupled over the past five decades. The study is aimed to is to integrate a forest therapy (Shinrin-Yoku) concept in a healthy forest that helps to enhance the wellness of senior citizens. Methodology used for the study consists of in-depth interview with two expert gerontologists, observation, questionnaire survey with 200 respondents, and conducting fieldwork at heath forest, Terengganu. The finding established that the senior citizen's behavior on their barrier and limitation in participating in physical activities, mainly because of ageing sickness such as dementia, disease, joint pain, impairment cognition, visual distortion, and others. Due to that, a limitation such as body ailment, lack of motivation, risk of injury and shy of carrying activities in public areas influence their activities. Besides, a design preference such as park facilities and amenities also affect their decision to do recreational activities. The therapeutic effects of the forest environment are considered the results of health treatment in the forest environment. Engaging both senses of touch and smell could stimulate the ageing society's psychological effects on their senses. Thus, the propose design and recommendations of forest therapy are recommended for senior citizen for their healthcare enhancement in natural forest specifically in heath forest.

Keywords: forest therapy, landscape design, heath forest, senior citizen, Shinrin-Yoku.

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1. Introduction

Forest therapy also known as *Shinrin-Yoku* by Japanese is considered nature therapy through a set of practices aimed at achieving 'preventive medical effects' through

exposure to natural stimuli that render a state of physiological relaxation and boost the weakened immune functions to prevent diseases (Hansen *et al.*, 2017). The concept of *Shinrin-yoku* engaged the users with all their senses during forest bathing through the forest's fragrance, green colors of the plants, the murmuring of streams and birds singing, eating forest food and touching the bark of the trees. Forest therapy exposed users to natural stimuli. It renders the state of physiological relaxation and boosts the weakened immune functions to prevent diseases. The targeted users, which are the ageing societies, will engage all their five senses during forest bathing. The forest's natural environment is considered essential in promoting health models as it is closely associated with human health issues. Climate, soil, and water are the main factors influencing the environmental factors in distributing plants and vegetation in the country (St Leger, 2003). One of the forest located in Peninsular Malaysia known as heath forest which is fragile and sensitive towards its environment and human disturbance (Hussein, 2014).

Soil from the heath forest is sandy, acidic, and extremely nutrient-poor (Othman *et.al.*, 2013). Usually, soils for recreational forests have faced degradation due to recreation such as camping or trekking activities. Hence, Suitable physical activities and biological methods must be applied to protect the soil from accelerated erosion. Once it is exposed and eroded, it may cause injury to the users (Hussein, 2014). Watercourses such as rivers, waterfalls, and lakes are added value for recreational landscape forest landscape. One of the attractiveness of forest landscape character is the watercourses and water reservoirs (Hussein, 2014). Rivers in heath forest are usually drained by blackwater river and usually acidic (between pH 3.0 to 4.5) with low oxygen content. Water is considered one of the essential natural resources of the earth because of its importance to living organisms.

Globally, the ageing of the population is one of the most significant demographic trends. With the globalization of senior citizens, including older people's growing requirements into public interest considerations poses a fresh issue for constructing a senior citizens' park (Suhairi *et al.*, 2017). Senior citizens are classified in Malaysia's Public Service Delivery and Local Government as those aged 60 years and above. This definition is consistent with the one adopted at the 1982 World Assembly on Ageing in Vienna. Malaysia's population has nearly quadrupled in the last five decades, expanding from 7.4 million in 1957 to 27.4 million in 2010. Since the 1970s, the number of persons aged 65 and over in Malaysia has gradually increased, and it is expected that the number would triple to more than 6.0 million by 2040, from 2.0 million today (Mafauzy, 2000). This shift in the demographic profile of the elderly population will also have an effect on the distribution of health care resources. Additionally, the elderly is less healthy than children. As a result, an increase in the population associated with ill health occurs among the elderly.

Malaysia's health care system is generally focused on acute care and hospitalisation, however the elderly who suffer from chronic ailments may require long-term care. In terms of preventing diseases and disabilities among the elderly, promoting a healthy lifestyle would help them. They would generally continue to be healthy elderly citizens if healthy lifestyles are maintained beginning in their adolescent years. Apart from alleviating illness and disability, this would increase their independence in daily tasks. Hence introducing and creating a recreational forest environment must be strategized carefully in order to achieve the goal of this study which is to integrate a forest therapy or *Shinrin-Yoku* concept in heath forest. It may help to enhance the wellness of the elderly

society by implementing therapeutic recreational element that is suitable for them while conserving the character of the forest (Hussein & Noorizan, 2007).

2. Methodology

Research framework

This research's primary focus is to integrate a forest therapy (Shinrin-Yoku) concept in a healthy forest that helps to enhance the wellness of senior citizens. First, to identify the elderly behaviour and their limitations related to physical activities. Secondly, to conduct in-depth interview with the experts and questionnaires distributed to the senior citizens in order to determine the seniors' behaviour and their design preferences in creating their spaces. Next, field data collection at health forest is conducted to identify and characterize the environmental elements. Last but not least, all the data will be analysed and interpreted using SPSS and Atlas t.i. Therefore, the outcome of the research is to establish design recommendations by integrating forest therapy concept into health forest that enhances the wellness of the senior citizens.

Identification of elderly behaviours, limitation and their design preference

According to Libakova & Sertakova (2015), an expert interview is an individual interview conducted between interviews and respondents – a specialist in the question's subject. This person is a carrier of in-depth knowledge of the research object. They are reliable to have authoritative opinions and professional assessment of the research topics. Hence, the experts who had been chosen are expertise in gerontologists, someone who has advanced education in the study of a senior citizen. The experts also were selected among those that know the field and working experience related to the elderly. The first expert was Dr. Ungku Ahmad Amen bin Ungku Mohd. Zam. He is a geriatrician who is working in Geriatric Unit, Department of Medicine at Hospital Tengku Ampuan Rahimah, Klang Selangor. Meanwhile the second interviewee was Dr. Rizah Mazzuin binti Razali who is the head Geriatrician at Geriatric Unit, Department of Medicine at Hospital Kuala Lumpur. The following questions are imposed in order to support the data analysis about related studies:

- 1) What are the factors that constraint the senior citizens from being active?
- 2) What are their pattern and preferences about open spaces?
- 3) What are the critical features in maintaining the physical and mental ability of the seniors?
- 4) In your opinion, what are your suggestions and recommendations for creating senior-friendly parks and open spaces?

Second stage is to conduct observation and survey questionnaire towards the senior citizen. There were 200 respondents were given out a survey questionnaire to identify the barriers of ageing societies, the needs, and their design preferences to create a forest therapy concept for the senior citizen. Five key details in collecting the demographic data are gender, age, race, marital status, and employment status. The age is needed to ensure that the respondents fall under the ageing societies category. Gender, race, marital status, and employment status are needed to affect the ageing societies' participation. This survey is focused on senior citizens that are currently experiencing their pre-elderly phase (50-60 years old) and elderly that are achieving their elderly's phase (60 years and above). The case study involving two forest setting parks in Selangor is Forest Research Institute Malaysia, Kepong and Taman Rimba Komanwel, Kepong. These two sites had been

chosen because it is setting as a forest nature preserved park. Both sites provide various activities that the visitors can experience, such as jogging, strolling, picnicking, gathering, and other recreational activities in the park. In order to achieve the targeting sampling, there were six steps should be taken (Taherdoost, 2016) and the details as below (Table 1).

