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MAPPING RECREATIONAL ECOSYSTEM SERVICE AT SUB-DISTRICTS OF MUAR

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Abstract

Cultural ecosystem services (CES) research are growing exponentially. Apparently, there is a need to consider spatial assessment for recreation provision service at the village scale, especially in southeast region of Asia. Mapping recreational CES is important in landscape planning and management, for identifying and designing recreation hotspots. The study areas were located at Muar district. The methodological design was divided into six steps. Firstly, the criteria were elicited based on recreational CES literature followed by determining its proxy-criteria. Next, constructing the ranking schemata, defining, and classifying each criterion into three ranks. Later, Geographic Information Systems ver. 10 (ArcGIS) was used to develop the criteria maps. Subsequently, questionnaires were distributed to experts to quantify the relative priorities of each criterion. Next, the relative priorities were rated using Analytic Hierarchy Process (AHP) through Expert Choice ver. 11.5 (EC). Lastly, each criterion map was combined through raster calculator function in ArcGIS to develop the CES recreational provision maps. The result suggested that the recreation provision of Bandar Maharani, Sungai Terap, and Ayer Hitam are considered mediocre due to abundant of low-level recreation provision. Nevertheless, the recreation provision of the urban area is slightly better than the suburb and rural areas mainly due to usability and accessibility. In conclusion, low and moderate recreation provision areas need to be functionally improved to promote ecotourism and leisure activities.

Keywords: Cultural ecosystem services, recreation provision, spatial analysis, Analytic Hierarchy Process, Geographic Information Systems.

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1. Introduction

One of the benefits afforded by the ecosystems is recreation and ecotourism activities that co-generated through the interaction of humans and the environment (Casado-Arzuaga et al., 2013). Recreation and ecotourism can be defined as recreational pleasure people derived from the natural or cultivated landscapes in an area (MEA, 2005; Nahuelhual et al., 2013). Recreation and tourism is an important type of cultural ecosystem service (CES) that need to be mapped, as it is important in land use planning, designing recreation hotspots, and reallocation of resources for new recreation and ecotourism activities (Nahuelhual et al., 2013). Grêt-Regamey et al. (2014) have proposed a tiered approach to map the recreational CES. Each tier has its own criteria that needed to be considered, but it can basically group into four major aspects- land use, usability and accessibility, landscape aesthetic, and non-managerial parameters such as weather condition and land form. One should note that which criteria are selected to assess recreational CES, are strongly depended on the goal of the assessment and the situation of the site. Nevertheless, Crossman et al. (2013) suggest that the accessibility and land use/ land cover (LULC) are important indicators in assessing recreational CES. In fact, most of the recreational CES research, LULC is the most commonly used criterion to evaluate naturalness, diversity of vegetation and scenic beauty (see Bunruamkaew & Murayama, 2011; Casado-Arzuaga et al., 2013; de Vries, Lankhorst, & Buijs, 2007).

On the other hand, accessibility also may influence people to visit the site, hence affecting the opportunities for recreation. For instance, Koppen, Sang, and Tveit (2014) posit that internal physical accessibility (i.e. topography, vegetation structure and infrastructure) and external physical accessibilities (i.e. distance and proximity) and social- cultural accessibility (i.e. gender, age, mobility, and preference) are among the indicators influence recreation provision services. In addition, features (e.g., facilities and amenities), accessibility (travel distance), aesthetic (e.g., greenery, cleanliness, and smell), and safety (e.g., traffic, lighting, undesirable users, poor maintenance, and surveillance) are also important factors that influence the usability of the recreational area (McCornack et al., 2010).

Another factor that influences opportunities for recreation is landscape aesthetic. Some researchers (e.g. Burkhard et al., 2012; Nahuelhual et al., 2013) considered them as part of the recreational CES while other (Casado-Arzuaga et al., 2013) suggested assessing recreation provision services and aesthetic quality separately. In this paper, we considered aesthetic quality as part of recreation provision services. The reason is, when people interacting with nature, they receive pleasure by enjoying the scenic beauty (TEEB, 2010). In other words, the scenic beauty of landscape may affect the preference of a people to engage with it. For example, if people perceive the visual of the site is poorly maintained, ugly, and unhygienic, they will avoid going there. In addition, topography (elevation and slope) has also been suggested by Chhetri and Arrowsmith (2008) as one of the important factors in evaluating recreation potential.

2. Problem Statement

The number of studies on ecosystem services are growing rapidly in various regions. However, majority of the previous studies were focused on North America, South America, and Europe. While, little studies have been conducted in Asia, particularly in the southeast regions (see Seppelt et al., 2011, p. 631). This may contribute to the lack of awareness on the importance of ES toward human wellbeing in southeast Asia region. Today, one of the most commonly used tools to estimate ES is through mapping. Mapping of

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ES is important in land use planning, management, and decision-making (Malinga et al., 2015). It is also useful to stakeholder in decision-making process. In the studies of mapping of ES, regulating and provisioning services are the most commonly being studied and mapped, whereas cultural and supporting services are still lack of attention (Crossman et al., 2013). In addition, many recreational CES studies are focused on municipality scale in which much smaller scale such as village or farm scale is seldom being explored (see Malinga et al., 2015, p. 61). This is also being highlighted by Yeo et al. (2017) in the mapping of LULC, small-sized resources such as small green space, playground, and square are relatively difficult to show and to illustrate in large mapping scale.

