Sustainable Indicator for Feature Attributes Assessment of Urban Green Space

Rabi'ah Ahmad[1], Abdul Nassir Matori[2]
[1]Department of Civil Engineering, Ungku Omar Premier Polytechnic, Ipoh, Perak, Malaysia
Email: rabimad@jka.puo.edu.my
[2]Department of Civil Engineering, Universiti Teknologi Petronas, Bandar Seri Iskandar, Tronoh, Perak, Malaysia,
Email: nasrat@petronas.com.my

Abstract

Urban green space features are natural or human-made facilities commonly found in community or recreational parks.Green features attributes such as size, design, usage, location and facilities are very influential in determining the satisfaction level of park users or visitors. There is a need to study the physical environment of green space that can be associated with the aspirations and demands of park users. For that reason, this research performed a study to design and develop a model for urban green space feature attributes. Two prominent recreational parks in Ipoh city have been chosen as a case study and the research investigates the influence of attributes features towards the needs of urban green space. The influence and effectiveness are measured using an integrated GIS mapping approach with qualitative assessments on satisfactory level of park visitors with the feature attributes available in both parks. A geo-referenced classified map of feature attributes of the recreational parks under study is initially prepared. Subsequentlyin the qualitative assessment, the variables measured on the physical and natural characters of the parks suggested that diversity of feature attributes for urban green space supports the social interaction for all age group. A sustainable indicator that defines the importance of urban green space feature components is proposed in defining the future Malaysian National Urbanisation Policy.

Keywords: Urban Green Space, Feature Attributes, GIS, Sustainable Indicator

1.0 Introduction

Urban green space is the principle part of the natural productivity in the urban structure and a tangible reflection of the quality of life in a community. It is an important feature of sustainability benefiting community at all age levels. Green space should serve as areas for inculcating the love for nature and the access to parks benefits cognitive skills such as concentration and the ability to deal with major life challenges (NRPA, 2010). The issue of urban green space is very important to address as the process of urbanization is going on rapidly in Malaysia, as it is elsewhere. Research has shown that urban green space serves various functions that benefit the environment (Ismail, 2014). Besides providing pleasant and natural environment, they also improve the quality of urban life areas and carry out essential environment functions (Dunse et al., 2007).

Urban green space as defined by Nigel et al (2002) comprised of land that are predominantly of unsealed, permeable, 'soft' surfaces such as soil, grass, shrubs and trees. They are categorized as community parks, play areas and other green spaces intended for recreational use, as well as other green spaces with other origins.It should be properly located, designed, furnished and maintained in achieving a sustainable environment, lifestyles and patterns. In contrariwise, urban green space features are natural or human-made facilities, such as recreation sites and trails that creates activities attraction includes accessibility, uniqueness, amount of current recreation use and other scenic view (RFI inventory, 1998). The features include wildlife, water body, human-made, aquatic flora/fauna, vegetation and cultural. Their feature attributes such as size, design, usage, location and activities in fact represent the instruments in measuringthe quality of urban green space. These are the main decisive factors that determine attractiveness of the parks and the satisfaction level of the users or community.

This paperexplainedan approach to determineand measure feature attributes thatinfluence the urban green space quality of two prominent recreational facilities in Ipoh city i.e. Taman DR Seenivasagam (TDRS) and Taman Sultan Abdul Aziz (TSAA).The methodological approach to measure the feature attributes qualityusesintegrated qualitative and quantitative assessments. The findings of this research work will be used as the basis for future development of a sustainable indicator towards defining urban green space feature attributes.

1.1 Urban Green Space Feature Attributes

A comprehensive literature review was made as comparative study to evaluate amenity benefits of various recreation areas of urban green space under different guidelines and tools. Thecommon featureattributes of urban green space was identified and adapted and their summary is described in Table 1.