Table 1. Sampling technique by Taherdoost (2016)

Steps	Sampling technique	A healthcare enhancement for senior citizen using forest therapy concept
1.	Clearly define target population	Target population for this research focuses on senior citizens that are currently experiencing their pre-elderly phase (50-60 years old) and elderly that are achieving their elderly's phase (60 years and above)
2.	Select sampling frame	Senior citizen that lives in Malaysia
3.	Choose sampling technique	Non-probability sampling – Quota sampling (“Quota sampling is a non-random sampling technique where participants are chosen based on their predetermined characteristic.” Davis, 2005.)
4.	Determine sample size	Sample size are 200 respondents
5.	Collect data	Questionnaire survey question's structure based on table 2
6.	Assess response rate	Analyzed data will be elaborated in discussion

Table 2 shows the example of a questionnaire survey that has been carried out in this study. There are some structures of the questionnaire that need to be arranged in the survey. The survey is purposely used to design preferences of the senior citizen in creating their space according to their physical needs.

Table 2. Questionnaire survey structure

Section	Structure questions
A Demographic Data	<ul style="list-style-type: none"> • Gender • Age • Employment status
B Park usage	<ul style="list-style-type: none"> • Frequency and timing • Purpose of using park
C Barrier and limitation in participation of physical activities	<ul style="list-style-type: none"> • Physical limitation • Psychological limitation
D Barrier and limitation in using park	<ul style="list-style-type: none"> • Park facilities and amenities • Weather obstruction • Travelling distance
E Design preferences for physical activities programme in park	<ul style="list-style-type: none"> • Preferred type of park • Preferred design

Study site, observation and environmental parameter sampling

The research fieldwork is performed to understand the physical and chemical characteristics of Heath Forest, Rantau Abang, Terengganu. Thus, soil and water sampling are performed. Rantau Abang (4°55'N, 103°21'E) is a small village in Terengganu, Malaysia, known for its leatherback Sea Turtle nesting and 22 km north Kuala Dungun and 8km South of Kuala Terengganu, Malaysia (Figure 1).



Figure 1. Study site (key plan and location plan) of heath forest at Rantau Abang, Terengganu

Site inventory had been conducted to help narrow down the scope of work, and it also can focus on the site of the study. According to Yin (2014), a case study is conducted to "investigates a contemporary phenomenon within its real-life context.." It can help the researcher understand the site by distinguishing the variables. The site inventory and analysis goal is to create and display information geographically and be used in the next step of the design recommendation. To integrate the forest therapy concept in heath forest suitable for the senior citizen, an observation technique is needed to identify the factor that can integrate forest therapy in the site. This technique is to observe the landscape character and condition of the Heath forest.

Environmental sampling

Soil samples had been collected and kept in a seal polyethylene bag and labelled for further analysis. Samples will then dried in an oven at 60 OC between three days to one week, depending on the soil's moistness. In this study, soil physical properties are focused more on two analyses which are soil texture analysis and soil colour analysis.

Water physicochemical analysis, various quality parameters are measured to determine the water quality index (WQI). Those are suspended solids (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen, nitrite and nitrate content, pH, dissolve oxygen, conductivity and salinity. The sample was taken in 3 litres of the bottle of each and it was quickly sealed and stored in the icebox during delivery to the laboratory. This was to ascertain the level of heavy metal, and their nutrient was not affected to obtain the most accurate results.

3. Results

Determination of the elderly behaviour and their limitations related to physical activities

Firstly, senior citizen's behaviour is analysed using an in-depth interview with the experts. An in-depth interview is an open-ended and discovery-oriented method where the interview explores the respondent's views deeply, feelings and perspectives. It is one of the most efficient methods of collecting primary data. The data obtained through in-depth interview discussion with the experts were analysed through a thematic analysis where data is transcribed using software Atlas T.i. Two experts with a Geriatrician background were approached to give their view and perception on the behaviour of the elderly on their barrier and limitations related to being less or not involved in physical activities.

The following aspects are explored:

1. Factors that constraint the senior citizen from being activities
2. Senior citizen's pattern and preferences about open spaces
3. Key features in maintaining their physical and mental health ability

These are the initial codes generated after systemically arranging the data (Figure 2). The coded data is used to identify the area of similarity or differences that may be overlapped between the codes. The codes are (1) constraint, (2) physical abilities, (3) mental ability, (4) recommendations, (5) design preferences. Some of the codes above may be related to other codes. Firstly, the constraint is associated with mental ability and physical ability. Mental ability is associated with constraints and can be caused by recommendations. So as physical ability. Lastly, recommendations are caused by both of the elderly's mental and physical abilities. Recommendations are also part of design preferences.

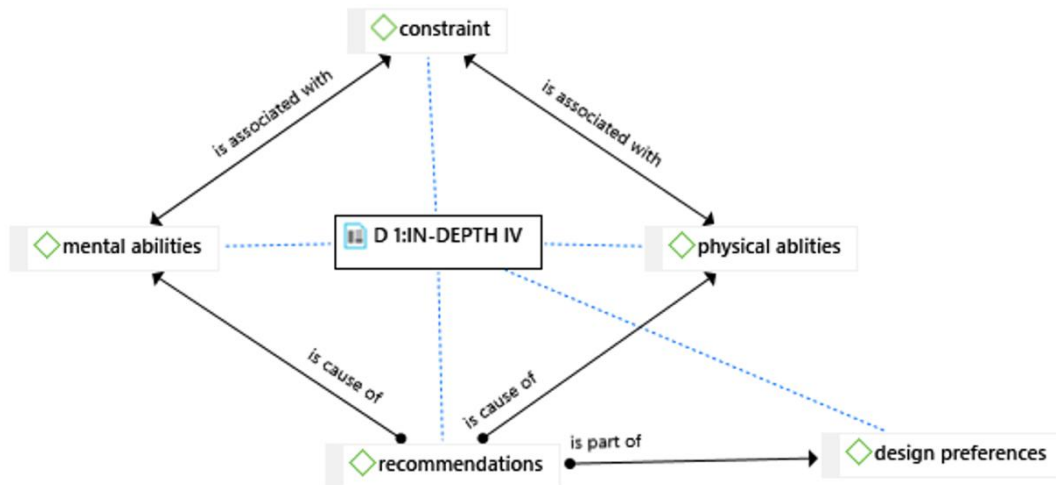


Figure 2. Initial codes to identify the area of similarity or differences between the codes

The first result analysis is about the senior citizen's constraint. The purpose is to understand the behaviour of the senior citizen's group regarding their barrier and limitations related to being less or not involved in physical activities. Hence, the following

codes emerged: (1) physical ability and (2) mental ability as a constraint associated with physical and mental ability (Figure 3).