3. Research Questions

The research question was formulated based on the assumption that urban area provided the lowest recreational provision opportunity as compared to suburb and rural areas since urban area has limited spaces. The research questions are: (i) what factors determine the recreation provision opportunity in urban, suburb and rural areas? (ii) Is urban area afforded the lowest recreational provision opportunity as compared to suburb and rural areas?

4. Purpose of the Study

The purpose of the study was to explore and map the recreational CES in a small town at spatially explicit scale and compare their differences in urban, suburb and rural areas.

5. Research Methods

5.1. Study areas

Muar is selected as the study area because it is one of the districts that has many natural and agricultural resources (Yeo et al., 2016). Muar district is located at Johor states, Malaysia. It is also known as a royal capital, and furniture hub (JPBD, 2010; MPM, 2013). The LULC spatial data were acquired from Department of Agriculture Muar (2010). Muar has 12 sub-districts, the LULC for each sub-district is also vary. For comparison purpose, we have selected three sub-districts areas from highly urbanized area (Bandar Maharani), moderately urbanized suburb area (Sungai Terap), and less urbanized rural area (Ayer Hitam) to evaluate the recreation provision services. The size of the village scale in plots was 2.7km x 1.8km. These areas were selected based on their different types of LULC. Most importantly, there is a lack of studies looking on village/ farm scale (Malinga et al., 2015) in fine spatial resolution. Since the study areas were not covered the whole districts of Muar, we managed to update the database based on real site data and aerial image derived from Google Earth (refer Yeo et al., 2017, p. 291). It took approximately three months to completely update the new LULC maps (see Figure 01).

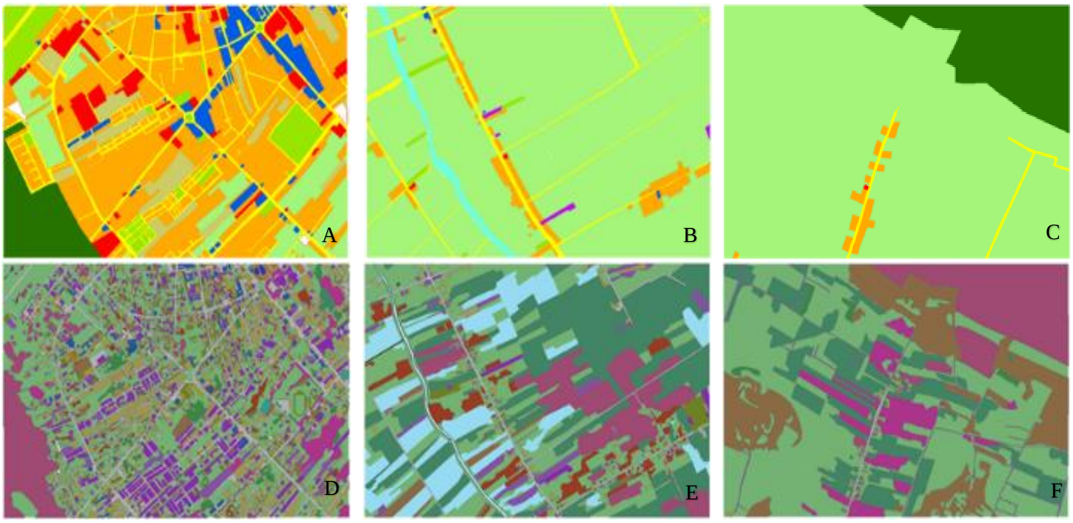

Figure 01. Maps A, B, and C were the original maps extracted from the land-use map acquired from Department of Agriculture Muar year of 2010. Whereas, maps D, E, and F were the updated LULC maps year of 2015.

5.2. Methods

Multi-criteria decision making (MCDM) processes incorporating with the ArcGIS capabilities is one of the conciliating techniques used in spatial planning to support spatial decision-making (Lawal, Matori, & Balogun, 2011). One of the capabilities of GIS-based MCDM is, it displays complex multiple criteria in visual pattern. These criteria maps can be used to coalesce with each other to communicate a spatially complex decision process based on decision maker's preference. One should note that the results of the MCDM are strongly influenced by the relative priorities of each criterion (Chen, Yu, & Khan, 2010). Hence, it is important to determine the weight of each criterion based on a ranking schema when exercising a suitability analyses. According to Bunruamkaew and Murayama (2011), deriving and rating the relative weights of the criteria in decision-making process are always difficult. Nevertheless, it can be solved with Analytical Hierarchy Process (AHP) for obtaining the criteria weights in MCDM (Chen et al., 2010). The methodological framework showed in Figure 02 explicates the steps to develop the recreation provision maps which was adapted from Nahuelhual et al. (2013, p. 73) and Bunruamkaew and Murayama (2011). In the beginning, we have elicited the criteria and the proxy-criteria from the scholarly articles that related to recreational CES literature. Next, we have developed a ranking schema to set the rule for generating the criteria maps. Next, we generated the criteria maps by using ArcGIS through spatial analysis. All the spatial criteria were then ranked and quantified by experts using AHP. The relative priorities acquired from the AHP was then used to perform the overlay analysis in ArcGIS to develop the CES recreation provision map.