Table 1 :FeatureAttributes for Quality Measure of Parks

No	Authors/Sources	Common feature attributes*							
		1	2	3	4	5	6	7	8
1.	Ariane I, et al (2005)	*	*		*			*	*
2.	Lo, et al (2003)		*	*	*	*			
3.	Liz, K. (2009)		*		*		*		
4.	Jamirsah, N. (2004)	*	*		*	*	*		
5.	Kshama, et al (2005)				*	*	*	*	
6.	Abdul Malek N, et al (2010)	*	*						
7.	Jennifer, M. (2012)	*		*	*				*
8.	Ann V.H., andTorsten,W. (2003)	*			*				
9.	Sofia E. and Cristina, (2011)	*		*					
10	Burhan, O. and Ahmet,T.P. (2014)	*						*	*
11.	Andrew et al (2008)			*	*		*	*	
12.	Gavin et al (2010)	*			*	*		*	*
13.	Stephen, K. (1995)	*							

*****1.Natural Setting, 2.Design, 3. Location,4. Facilities,5. Accessibility,6. Water Element,7. Safety, 8. Maintenance

Past researchers have suggested that feature attributes correlates with visitors' attraction and activities as it provides places for health and well-being that are accessible by all ages group. Relevant attributes features such as natural setting (visual quality), facilities, design, accessibility, location, water element, safety and maintenance are important factors influencing their usage and impact on visitors-level.

The resulting summary of feature attributes provides the basis in the development of qualitative questionnaire pertaining to the satisfaction level of the park users. In contrary, local Ipoh city lacks of preferences analysis for park planners and designers in assessing basic requirements for better park design and utilisation.Changes in the physical environment in Ipoh cities hassled to associate changes in the aspirations and demands placed upon existing green spaces. There should be a provision of well-connected system of attractive parks and green spaces that are manageable and sustainable to satisfy the diverse needs of the local communities.

2.0 Quantitative Assessments – Mapping Urban Green Space Features Study Area

The spatial analytical mapping of feature attributes inTaman DR Seenivasagam (TDRS) and Taman Sultan Abdul Aziz (TSAA) green space was carried outusing GISmethod. The work comprised of preparation of orthophoto images and digitizing specific spatial features pertaining to the selected green areas in TDRS and TSAA. A geo-referencing work was undertaken to produce true geographic location of various spatial feature attributes in the parks. As-built green features within the parks that are not possible to be are captured from orthophoto images (i.e. places covered by trees and other plants) are resolved by ground survey method using android GPS and later mapping it to Google geo-referenced images. Additional GIS spatial analysis was accomplished using IDRISI-GIS software (ANDES edition) such as surface modelling, image enhancement, image overlay, image re-classification, area and perimeter calculation, etc. The final images produced are the re-classed green features of various categories available within the recreational parks under study. The initial orthophoto image and the reclassified final images producedin GIS format thatdescribe true classes (categories) of green feature attributes are shown in Figure 1 (TDRS) and Figure 2(TSAA) respectively.

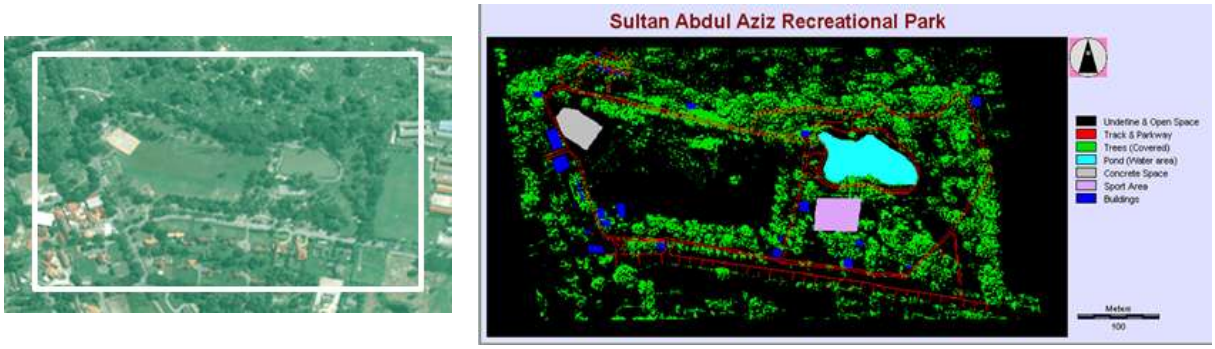

Figure 1: Orthophoto Image and Reclassified Feature Attributes of Taman Sultan Abdul Aziz