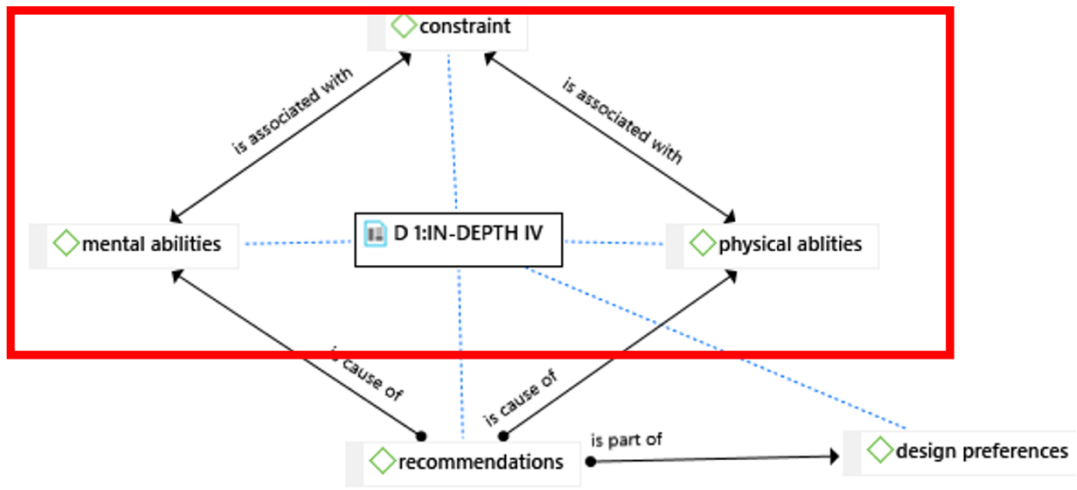


Figure 3. Physical and mental ability as a constraint associated with physical and mental ability

The experts were interviewed on the senior citizen's constraints limiting them from being involved in their daily activities. Their constraint is also associated with physical and mental ability as it affected them each way. Figure 4 summarised the constraint of the senior citizens from each expert and how they are related to physical or mental ability.

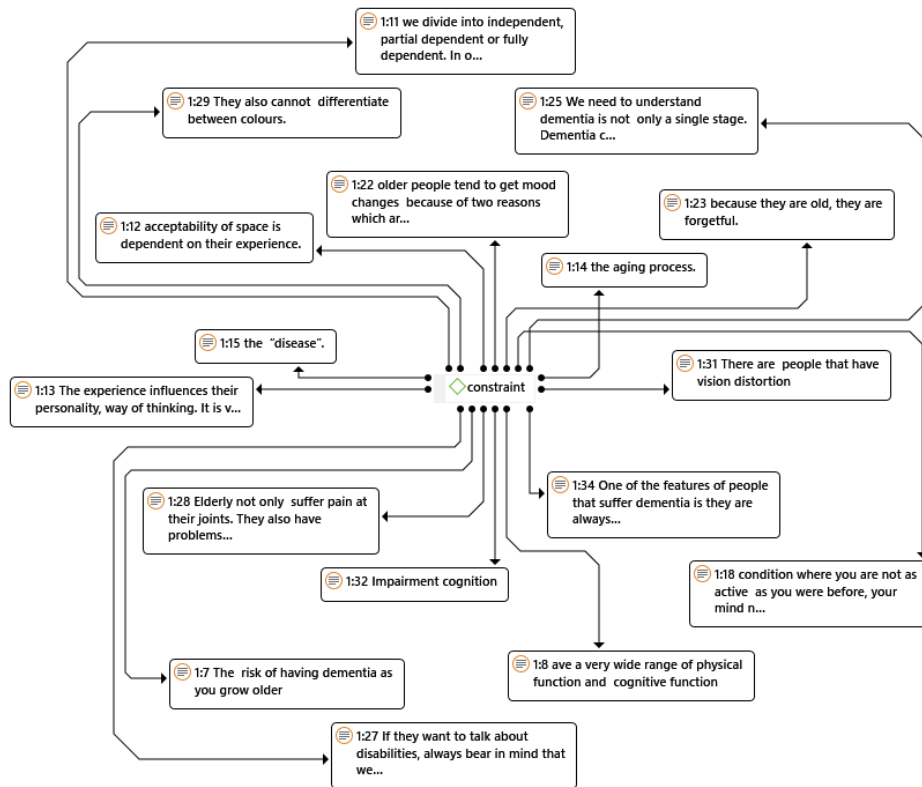


Figure 4. Constraints of the senior citizens (generated from Atlas t.i)

Figure 5 shows the summarisation constraints of the elderly from both experts. It can be summarised that most senior citizens faced constraints mainly because of dementia, the process of ageing, disease, joint pain, impairment cognition, acceptability of space, problems in hearing and seeing and visual distortion. It also shows the relationship between physical and mental ability associated with the senior citizen's constraint. During ageing, a person might experience various changes in terms of its physical and mental abilities.

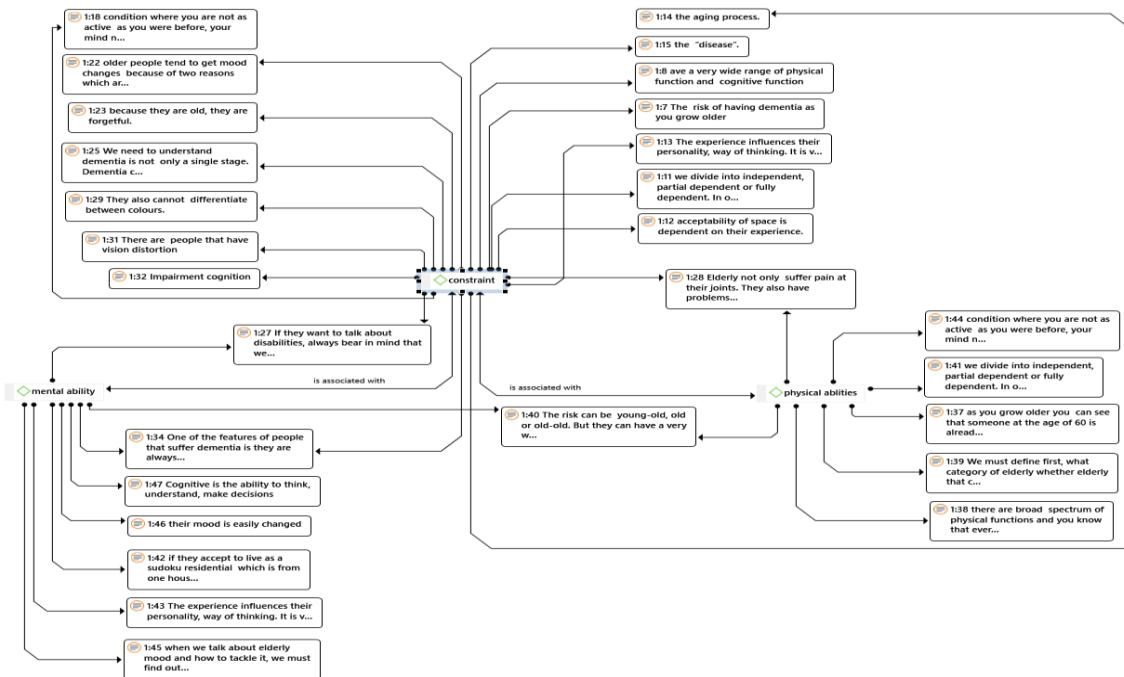


Figure 5. Network that show constraints of the elderly and its relationship with mental and physical ability (generated from Atlas t.i)

The senior's patterns and preferences about open space are discussed because of their physical and mental ability constraints. Expert recommendations are used to understand their pattern better and the suitability of creating an open space for them. As seen in figure 6 below, recommendations are also part of design preferences. Hence, the following codes occurred: recommendations (1) and design preferences (2).