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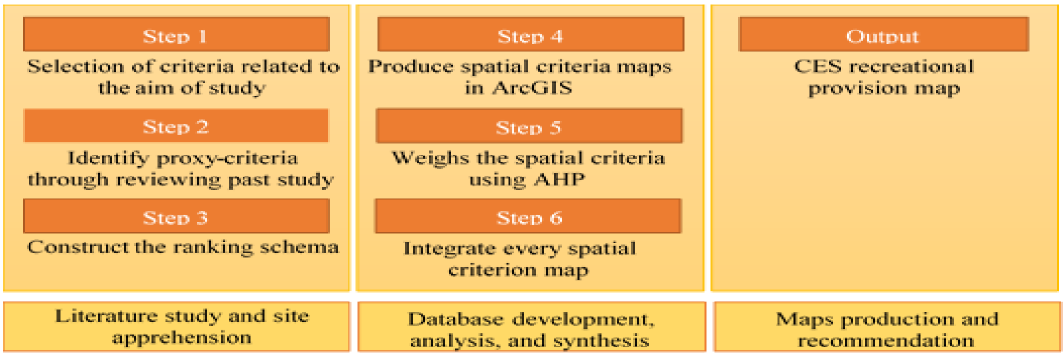

Figure 02. Methodological steps to map CES recreation provision map

5.3. Selection of criteria

The selection of criteria is mostly elicited from peer-review papers of recreational CES (Bunruamkaew & Murayama, 2011; Casado-Arzuaga et al., 2013; Crossman et al., 2013; Grêt-Regamey et al., 2014; Nahuelhual et al., 2013). Whereas, the proxy-criteria were selected based on their relevancy to the study areas. For example, the study areas did not have cycling path and trail, consequently, those parameters were ruled out. Other than that, we were examined on recreation and natured based recreational provision rather than spiritual or heritage value. Hence, criteria related to heritage is not considered. Eventually, the proxy-criteria we used to map the recreation provision map were naturalness, distance from the home, distance from the road, usability, scenic beauty, and relief (see Table 01). Every criterion map was produced individually, either from the primary data collected at the site, distributed survey questionnaires, or extracted from the updated LULC database.

Factor Rating Classification		**Based on literature**	**Process Methods**
Moderate (2)	**Low (1)**		
Semi-natural: agricultural (abandoned) plantation, grass	Non-natural: housing, industry areas, streets, and built-up elements	Nahuelhual et al. (2013); Norton et al., (2012)	Reclassify
100-200m	200-300m and beyond	Barbosa et al. (2007) & Koppen et al.	Extract, Euclidean distance &
Area within 200m buffer around main street	Area within 300m or more buffer around main street	Koppen et al. (2014)	Extract, Euclidean distance & Reclassify
Limited play facilities, good maintenance, clean and attractive	Lack of play facilities, poor maintenance, vandalism and	McCormack et al. (2010); Kaczynski & Henderson	Extract and Reclassify
The view comprises some vegetation with acceptable condition, close to water element, landform is kind of	The view lack of greenery, non-water element nearby, the landform is boring	Dramstad et al. (2006); Chhetri & Arrowsmith (2008)	Buffer & Reclassify
Moderate relative relief 20-40 m	Low – no relative relief 0-20m	Modified from Bunruamkaew and Murayama (2012)	Interpolation Reclassify

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Category (Criteria)	**Proxy-criteria and description**	**High (3)**
LULC	Naturalness- type of landscape, and degree of human interference	Natural: reserved forest, river, and mountain
Usability & Accessibility	Settlement- distance from the residents to	100m and below
	Distance from the road	Area within 100m buffer around main street
	Recreational usability- facilities and maintenance	Substantial play facilities, good maintenance, clean and attractive
Visual Landscape Aesthetic	Scenic beauty- condition, species variety, proximity to water and topography	The view comprises variety of vegetation that are in good condition, close to water element, landform is
Topography	Elevation- the different in z-value.	High relative relief 40-60 m

Table 01. Criteria and ranking schema for producing the criteria maps

Naturalness is defined as a gradual indication of degree of disturbance by man (Frank et al., 2013). For example, the naturalness is considered high when the forests are well preserved. Whereas, if the forests were partially or fully converted to agricultural land or built-up areas, then the naturalness would fall. We referred and adapted the tourism used aptitude (Nahuelhual et al., 2013, p. 80) and CES delivered by different landscape features (Norton et al., 2012, p. 452) to classify and rank different types of LULC. The LULC of the selected study areas included built-up areas, agricultural plantation, grassland, bushes, forest (mangrove and reserved), and river. Hence, only these factors were employed to evaluate naturalness. Based on the literature review, we suggest that the higher the naturalness of an area, it provides more recreational opportunities. To develop the naturalness criterion map, we have reclassified the LULC data in ArcGIS into high (forest, river, and mountain), moderate (agricultural plantation, grassland, and bushes), and low (housing and industry areas, street, and built-up elements) categories.