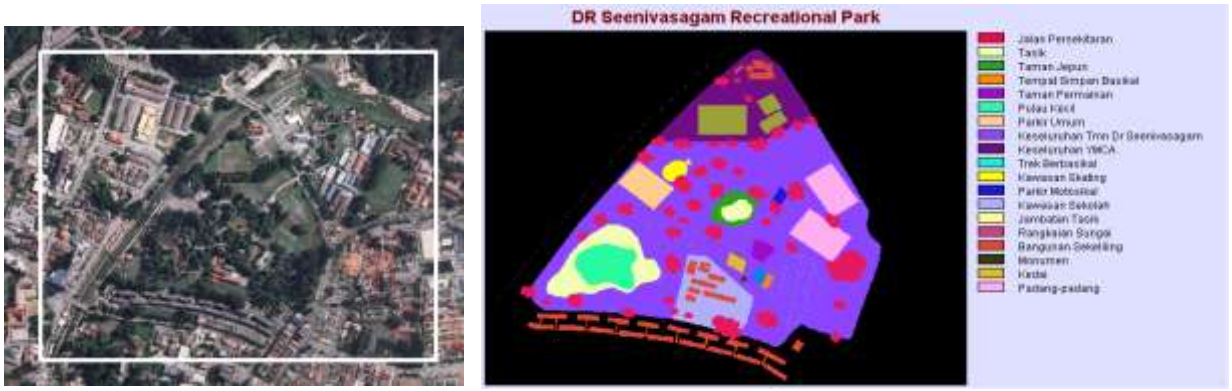

Figure 2: Orthophoto Image and Reclassified Feature Attributes of Taman DR. Seenivasagam

3.0 Qualitative Assessment –Measuring the Effectiveness of the Present Urban Green Space Areas

Consequently, the primary data (qualitative assessment) was collected through interviewed questionnaires where the correspondents were the visitors of both recreation parks under study (i.e. TDRS and TSAA). The public perception towards green space area was evaluated through distributed questionnaires from total of 100 respondents (park visitors) from each park. Survey questionnaires helps to investigate what users want from urban green spaces and the extent to which the urban green spaces meet these expectations. It provides identification of different categories of users of urban green spaces and how they use the range of types of such spaces and their gender whether children, young people, the elderly, disabled people etc. Subsequently, the common statistical analysis applying the SPSS software was performed in analysing the responds collected from the questionnaire. Detailed discussion on the analysed statistics is also presented in the next section of the report.

3.1 Survey Questionnaires

The correspondents were from various range of age group of urban residents in Ipoh. The survey was administrated on March 2015 over a month period. The totalrespondentswere up to 200 for each park andthey participated in face to face survey interview. This approach would bringvariousadvantages where researcher can adapt the questions as necessary, clarify any doubts and ensure that the responses were properly understood (Sekaran, 2003). The surveys consisted of pre-coded, scaled and open-ended questions for park visitors/users.

Table 2described the visitors' demographic characteristics, mode and distance of travelling, frequency of visit, length of stay and visitors sense of safety for both parks. The respondents are largely constituted from male (65.5%) and the mean age of total sample ranged from 21 to 29 years. The variables indicated that most of the visitors were locals who travelledfrom 5 to 15 minutes to the parks. Motorbikes and cars were the most popular mode of transportation by respondents. The frequency outcome indicated that most of visitors would stay 1 to 2 hours in both parks to perform their activities and enjoy with the surrounding nature.