Elder people may experience ongoing loss in capacities and declining functional ability. As discussed previously, their constraint is associated with their physical and mental abilities. From the interview session, Dr. Ungku Ahmad described that elderly needed to be surrounded by the environment and social support that influences their health condition. Meanwhile, Dr. Rizah Mazzuin also expressed that the elderly is frailty, which means their conditions are not as active as they were before; they are young. Whether they are active or not, it will affect the risk of frailty. It can be tackled by providing them with an environment that advertised a healthy lifestyle and makes them enjoy their health. These are explained in detail and supported by the excerpt from the data shows in the table 4 below.

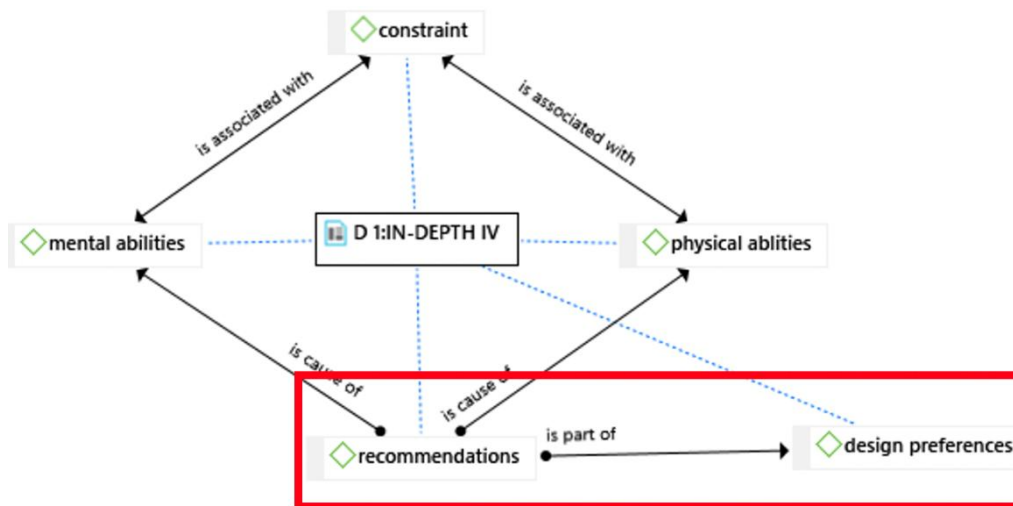


Figure 6. The recommendations and design preferences

Table 4. Key features for elderly’s pattern and preferences about open spaces

Experts	Summary
Dr. Ungku Ahmad	<i>“It all comes back to the bio-socio cycle called PIES; P for physical, Intellectual, E for emotional and S for spiritual. So, if you want to maintain elderly health, these are the key factors. Besides, the surrounding environment and social support also influence their health conditions.”</i>
Dr. Rizah Mazzuin	<ul style="list-style-type: none"> • <i>“This is something you can tackle by providing the environment what will advertise a healthy lifestyle and make them enjoy their health. At the same time, the environment must be safe for the elderly to do their activities.”</i>

Therefore, it can be summarised that most elderly faced constraint mainly because of:

- dementia,
- the process of aging,
- disease,
- joint pain,
- impairment cognition,
- acceptability of space,
- problems in hearing and seeing
- and visual distortion.

Beside, to tackle the elderly’s constraints and limitations, experts recommend providing them with an environment that advertised a healthy lifestyle and makes them enjoy their health. It is advisable to integrate these key factors. Which are: bio-socio cycle called PIES.

- P for physical,
- I for Intellectual,
- E for emotional and
- S for spiritual

Determination the seniors' behaviour and their design preferences in creating their spaces

Based on the survey questionnaires conducted, there are several limitations and barriers of the senior citizen societies from their perspectives. The limitations were observed and listed according to the variables based on creating forest therapy parks for the ageing society. The questionnaires comprise of five sections, which is (1) Demographic data, (2) park usage, (3) barrier and limitation in participating in physical activities, (4) limitations in using the park, and (5) design preferences. The data obtained from the questionnaire were analysed through descriptive analysis. Table 5 summarised the variables in the survey questionnaires and their purpose.

Table 5. Variables in the survey questionnaire and the purpose if the variables

No.	Variable	Purpose
1.	Demographic Data	To identify the respondents' demographic background that can affect the limitations and the needs to participate, such as age, gender, race, marital status, and employment status.
2.	Park Usage	To identify the average frequency and timing of the ageing societies in using the park. This is needed to examine the activities of the elderly in the park.
3.	Barrier and limitations in participation	To identify the elderly's participation constraint in participating in any activities in the park.
4.	Barrier and limitations in using park	To analyse the concerns that limit the participation of the ageing societies in using the park. This relates to the facilities provided in the park.
5.	Design preferences	To identify the respondent's recommendations and preferences in creating a forest therapy concept park for the ageing society.

Demographic data

Based on Table 7, 62.5 percent of the respondents are in the age group of 50-60 (pre-elderly phase) followed by those in age group <50 with 31.0 percent then, age group of 61-70 with 6.0 percent and lastly from the age group of 71-80 with 0.5 percent. More than half of the respondents are Malay, with 98.0 percent of the respondents. In addition, 92.5 percent of the respondents are married, while 6.0 percent are single, and the rest are divorced.

Park usage, barrier and limitations in participation

Next section presents data from a questionnaire that measures senior's participation constraint in participating in physical activity and their concern in using the recreational park. Table 8 shows the results for the senior's constraint and their concern for participating in recreational activities.

Table 8 shows that 19.5 percent of the respondents never felt constrained participating in recreational activities. On the other hand, 4.0 percent of the respondents always felt their concern and constraint. Most of the respondents (30.5) felt neutral in having body ailments and physical limitations such as knee or back pain. It was common to have body ailments for the elderly at this age. Next, having a lack of motivation is one factor that concerned senior citizens in doing recreational activities, as having support from people around them could boost their motivation. The data above shows that only 6.5 percent of the respondents have a lack of motivation. They are easily exposed to injury as they are fragile; this can be seen in data as 6.0 percent always felt easily exposed to injury while carrying any recreational activities. Lastly, significant of the respondent

(45.0%) never felt shy doing activities in public spaces. This because some of the seniors (2.0%) are shy and insecure as they felt that people around them would laugh and make fun of them, especially while doing physical activities.