Besides looking on the LULC aspects, this study also considered the accessibility, both physical (distance) and social- cultural (age). For instance, walking distance is recommended should not more than 300m from home (Barbosa et al., 2007). Similarly, (Koppen et al., 2014) also suggest that children and elderly can walk to a maximum of 400 m, while 250 m to 300 m walking distance to recreational areas and green spaces is salutary. If the walking distance is more than 500 m away from the residential areas, the numbers of the visit will decline by half. By adapting what the literature suggested, we proposed 0- 100m is the optimum walking distance to the nearest green space either from home, road, or car park areas in order to encourage people to go to the recreational areas. In addition, 100-200 m walking distance is considered acceptable, whereas 200-300 m and beyond are discouraging people visiting the green spaces. To develop the distance from the home criterion map, we extracted the residential area's layer from LULC database and performed the Euclidean distance analysis with output distance set to 100 m, and then reclassified to the following range: low (>200 m), moderate (100-200 m), and high (<100 m). Same analysis technique was applied to the distance from the road's criterion map, but the input data was road layer.

McCormack et al. (2010) suggest the usability of the park is positively or negatively influenced by several attributes (e.g. facilities, cleanliness, condition, and maintenance), and it will affect the frequency

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of visiting the site. In addition, Kaczynski and Henderson (2007) also suggest that facilities (i.e. leisure services and recreation settings) can encourage people to become physically active, thereby using the recreational space more frequently. To assess the quality of green and recreational spaces, we adapted parameters of the use of park suggested by McCormack et al. (2010) as a benchmark. The requirements to classify whether it is good or poor quality can refer Table 01. Initially, we have conducted the evaluation on-site on all the green and recreational spaces. On the other hand, we also have sent some of the photos of the park (1), grass-covered area (3), agricultural plantation (3), and forested area (2) that we captured on-site to 30 experts via email. 30 emails were sent out, with only 19 participants responded. The reason we did not send all the photos to the experts is due to outstanding numbers of grassland and agricultural plantation that exhibited the same visual characteristic. Besides, some of the areas can classify as poor usability, for example, grass-covered areas that overgrew with bushes or abandoned agricultural land. All the experts selected are currently practiced as a landscape architecture and have at least 2 years working experience. The scale of the measurement was 3-point Likert scale. The result of the evaluation was used to determine the usability of the spaces, number 1 indicates poor usability while number 3 indicates good usability. To develop the usability criterion map, all the green and recreational spaces layers were extracted from the LULC database, and reclassified to three different categories based on the classification mentioned above.

Scenic beauty is one of the criteria being used in measuring recreational CES (Nahuelhual et al., 2013). There are several criteria used to determine scenic beauty. For example, Chhetri and Arrowsmith (2008) suggested elevation, relative relief, vegetation variety, proximity to water and slope diversity are the predictors for scenic attraction. Similarly, Dramstad et al. (2006) also suggested that the present of water, vegetation and topography are strong predictors for aesthetic preference. To evaluate the scenic beauty, we have captured 30 photos randomly at urban, suburb and rural area, respectively. The selection of the spots was located near the streets or roads because people respond to the visual environment are highly depended on what they can see all around them (Bishop & Hulse, 1994). The scale of the measurement was also 3 points Likert scale. Based on the evaluation by the experts, four pictures have shown considerably high standard variation which means the responses were varied. In this case, mean values are not a suitable measurement for central tendency due to ordinal scale data and skewed distribution (Manikandan, 2011). One of the reason might be the evaluation of scenic beauty is rather subjective and lack of standardization (Dramstad et al., 2006). Hence, median values were used to classify the scenery of the spot (good, moderate, or poor) among 19 experts to produce the scenic beauty criterion map.