Table 2: Descriptive Data of Correspondents

Descriptive Findings	**Taman Sultan Abdul Aziz**			**Taman DR Seenivasagam**		
Variables Measured		Gender			Gender	
Age Group	Male	Female	%	Male	Female	%
	62	38	100	69	31	100
Travel Distance						
Less than 5 min		8			6	
5 – 10 minutes		35			20	
10 – 15 mins		32			40	
15 – 20 mins		17			13	
20 – 30 mins		8			15	
More than 30 mins					6	
Mode of Transport						
On Foot		4			4	
Bicycle		7			8	
Motorbike		39			50	
Car		50			38	
Stay Timeframe						
Less than 30 minutes		1			5	
30 mins – 1 hour		41			52	
1 – 2 hours		52			38	
2 – 4 hours		6			5	

2.2 Statistical Analysis

The data collected from survey questionnaires were coded into SPSS software for descriptive statistical analysis (frequencies analysis). Comparative analyses were made to see how usage pattern of public green space were related to the spatial design characteristics and user' visit frequencies. The main focus of this analysis was to understand the relationship between spatial arrangement feature attributes and users' usage pattern. Additional attributes such as gender and age group details were considered to give additional information of the relationship. Trip characteristics and park activities (e.g. travel distance, length of stay, frequency of visits, mode of transport, and perception of safety, aesthetics quality and facilities) were being analysed to see the trend of visitors' preferences. Thestatistical results will show how changes to visual models of the two case study sites affect perceptions of safety, use and aesthetic quality.

3.0 Results

3.1 Age Group

The young age group (range from 21 – 29) were dominant visitors to both parks as they enjoy doing active recreation i.e. exercising, jogging, playing sports and meeting friends. As described in the pie chart in Figure 3, 40% of that age group visited Taman Sultan Abdul Aziz, while 44% goes to Taman DR Seenivagasam respectively.

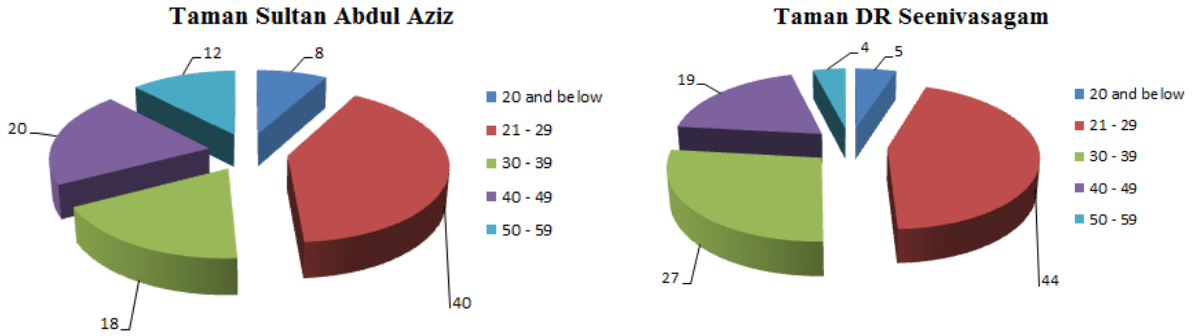

Figure 3: Age Group of ParkVisitors

3.2 Frequency of Visit

The result in Figure 4 shows that more than 40% of respondents visit as frequently as once a week to both parks. 29% of respondents visit Taman Sultan Abdul Aziz monthly and 25% visit Taman DR Seenivagasam daily. Most of the visitors would stay 1 to 2 hours in both parks to perform their regular activities and enjoy with the surrounding nature.