Table 7. Summarisation of the demographic data of the respondents

Choices	N	Valid (%)	Cumulative %
Gender			
Male	97	48.5	48.5
Female	103	51.5	100.0
Total	200	100.0	
Age			
<50	62	31.0	31.0
50-60	125	62.5	93.5
61-70	12	6.0	99.5
71-80	1	0.5	100.0
Total	200	100.0	
Race			
Malay	196	98.0	98.0
Chinese	0	0	0
Indian	1	0.5	98.5
Others	3	1.5	100.0
Total	200	100.0	
Marital Status			
Single	12	6.0	6.0
Married	185	92.5	98.5
Divorced	3	1.5	100.0
Total	200	100.0	

*N = Number of respondents

Table 8. Results for the senior’s constraints and their concern in recreational activities

Nos.	Question	1	2	3	4	5	Mean	SD
8	I’m having constraint in participating any of the recreational activities	19.5	25.0	37.0	14.0	4.0	2.59	1.090
9(a)	I’m having body ailment/ physical limitation such as knee or back pain, tired, asthma, and others	23.0	23.0	30.5	19.5	4.0	2.58	1.157
9(b)	Lack of motivation	16.5	20.5	37.5	19.0	6.5	2.79	1.129
9(c)	Risk of injury	21.5	25.0	28.0	19.5	6.0	2.64	1.191
9(d)	Shy of carrying activities in public areas	45.0	29.0	15.0	9.0	2.0	1.94	1.069

1= Never, 2= Rarely, 3= Neutral, 4= Often, 5= Always

*Mean= Average respondent choose as an answer

*Standard deviation= >0.5 (good)

Barrier and limitations in using park

The park facilities and amenities are also factors that can limit the participation of senior citizens. Table 9 presented the senior citizen’s concern of the respondent is using the recreational park.

Table 9. Summarised and discussed the results for senior citizen's concern in using recreational park provided

Nos.	Question	1	2	3	4	5	Mean	SD
10	I'm having concern in using recreational park provided	26.5	24.5	41.0	6.0	2.0	2.32	0.997
11(a)	Lack of safety and security that limits my participation	9.0	18.5	33.0	32.0	7.5	3.11	1.077
11(b)	Fear of crime in recreational park	8.5	17.5	31.5	28.0	14.5	3.22	1.154
11(c)	Bad lighting in recreational park	11.0	18.0	29.0	31.0	11.0	3.13	1.116
11(d)	Unsafe park facilities	6.0	11.5	26.5	33.5	22.5	3.55	1.138
11(e)	Non-ergonomic features facilities	7.0	15.0	28.0	35.5	14.5	3.35	1.116
11(f)	Bad toilet facilities	2.5	6.5	22.5	34.5	34.0	3.91	1.023
11(g)	Bad accessibility such as no route sign	9.5	20.0	27.5	29.0	14.0	3.18	1.185
11(h)	Fear of going alone	9.5	14.0	24.0	30.0	22.5	3.42	1.246
11(i)	No safety design features such as handrail, ramp	5.0	12.0	33.5	35.5	14.0	3.42	1.033
11(j)	Far travelling distance from home	4.5	22.5	28.5	27.5	17.0	3.30	1.130
11(k)	Bad scenery and landscape	8.5	18.0	34.5	24.5	14.5	3.19	1.148

1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree

*Mean= Average respondent choose as an answer

*Standard deviation= >0.5 (good)

Table 9 detailed out concerns of a senior citizen in using the recreational park. Firstly, 26.5 percent of the respondents strongly disagree that they are concerned about using recreational parks. Meanwhile, 2.0 percent felt the opposite. However, the majority of them (41.0%) are neutral. Some of the respondents (18.5%) disagree that lack of safety and security in recreational parks limits their participation; however, (32.0%) agree that safety and security are essential in using recreational parks. Then, 28.0 percent of the respondent agree that the fear of crime might occur during their recreational activities. Next, 33.5 percent of the respondents agree that the park facilities should be safe for their usage, and the facilities should also be ergonomic (34.5%). Most of the respondents (34.5%) agree that they are concerned about using recreational parks if it has a lousy toilet facility while only 2.5 percent strongly disagree. This data shows how essential toilet facilities to them. Having poor accessibility, such as no route sign or map, could lead to loss and confusion in finding ways, especially for the elderly. Hence, 29.0 percent of the respondent agree with that statement. 30.0 percent of the elderly responded that they fear going alone to the recreational park. This may be associated with the previous statement of fear of crime and lack of safety and security. Contemporary with 9.5 percent of the respondent where they are strongly disagreed with going alone. Other than that, 35.5 percent of the respondent agree that the park should have safety design features such as a handrail and ramp. Far travelling distance from home is also one of the respondents' concerns, as 27.5 percent agree and 17.0 strongly agree with the statement. Meanwhile, 4.5 percent of the respondent strongly disagree with it. Lastly, 24.5 percent agreed that having bad scenery and landscape in the recreational park is a concern, while 8.5 percent strongly disagree that this statement should concern.

Design preferences

This section presents and discussed data from the questionnaire that measures the senior citizen's type of design they prefer to have in the park. In addition, descriptive statistical analysis that was run is the frequency (percentage) mean and standard deviation were calculated. The analysis results are presented and discussed in Figure 7 and Table 10.

Figure 7 shows summarised preferred parks that the elderly choose based on question no.12 in the survey questionnaires. The results have been supported by the quantitative findings as presented below:

12. Preferred park (Pilihan tempat rekreasi)
197 responses



Figure 7. Preferred park of respondents

Table 10. Senior citizen's preferred park

Preferred park	Choices	N	Valid (%)	Cumulative %
	Nature preserved park	58	29.0	29.0
	Open green space	49	24.5	53.5
	Lake park	80	40.0	93.5
	Jungle trails	5	2.5	96.0
	Sport centre	8	4.0	100.0
	Total	200	100	

*N = Number of respondents

Table 10 shows that 40 percent of senior citizens prefer lake parks to do their recreational activities. Twenty-nine percent of them prefer nature preserved parks followed by open green spaces such as neighbourhood parks or any green area near them with 24.5 percent. 4 percent prefer sports centres and the least choices are jungle trails with 2.5 percent. Based on the data above, most senior citizens prefer lake parks (40.1%) and a nature preserved park (28.4%) rather than the others. Other preferences include open green spaces or neighbourhood parks, jungle trails, and sports centres. This can conclude that they prefer parks with natural attributes and elements rather than something human-made.

The respondents also were asked about the design preferences in the park. This question is the rating scale question. Table 11 below present the data of the design preferences of the respondents.