Topography is defined as the “study and mapping of land surfaces, including relief and the position of natural and constructed features” (ESRI, n.d). Topography is one of the important factors in evaluating the attractiveness of landscape, scenic and recreation potential (Chhetri & Arrowsmith, 2008). In addition, topography (elevation and slope) has also been used as one of the criteria in suitability analysis of ecotourism (see Bunruamkaew & Murayama, 2011). We adopted the interpretation from the literature to fit into the context of this study. Therefore, it is assumed that the higher the relative relief the higher the recreational opportunities. We have derived the spot elevation data from Google Earth, and reprocessed in ArcGIS to produce the DEM map due to data unavailable. Besides, Google Earth also provides commendable accuracy data as compare to ASTER and SRTM elevation dataset (Rusli, Majid, & Din,

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2014). There are several interpolation options including IDW, Kriging, Natural Neighbor and Spline (see Childs, 2004, p. 34) that can be used to develop the DEM map in ArcGIS. In this paper, we selected the natural neighbor analyst to develop the DEM map due to the scattered points derived from Google Earth (Figure 03). Based on the DEM map we have had developed, we knew that the highest elevation (relief) is 60 m above sea level, and the lowest is 0 m. To produce the relative relief criterion map, we reclassified 40-60 m as high, 20-40 m as moderate, and 0-20m as low categories that influence recreational CES diversely.

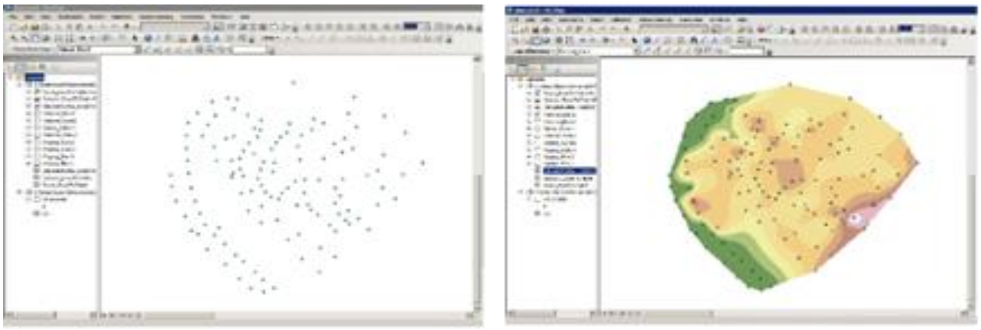

Figure 03. Earth's spot elevation data was processed to DEM map

5.4. Analytic Hierarchy Process (AHP)

AHP is a general theory of measurement to quantify relative priorities. It is used to derive ratio scales from both discrete and continuous paired comparisons (Saaty, 1987, p. 161). It is widely employed in multicriteria decision-making, planning, and resource allocation and in conflict resolution (Saaty, 1987; Saaty and Alexander, 1989). In this paper, we have strictly followed the AHP procedures described in the previous studies (Al-Harbi, 2001; Saaty, 2008) to quantify the relative priorities.

Firstly, we need to set the goal to identify the relative priorities of each criterion that were used in mapping recreational CES. Next, we structured the decision hierarchy into two levels only, since we did not propose alternative choices. Thirdly, we developed a pairwise comparison matrices (Figure 04) based on the results (median) from the survey questionnaires among 19 experts. The survey questionnaires were based on 9-points pairwise comparison scale, the levels of importance are range from 1 (equal), 2 (slight), 3 (moderate), 4 (moderate plus), 5 (strong), 6 (strong plus), 7 (very strong), 8 (very strong plus) to 9 (extreme). Fourthly, we calculated the priority vector (synthesis) as shown in Figure 05. Lastly, consistency ratio (C.R.) was identified based on the suggestion of R. W. Saaty (1987), Al-Harbi (2001) and Bunruamkaew and Murayama (2011) in which the value should be less than 0.1. If the C.R. value is more than 0.1, the result may not yield meaningful results in which re-examination and re-adjustment are needed. The C.R. value is 0.09 (<0.1), so it is considered acceptable. All the calculation was performed in Expert Choice ver. 11.5. For the manual calculation, one can refer to Al-Harbi (2001, pp. 24-26).

	Naturalnes	Settlement	Road	Uses	Visual	DEM
Naturalness		6.0	7.0	3.0	1.0	8.0
Settlement			2.0	7.0	5.0	5.0
Road				6.0	5.0	5.0
Uses					3.0	8.0
Visual						7.0
DEM		Incon: 0.09				

Figure 04. Pairwise numerical comparison using Expert Choice

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Figure 05.