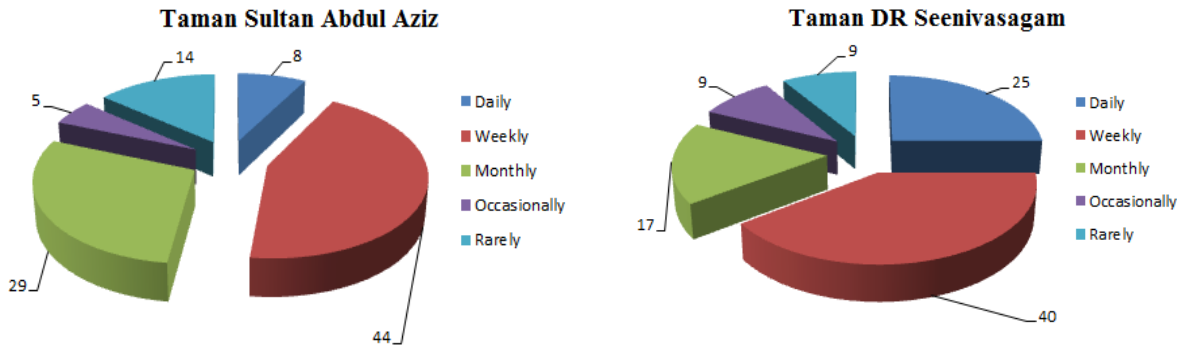

Figure 4: Frequency of Visit to the Parks

3.3 Preference of Activities

The result shows that visitors coming to both parks enjoy doing exercise/jogging, walking, relaxing and spending time with families and friends (Figure 5). Taman Sultan Abdul Aziz becomes the favourites choice for joggers since it has the best jogging track in town. 78% of respondents choose exercising as their main activities in Sultan Abdul Aziz Recreational Park 50% walking and 53% spending time with families and friends. Responses from Taman DR Seenivasagam indicates that most visitors choose to do balance activities ranging from doing passive i.e. walking, sightseeing to active recreation activities i.e. play sports and soccer.

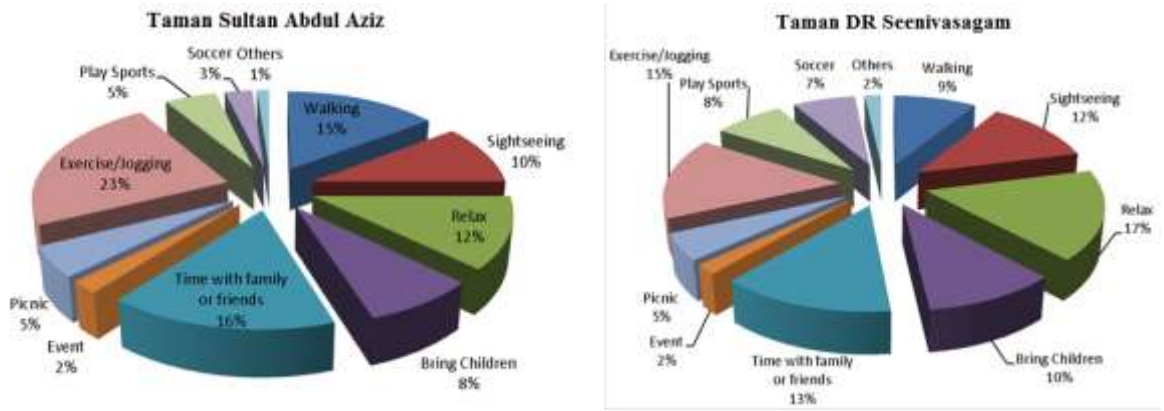

Figure 5: Preference of Activities in Parks

3.4 Rating on Design, Appearanceand Facilities

The statistics in Table 5 shows that both urban green spaces were rated as good and sufficient in terms of design and facilities.This gives an indication that both parks have good feature attributes under recreational environment and facilities provided. The results also indicated that beautiful scenery and peaceful surroundings are one of the reasons of why visitors love to visit the park.Hence, the environment of the park clearly plays a vital role in attracting participantsas according to Gray and Pelegrino (1973).