Table 11. Summarised results for the senior citizen's design preferable

Nos.	Question	1	2	3	4	5	Mean	SD
13(a)	Must have good accessibility and navigation	0.0	0.0	11.0	30.0	59.0	4.48	0.687
13(b)	Must have physical health needs design and facilities	0.0	1.0	11.0	28.0	60.0	4.47	0.729
13(c)	Safe environment from wildlife	0.0	0.5	5.5	20.0	74.0	4.68	0.601
13(d)	Good toilet facilities	0.0	0.5	4.5	13.0	82.0	4.77	0.549
13(e)	Must have lots of seating or rest area	0.0	0.5	7.0	25.0	67.5	4.59	0.643
13(f)	Must have good lighting	0.0	0.5	7.0	20.0	72.5	4.64	0.658
13(g)	Good safety and security	0.0	1.0	3.0	14.0	82.0	4.77	0.546
13(h)	Provide recreational opportunities	0.0	1.0	7.0	32.0	60.0	4.51	0.672
13(i)	Offer social interaction and gathering space	0.5	4.5	12.5	30.0	52.5	4.30	0.890
13(j)	Offer nature and greenery scenery	0.0	0.0	3.0	22.5	74.5	4.72	0.515

1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree

*Mean= Average respondent choose as an answer

*Standard deviation= >0.5 (good)

Table 11 revealed the design preferable of the senior citizen in a recreational park. The first item in the result shows that most elderly (59.0%) prefer good accessibility and navigation in the park, such as route map, route marker, jogging track, and others. Having good accessibility is crucial for them as this can ease their movement, especially for wheelchair users. Next, 60.0 percent of the senior citizens also strongly agree that any facilities or design need physical health needs such as handrail, provided ramp and more. The seniors have different capability functions. They also strongly agree (74.0%) that an environment for their physical activities should be safe from wildlife and have suitable toilet facilities (82.0%) since their urine resistance is not as durable as younger ones. Other than that, 72.5 percent of respondents strongly agree that space should have lots of seating and rest area, good lighting (82.0%) around the area, making them feel secure and safe. In addition, 60.0 percent of the elderly would like the space to provide recreational opportunities such as exercise equipment, stone-foot walk reflexology and more. Recreational activity can help them practice physical activities to achieve a better quality of life. Lastly, 52.5 percent of the respondents would like to offer social interaction and gather space to socialize. Finally, 74.5 percent would like a space that offers nature and greenery scenery as it gives them a calm and serene feeling. It can be summarised that to create a forest therapy park for the senior citizen. It is crucial to know the reasons for their limitation and barrier from their perspectives. Their participation constraint and concern are:

- Body ailment
- Lack of motivation
- Risk of injury
- Shy of carrying activities in public areas

Other than that, park facilities and amenities also contribute to the factors of their participation. The factors are:

- Lack of safety and security/fear of crime/ and unsafe park facilities
- Non-ergonomic design and no safety design features

- Bad accessibility
- Bad scenery and landscape

Based on the results, the elderly prefer nature preserved parks as their preferred park in physical activities. This can conclude that ageing societies prefer parks that have natural attributes and elements.

Identifying and characterizing the environmental elements of heath forest

The study area is stretched to 12 km long where it was divided into three-section, point A, B and C (refer to figure 8). Along the route, there is also an island formed during rain. It is also known as an oasis of heath forest. The oasis water is taken at each checkpoint to undergo the water sampling process to find out the chemical inside the water. Soil also are taken at each checkpoint to get the average reading of the whole heath forest. The coordinate of the study area is labelled with a point:

- Point A to point B
- Point B to point C
- Point C to point D



Figure 8. Base plan of Rantau Abang, Terengganu

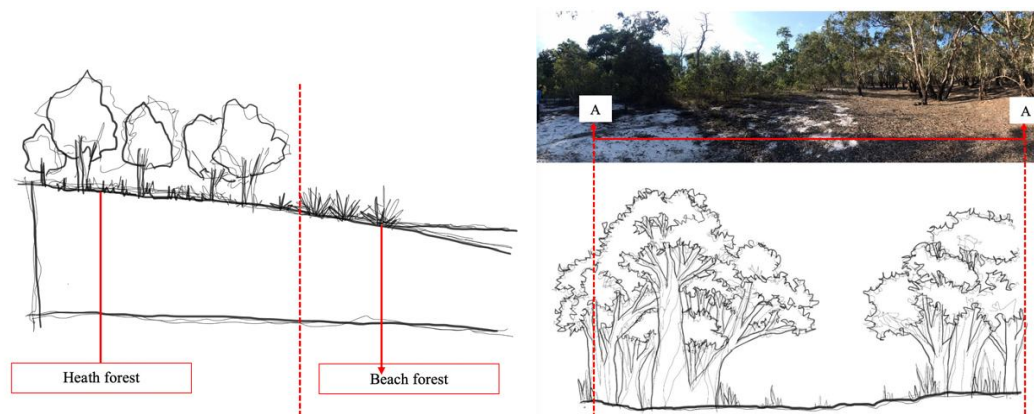
Table 12 summarises the forest therapy concept of stimulation that needs to be integrated into the heath forest in order to suit the concept of forest therapy based on sensory stimulation.

Table 12. Intergration of forest therapy concept into heath forest

Stimulation	Forest Therapy	Heath Forest
Sight	Engaging with scenery	✓
Sound	Sound of streams and rustle of leaves	✓
Touch	Touching the surface of trees and leaves	✓
Scent	Smell of woods	✓

Sight

The first stimulation is sight, where the users can engage with the scenery. It is found that natural sceneries have a positive effect on stress recovery and others (Tsunetsugu *et al.*, 2013). Based on the figure 9 below shows a cross-section of the Heath forest's landform.

**Figure 9.** Landform of the heath forest and cross section A-A'

Heath forest is elementary in structures compared to other lowland forest formations. Landform influence the users to visualize the forest as their eyes tend to look around a scene. Having a flat landform could widen their vision and engage their sight with natural sceneries. Based on cross-section A-A' above, it shows that heath forest is mostly flat in the surface. The landform is suitable for the elderly to carry out their recreational activities such as strolling, and light exercises. It is mostly flat and does not require any extra strength. A simple landform structure would help ease the users' movement, especially the elderly, where their movement is limited. Many ageing societies have a problem with their sights and hearings, so they need a space that is not secluded and spacious to cater to their constraints. The sense of sight and vision can monopolize the users based on their perception as the eyes take the surrounding in and locate them. The amount of information they received through sight is enormous. A simple observation can achieve intense experiences of connection. Based on this result, it can be concluded that having a flat surface structure is one of the factors of the forest therapy concept that stimulate the vision of the elderly in using heath forests.

Sound

Next, one of the heath forest landscape characters is the oasis formed in the forest that looks like a stream. The streams' sound would give calming and serene feeling to the users, especially for the ageing societies. Most of them live in a rapid development area with very few opportunities to encounter natural surroundings. Other than that, it also can act as therapy for ageing societies and improve their mental health. Figure 10 below shows the element of landscape character that contribute to the sound stimulation for the users.



The sound of the rustling leaves when wind hits could stimulate the sense of the users



An oasis was formed at the forest that looks like stream. Other than stimulating sound senses, it also engaged with vision senses

Figure 10. The engagement of nature (sound)

Engaging the sense of sound can help the ageing society to experience the forest therapy environment. The forest experience provides a specific state where it is not accessible in everyday life. During forest bathing, the users will experience a conducive thought on the mystery of nature and the incredible beauty of God's power. The wholeness of the forest experience resulted from the individual being wholly absorbed with nature and may feel that they have been cut off from the chaotic human world. Hence, to experience a forest therapy environment, sound is one factor that connects the users with the environment. Exploring and stimulating the senses can be tricky as interaction with the surroundings depends on how the senses perceive it. Therefore, it is

vital to use sound as an essential part of the sensory stimulation as natural sounds generate a state of relaxation for mental and well-being.