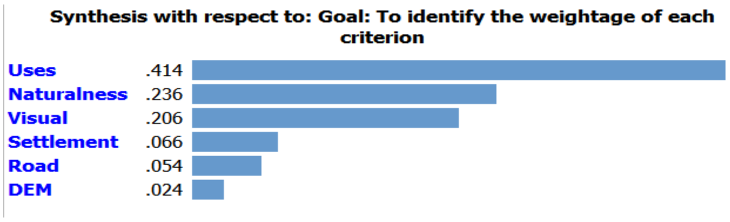
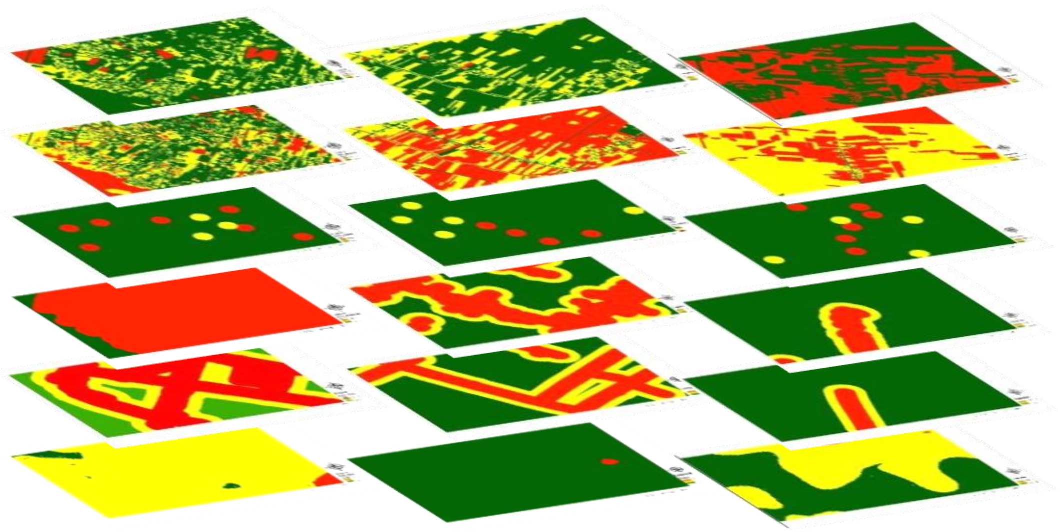


Figure 06. Synthesis bar chart for priority vector

5.5. Integrating AHP with ArcGIS

Integrating AHP in GIS modelling is still considered relatively new (Ishizaka & Labib, 2009). In this section, we discussed how the AHP can be used together with ArcGIS. Each of the criterion map generated from the ArcGIS was as shown in Figure 06. The colours of each criterion map indicate discrete impact on recreation provision service. For example, red colour indicates it has a great influence toward recreation provision, and yellow colour indicates moderate influence, whereas green colour indicates little influence. All the criteria maps were coalesced through raster calculator function in ArcGIS. The overlay analysis was executed through adding up all the criterion maps (raster data) multiply the weights of the criteria, respectively. The resulting spatial distribution of recreational CES maps was developed as shown in Figure 07 (A, B, and C). However, they were still not the final version yet due to the pixel value of the maps were floating type. After compartmentalizing the floating values to an integer with the reclassify tool in ArcGIS, the final recreational CES maps were generated as shown in Figure 07 (D, E, and F). The rank 1 indicates lowest recreation provision opportunities, whereas the rank 5 indicates highest recreation provision opportunities.



A) Bandar Maharani

B) Sungai Terap

C) Ayer Hitam

Figure 07. Different layers of criterion map, the first layer is usability criterion followed by naturalness, scenic beauty, distance from the home, distance from the road, and relative relief.

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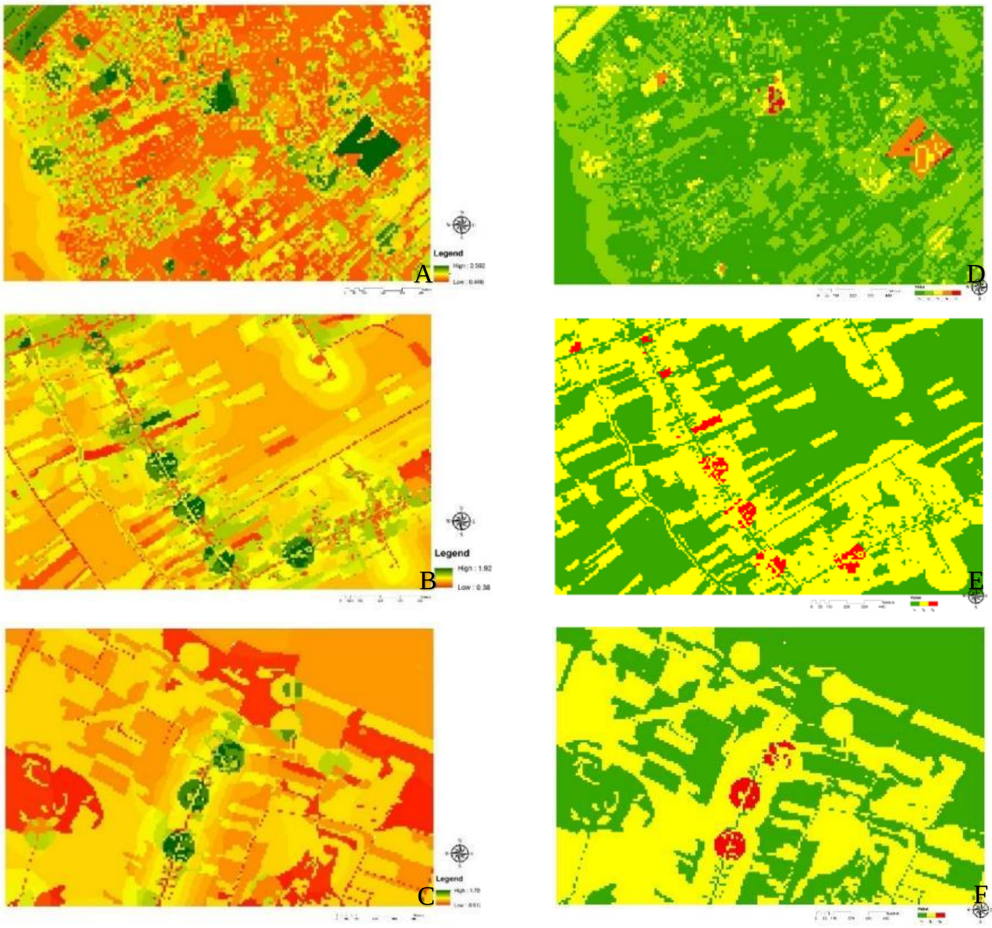