Table 5: Rating Preference of Parks

	Design and Appearance of Park		Facilities available at Park	
Park Performance	Taman Sultan Abdul Aziz	Taman DR Seenivasagam	Taman Sultan Abdul Aziz	Taman DR Seenivasagam
Very Good	23	29	24	38
Good	65	68	60	54
Fair	11	3	16	8
Poor	1	0	0	0
Very Poor	0	0	0	0
Mean	1.90	1.74	1.92	1.70

3.5 Preference of Safety

The safety parameters as shown in Figure 6 described that roughly 50% respondents have the safety feel aspects in both parks. This indicated that the level of safety needs to be upgraded for both parks.For instance, by placing guards, more lighting placement or having fencing around parks.

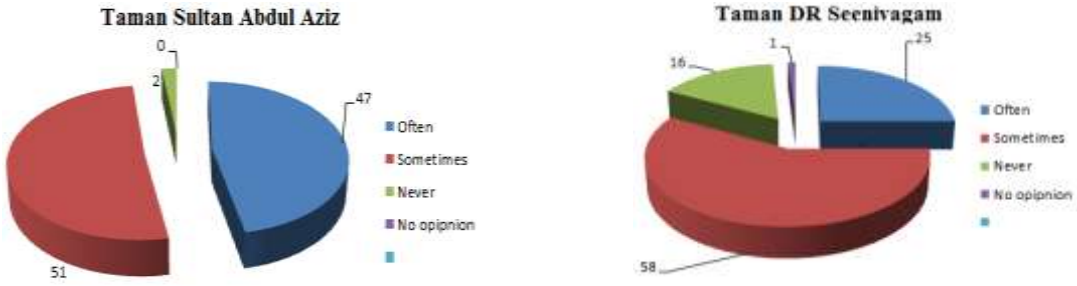

Figure 6: Visitors' Preference of Safety

3.6 Satisfactory Level of Feature Attributes

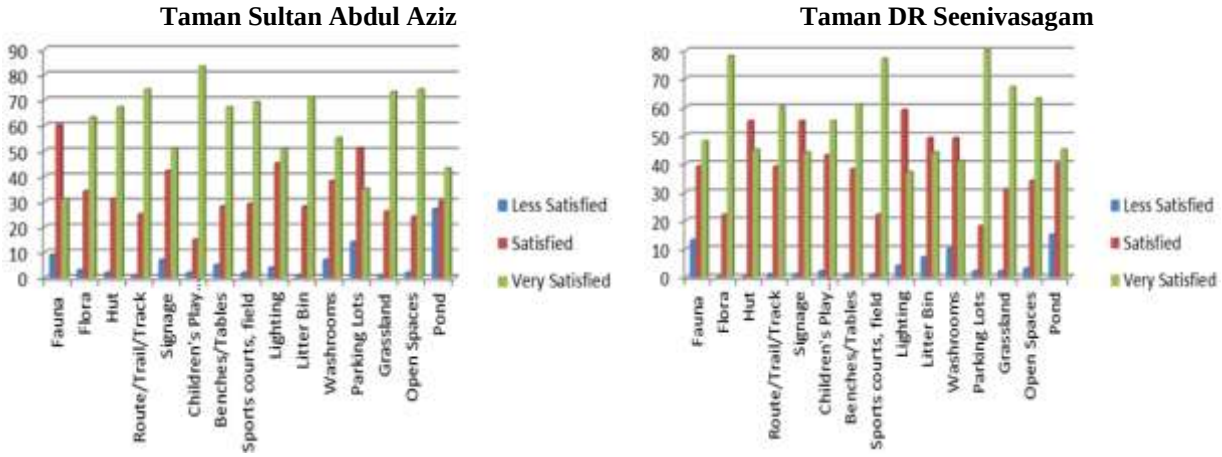

Figure 7:Visitors Satisfaction on Park Features

The feature attributes are classified into four categories i.e. aquatic, human made, vegetation and water body. The bar chart in Figure 7 shows that 60% respondents were satisfied with fauna features, while 63% with flora features in Taman Sultan Abdul Aziz. While in Taman DR Seenivasagam, 48% respondents are satisfied with fauna and 78% with flora features. Based on multiple responses given on human made features both respondents were satisfied with the facility features provided in both parks. Consequently, responses regarding vegetation features show that more than 70% respondents were satisfied with the trees and grass areas in TSAA