Touch and scent





Touch and smell senses are often related. For example, touching the surface of trees and leaves (vegetation) could help to stimulate the senses. Meanwhile, wood and forest environment scent could give comfort and caused a relaxed physiological state. Based on this, the most contributing landscape character element for touch and smell is the vegetation. According to the experts' interview, it is advisable to make the elderly spend their time in a natural-healing way. The experts also recommend that the space for the elderly needs to have something that can make them feel interested in participating. Integrating the concept of forest therapy in stimulating their senses, especially touch and smell, could increase users' relaxation and improve their moods. Table 13 below shows the plant species found in the heath forest and how they can stimulate the users' senses. The therapeutic effects of the forest environment are considered the results of health treatment in the forest environment. Engaging both senses of touch and smell could stimulate the ageing society's psychological effects on their senses. As discussed by the experts, older people commonly tend to get their mood changes. One way to tackle their mood is by engaging their senses with the natural environment as it helps them calm down feel relaxed. In conclusion, planning and creating the forest therapy concept is a way to restore experiences and well-being in nature. Commune with nature by touch and scent is one of the ways to connect with the environment. Stimulating the sensations will help the mind and body calm down and relax and help tackle the mood of ageing societies.

Next, for soil colour analysis, the result shows that the colour of heath forest soil is light grey, as shown in Table 14 below. The main pigmenting agents are soils which are organic matter and iron oxides. Organic matter will affect the soil by darkening its colour, while iron oxides produce a range of soil colours dependent on the iron oxidation state. In the Munsell colour system, colour is expressed in terms of hue (primary colours), value (lightness or darkness), and chroma (intensity of primary hue). According to the result (Table 14), the soil colour of area A was recorded as grey (2.5y 6/1), while B was recorded as almost light grey (7.5y 7/), and C was classified between light grey and white (5y 7/1-8/1). This explained that heath forest soil is low in oxygen and high in organic matter content.

Table 14. Results for soil physical properties analysis

Area of soil	Soil colour (Munsell chart)	Soil Texture (%)		
		Coarse land	Fine sand	Silt
Plant with 2'' diameter area	Grey 2.5y 6/1	14	85	1
Plant with 12'' diameter area	Light grey 7.5y 7/1	5	94	1
Plant with 40'' diameter area	Light grey to white 5y 7/1-8/1	7	92	1

Table 13. Plant species and their stimulation

Code	Plant species	Sensory Touch
T	<i>Melaleuca cajuputi</i> 	<ul style="list-style-type: none"> • The bark of the tree • The leaves of the tree • The roots of the tree <hr/> Smell <ul style="list-style-type: none"> • The flower of <i>Melaleuca cajuputi</i> • The trees emit an odour like camphor (menthol) with slight bitter taste
FP	<i>Drosera burmannii</i> 	Touch <ul style="list-style-type: none"> • The plant grows close with the ground, where the users can engage with touching of the soil. • <i>Drosera burmannii</i> has mucus or mucilage produced at the edge of plant hair, where it stimulates sticky to touch.
AP	<i>Utricularia aurea</i> 	Touch <ul style="list-style-type: none"> • During the dry season, the plant grows close to the ground, where the users can engage with the soil's touching. • During wet seasons, this aquatic plant float on top of the water. Users will also engage by touching the water.
S	<i>Eriocaulon sexangulare</i> 	Touch <ul style="list-style-type: none"> • This shrub can be found both in dry area and water. • The flower part stimulates soft touch to the user's sensory.

CP *Nepenthes gracilis***Touch**

- This climber plant is surrounded by leaves and can grow high up to 10 meter and more.
- The plant stimulates waxy and sticky feels to the user when they touch.

Smell

- The plant does not usually smell. However, the usual smell is somewhat minty due to the nectar they produce to eat their prey.

Code:

*T – Tree *FP – Flower plant *S – Shrubs *AP – Aquatic plant * CP – Climber Plant

This shows that heath forest soil conditions will increase the soil's leaching, affecting plant growth availability. There is almost no vegetation-covered on the surface. White sand also makes the land surface high (above 37.50°C), especially in the dry season. However, nature has its mechanism to recover itself. To conclude, the soil of the heath forest sandy and nutrient-poor with a high level of acidity. Hence, proposing plants that are suitable for this condition is crucial in ensuring the species live. By providing more mature trees can give adequate shade for the users. They will not feel uneasy when the weather is uncertain as the weather can sometimes be too sunny or rainy as mature trees with large canopies help them have shade as a shelter during any weather. Trees can also act as a natural buffer to screen uneasy views and minimise outside noises to create a forest therapy space for ageing societies.

Table 15. Results for physicochemical and nutrient analysis for water heath forest based on Water Quality Index (WQI)

Parameters	Unit	Average	Quality Index	Status
Biochemical Oxygen Demand	mg/l	1.10 ± 0.18	≤ 2.00	Normal
Chemical Oxygen Demand	mg/l	98.33 ± 19.30	≥ 100.00	Slightly Polluted
Total Suspended Solids	mg/l	0.06 ± 0.05	≤ 1.00	Normal
Nitrite	µg/l	0.01 ± 0.01	≤ 1.00	Normal
Nitrate	mg/l	0.26 ± 0.05	≤ 1.00	Normal
Ammoniacal Nitrogen	µg/l	0.18 ± 0.07	≤ 1.00	Normal
pH	pH	4.33 ± 0.13	≤ 7.00	Acidic
Dissolved Oxygen	mg/l	4.71 ± 0.85	≥ 1.00	Normal
Conductivity	µS/cm	44.37 ± 9.46	≤ 1000	Normal
Salinity	ppt	0.02 ± 0.00	≤ 0.5	Normal
NWQI	%	53.34	Class III (range within 51.9 – 76.5)	•Water supply III - Extensive treatment required. • Fishery III - Common of economic value, and tolerant species; livestock drinking.

As for water physicochemical properties and water nutrient analysis result shown in Table 15, all the parameters showed normal status except for two parameters (Chemical Oxygen Demand and pH), indicating the heath forest was slightly polluted and acidic. The COD represents the pollution load of most wastewater discharges. The COD values for all areas were more than 100mg/l, which can also be classified as polluted. Lastly, the result for water pH can be considered as very acidic with a pH below 5. According to the National Water Quality Index for Malaysia, the total average for all parameters is 53.34 (refer to Table 15). Therefore, it can be considered as polluted CLASS III (a range within 51.9-76.5) and can be used for water supply III (extensive treatment required) and fishery III (daily economic value, and tolerant species; livestock drinking).

Water quality is highly related to the general environmental status of the areas elaborated in many scientific publications. Based on the overall water analysis results, chemical oxygen demand showed that water is slightly polluted, and the pH range was acidic. Therefore, the most critical parameters in assessing freshwater quality variation are acidity/ alkalinity, BOD, COD, and DO concentration. Water acidity (pH) influences most chemical reactions in aquatic medium and determines the structures of aquatic biological communities (plants, animals, and other microorganisms). The pH value of the majority of freshwater in heath forests is range 4, which generally creates an unfavourably living condition, especially for aquatic systems. Based on the available data, it is proven that the water of heath forest is categorised as underclass III, which cannot be described as good. However, this water quality can suit irrigation and recreational purposes merely to create a forest therapy concept that integrates with the water of heath forest.