Figure 08. The earlier recreational CES map of Bandar Maharani (A), Sungai Terap (B) and Ayer Hitam (C) and after reclassifying (D, E, and F)

6. Findings

At Bandar Maharani (Figure 07 D), 57.9 % and 35% of the areas were classified as ranks 1 and 2. While, a small amount, 1.3% and 0.3% of the areas were classified as ranks 4 and 5, respectively. The remaining 5.5% of the areas were classified as rank 3. Sungai Terap (Figure 07E) also had the highest values of rank 1 and 2, which were 53% and 45.5%. Only 1.5% of the areas were categorized as rank 3. The overall recreation provision of Sungai Terap was slightly worse than Bandar Maharani due to the absent of ranks 4 and 5. Ayer Hitam (Figure 07F) exhibited the same results with Sungai Terap in which only had three ranks, with majority fell under ranks 1 (48%) and 2 (50.7 %) and a small amount fell under rank 3 (1.3%). The recreation provision at Bandar Maharani, Sungai Terap, and Ayer Hitam were considered mediocre due to most of the recreational CES were rank 1 (Figure 08).

For urban area, ranks 1 and 2 areas included wild grass-covered areas, fragmented lowland forest and abandoned agricultural lands. In term of the naturalness of the landscape, these areas were considered acceptable for passive recreational activities such as sightseeing for birds. However, the usability of the space was relatively poor, particularly lack of facilities and poor maintenance were the most dominant factors that contributed to low usability. On the other hand, ranks 4 and 5 areas were classified as high recreation provision mainly due to the maintenance of the landscape was good, and the place was clean and attractive. Besides, these areas also provided with numerous facilities, for example, running track, football

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field, and car park areas. In fact, we could see quite numbers of people were playing football and jogging along the road during our field visit. The finding is evidently parallel with Kaczynski and Henderson (2007) in which facilities (i.e. leisure services, parks, and recreation settings) can encourage people to become physically more active. The rank 3 areas were mostly grass- covered areas that provided moderately recreation provision. These areas mostly were opened lawn, the usability at these areas were also limited. However, the maintenance was still considered acceptable since the grasses were well trimmed, clean, and attractive. Thus, it still allowing for activities such as playing soccer, kite, and any other recreation related activities that suitable at opened lawn. This finding is slightly contradicting with Norton et al. (2012) suggestion in which grassland provided low recreational activities. In this case, we suggest that a proper and well-maintained grass covered areas indeed can support physical activities as compared to wild grassland with excessive growth of cogon and fescue grasses.

For suburb area, the classification of ranks 1 and 2 areas mostly were agricultural lands. These agricultural lands include durian, rubber and oil palm estates and orchards with a mixed planting of edible plants. Apparently, these areas had no facilities for recreational uses and the accessibility was disconnected. Since these areas were designated for cropping purposes, it was comprehendible the usability was low. In addition, poor accessibility also contributing to the difficulty of the people to reach and visit these areas. Generally, these findings are closely associated with Nahuelhual et al. (2013) positions in term of tourism use aptitude in which agricultural land provided very limited (low) recreational activities. In term of naturalness, river has the potential to provide various recreational and leisure activities including trekking, climbing, kayaking, and bird watching (Nahuelhual et al., 2013; Norton et al., 2012). Surprisingly, the results shown in Figure 8E suggested otherwise. If considering the river itself, it provides various leisure activities. However, considering on single aspect is insufficient, factors such as travel distance, facilities, and visual landscape aesthetic also play an important role in recreation provision as well. Apparently, the river at Sungai Terap was not developed as a recreational hotspot since the usability was poor. In addition, there were no proper facilities provided at all. Not to mentioned that it was difficult to access to the river due to poor circulation. In term of landscape aesthetic, these areas also ranked as poor condition due to the wilderness of the surrounding vegetation. In sum, the finding suggests the naturalness of the river is high, but the lack of facilities, poor accessibilities, and bad visual landscape have contributed to the low recreation provision opportunities. The remaining 1.5% of the areas (rank 3) were located near the main roads, namely, Jalan Jeram. These areas were slightly better than other areas because it was accessible, and the landscape aesthetics was high.

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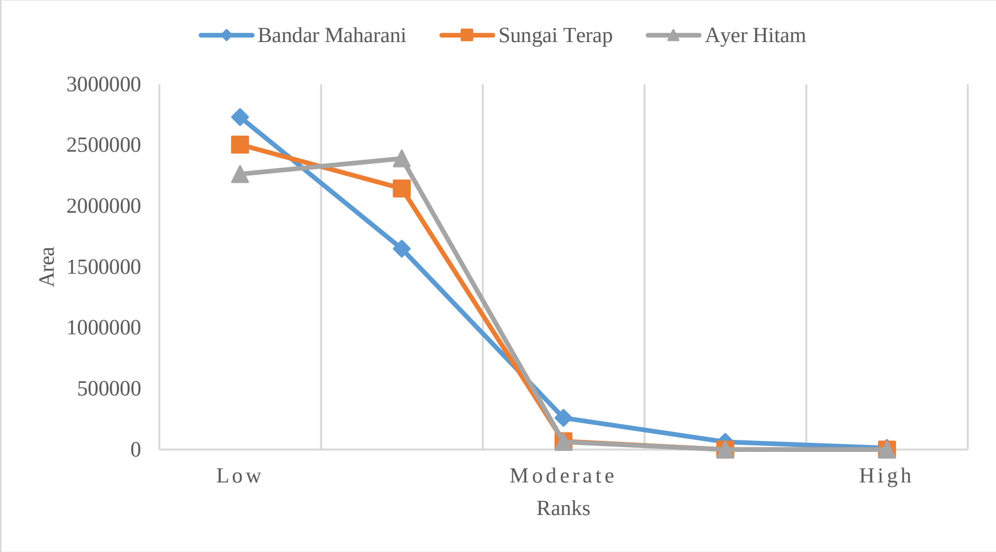

Figure 09. Different ranks of recreational provision among urban, suburb and rural areas

Ayer Hitam as the rural area has many barren lands, agricultural plantation and reserved forest that classified as rank 1 (48%). The highest percentage was rank 2 (50.7%), and it was grass- covered area. These areas were being classified as ranks 1 and 2 due to the lack of facilities, poor maintenance of the spaces, and poor accessibility, despite the naturalness of the place was considerably high. For example, forested areas could provide various recreational activities such as jungle trekking and rock climbing. Nonetheless, without proper facilities provided, for example, trekking path and signage. It is difficult for people to safely explore it. In this perspective, we disagree with Norton et al. (2012) that woodland or trees covered area provided high leisure activities if the usability is poor. On the other hand, we agree with Kaczynski and Henderson (2007) that facilities play an important role in determining the recreation provision opportunity. Figure 07F shows most of the grass covered areas were classified as rank 2 while partially were classified as rank 3 (1.3%). There were also grass- covered areas classified as rank 3 due to the distance travel from home to the place was neared and closed to the roads.

In sum, the recreation provision of the urban area is slightly better than the suburb and rural areas mainly due to usability of the space and accessibility to the site. However, this does not mean suburb and rural areas should be neglected. In fact, with a proper planning and designing of these areas, improving the facilities and infrastructures, there can provide various recreational activities. For instance, transforming the existing green spaces into playground, park, square or plaza, and converting the existing agricultural land to integrated farming for agrotourism. Considering the condition of the agricultural lands and green spaces, management and maintenance of these resources also need to be regulated by a proper guideline or policy to make sure that these resources are safeguarded and not in deserted condition.

7. Conclusion

This paper presents an innovative way of combining AHP with ArcGIS to produce the CES recreation provision maps to support decision-making and land use planning. With this integrated mapping approach, it was possible to differentiate which areas delivered the highest recreational CES and which areas delivered the lowest. This approach is considered relatively new, and seldom being used in the mapping of CES. In fact, we can distinguish the priorities of each criterion with the used of AHP, which is crucial in determining the recreation provision. However, the shortcomings inherent in this approach is the subjectivity of assigning preference values. In this study, we only based on the opinions from 19 practitioners. To improve the credibility of the findings, future research can consider from the perspectives of public users and government sectors as well.

In the study of mapping recreational CES, the municipal or local scale is the most commonly mapped. In this study, we have demonstrated that mapping in a spatial explicit village scale is important to present the result in a fine resolution, which is useful in landscape planning, management, and decision-making. Besides, comparing three different sites also providing us the reasoning insight to show the difference between urban and rural landscapes that influence the recreation provision. In this paper, the results demonstrated that indeed urban area provides more recreational opportunities as compared to suburb and rural areas. Of course, we cannot generalize that it is the same across all the other region due to different types of landscape pattern and condition. Hence, it is recommended that future research should seek to explore other places as well, particularly in developing countries within southeast Asia region.

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