It can be summarised that landscape characters of heath forest are discussed to match based on the stimulation of the senses suitable for the elderly to integrate forest therapy concept in heath forest:

- Sight – Integrate with the scenery of the heath forest based on its landform and view.
- Sound – Integrate with the water bodies found in the heath forest and large trees that can create a rustling wind sound.
- Touch and scent – Integrate with the surface of vegetation and their smell.

Other than that, for the environmental quality of the heath forest, it can be concluded that:

- Soil physical properties – The overall colour of heath forest soil is light grey as the main pigmenting agents of soils are organic matter and iron oxides. This explained that heath forest soil is low in oxygen and high in organic matter content.
- Water quality index –The water of the overall forest is categorised as underclass III, where the quality of this water suits irrigation and recreational purposes.

4. Discussion

First, based on the interview conducted with the experts, it can be summarised that ageing societies each have different functional capabilities, and it is challenging to tackle their physical and health needs. There is a broad spectrum of physical functions, and everyone who becomes older has different physical abilities. According to Justine et al. (2013), each elderly has their level of physical activities and health issues related to their age. Thus, it makes changes to their physiology and psychology ability. As stated by the

expert during an interview, one of the constraints of the elderly is associated with physical and mental ability as it affected them in each way. Next, Schutzer and Graves (2004) elderly who are inactive often lives far from a space that offers recreational activities. Lack of recreational opportunities found to be a barrier for the elderly in participating in physical activity. Hence, it is associated with deteriorating the elderly's physical and mental abilities. According to the experts' interview, it is found that the elderly's pattern and preferences about open space are associated with their physical and mental ability. Expert recommendations are used to understand the elderly's a pattern and suitability better to create an open space for them. Older people may experience ongoing loss in capacities and declining functional ability. Thus, it is crucial to know the key features of maintaining the elderly's physical and mental health abilities. According to Justine et al. (2013), the elderly believed that their daily routines already provided them with enough exercise and physical activities. Their routines include social interaction activities such as charity work, "*marhaban*," and religious activities. In this study, both experts highlighted that the elderly needed to be surrounded by the environment and social support that influences their health condition. At the same time, the environment must be safe for the elderly to do their activities. In conclusion, the elderly also has an extensive range of physical function and cognitive functions. In medical terms, giving the treatment by not using medicine is called non-farmacule treatment. This research aims to integrate a forest therapy park concept in heath forest to enhance the wellness of the elderly society by implementing a suitable therapeutic element.

Second, based on the findings for questionnaire results, it can be analysed that most ageing societies are willing to create accessible and sustainable ageing-related needs spaces. However, according to Chao et al. (2000), the study pointed out that senior citizen's motivation to participate in physical activities may be altered over time, in conjunction with their commitment. Other than lack of motivation, it is found that the most common physical activity barriers are time constraints and cost. This statement is found in this study where having a lack of motivation is one factor that concerned seniors in doing recreational activities, as having support from people around them could boost their motivation. The concern that arises among senior citizens limiting them to practice physical activity in a park is that the park has a limited age-friendly and ergonomic design. According to Justine et al. (2013), facilities that are not suited to senior citizen's practice are among the main reasons limiting the seniors in participating in physical activity. It is found that in this study, the seniors mostly have different functional capacities. The dependency of ageing societies is based on their capacity to do daily activities. Thus, providing an age-friendly and ergonomic design suitable for them will give more significant opportunities for lifestyle modification for the elderly. Dzhambov and Dimitrova (2014) mentioned that "awareness of nature experiences" interacts with a person with nature. It gives a beneficial impact for the users as it can promote health. In this study, the senior citizen also prefers to have a natural park with lots of greenery and natural elements. This type of park could help them to enhance their wellness, health, and quality of life. Besides using the park as a medium of exercise, ageing societies could use them as nature-escape, and connection can help them enhance the healthcare of physical and mental needs. In conclusion, by understanding and analysing their concern, constraint, and design preferences through questionnaires distributed targeted to the senior citizen as main users, a forest therapy concept park could be created, and objectives of this research could be reached.

Third, according to Othman and Mat Rani (2013), The overall condition of heath forest soils can create a habitat dominated by high-combability species such as *Melaleuca cajuputi*. Most of the heath forest vegetation belongs to plant family rich in secondary compounds and high value of ethnobotany, especially medicines such as *Moraceae*, *Myrtaceae*, *Rubiaceae*, *Podocarpaceae*, *Sapotaceae*, *Guttifereae*, *Dipterocarpaceae*, and *Fagaceae*. This statement is found in this study where the heath forest's soil is nutrient-poor but with a high acidity level. Hence, not all plants are suitable to be planted due to their condition.

Next, water quality is highly related to the environmental status of the area. As elaborated by Othman et al. (2019), BOD is a measure of the biological self-purification of water, while COD indicates the amount of oxidation of the total organic matter present in the water. Therefore, regarding the results (Table 15), the consequences of higher values of COD are water pollution. Simultaneously, the pH of the water is slightly acidic and causes it to fall into class III. Thus, these factors created negative impacts, especially for the aquatic environment, as the declining water quality could cause water pollution. To conclude, integrating the forest therapy concept into heath forest is achievable after identifying all the elements and properties of heath forest that suit the concept of forest therapy. Furthermore, creating a forest therapy for ageing societies helps enhance the wellness of the users by implementing a therapeutic recreational element suitable for them.

5. Conclusions

This research aims to integrate a forest therapy concept in heath forest that helps to enhance the wellness of the senior citizens by implementing therapeutic recreational element that is suitable to the target group. This study was achieved with three main objectives. Where the first objectives are to understand the behaviour of the senior citizens on their barrier and limitation, which are the ageing sickness such as dementia, disease, joint pain, impairment cognition, visual distortion, and others.

The second objective is to study the design preferences of the senior citizens in creating senior citizen's space by knowing the reasons for their limitation and barrier from their perspectives which are:

- Body ailment
- Lack of motivation
- Risk of injury
- Shy of carrying activities in public areas

Also, identifying their design preferences for using park facilities and amenities also contributes to their participation. The factors are:

- Lack of safety and security/fear of crime/ and unsafe park facilities
- Non-ergonomic design and no safety design features
- Bad accessibility
- Bad scenery and landscape

The third objective is to integrate the concept of forest therapy itself into heath forest by identifying the forest's landscape character and environmental quality index. The landscape character is used to integrate with the senior citizen's senses to create forest therapy concept space for them. Environmental quality such as soil physical properties and water quality index is identified to understand the forest conditions before proceeding to proposed design guidelines. Hence, based on the data collected during the research, it

is believed that nature effectively enhances wellness and healthcare, especially for the senior citizen. The proposed design and recommendations are especially recommended for senior citizen for their healthcare enhancement by implementing the forest therapy concept into heath forest. The design guidelines and recommendations considered their limitation, barrier, and design preferences to ease them from doing physical activity regularly.

To conclude, the research aims to achieve all the limitations, barriers, and design preferences of the respondent were identified. Other than that, heath forest's landscape character also had been identified to suit forest therapy's concept to create a healthcare enhancement space for the senior citizen.

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