and more than 60 % in TDRS. Likewise, the respondents were satisfied (more than 40%) with the waterbody features in both parks. These features enhanced the beauty of the park landscapes and represent an important element for park visitors as it significantly improves the quality of urban landscapes (Bernasconi et al., 2009). The maturity and density of the trees are positively related to increase feelings of pleasure in the environment(Hull and Hervey, 1989). Besides density, it is also believes that the respondents were attracted to the scenes because of their greeneries. Parks containing omit variety of features and amenities may support a wider range of users (Kaczynski et al., 2008; Giles-Corti et al., 2005a).

4.0 Conclusion

This research explores urban residents' responses according to their social preferences and experiences within green spaces especially their relationship with green space design components. Both of the green space are situated in the heart of Ipoh city and are chosen out of the similar comparable size, green density and design character which represents the frequent usage by users. The result shows a great satisfaction of the respondents towards feature attributes such as flora and human made vegetation features in both parks. The design of the spatial configuration could serves as platforms for social bonding and interaction. This paper has described a comprehendeddesignedgreen space feature attributes qualitymeasure that bled the social attributes (i.e. personal information and social preference) and green space properties (i.e. green space design character and attributes features) through well documented procedure.It can act as a sustainable indicator that defines the importance of urban green space feature components in the future Malaysian National Urbanisation Policy.

5.0 References:

Ann, V.H. &Torsten W. (2003). A Monitoring Tool for the Provision of Accessible and Attractive Urban Green Space, *Landscape and Urban Planning*, 63, 109-126.

Andrew, T.K., Luke, R. P& Brian, E.S. (2008, August). Association of Park Size, Distance and features With Physical Activity in Neighbourhood Parks. *American Journal of Public Health*,98(8), 1451-1456.

Ariane, L.R., Andrew, J.M., Stephenie, T.B. & Jeanette, G.,(2011), The Role of Park Conditions and Features on Park Visitation and Physical Activity, *Journal of Physical Activity and Health*, 8(2), S178-S187.

Burhan, O., Ahmet, T.P. (2014). The Evaluation of User Preferences: the Case of Urban Parks in Konya, *Journal of MacroTrends in Energy and Sustainability*, *2*(1) 48-57.

Dunse, N., White, M., Dehring, C. (2007). Urban parks, open space and residential property values. London, United Kingdom: RICS.

Eastman, J.R., JIN, W., Kyem, P.A.K., &Tolendo,J. "A Procedure for Multiple objective Decision Making in GIS under conditions of competing objectives*".Proceeding on EGIS '93*, 438-447.

Gavin, R.M.., Melanie, R., Ann, M.T.,&Danica H., (2010). Characteristics of urban parks associated with park use and physical activity: A review of qualitative research. *Journal of Health & Place*, *16*, 712 – 726.

Giles-Corti, B., Broomhall, Melissa; et al, (2005), "How Importance is Distance To Attractiveness and Size of Public Open Space?", *American Journal of Preventive Medicine*, Vol. 28 (2), 169 – 176.

Hull, R. B. and Harvey, A. (1989), Explaining the Emotion People Experience in Suburban Parks. Environment and Behavior, 21, (3): 323-345

Lo, S.M., Yiu, C.Y.,& Alan, L., (2003) "An analysis of attributes affecting urban open space design and their environmental implications" Management of Environmental Quality; *An International Journal*, 14(5), 604 -614.

Liz, K &Doffman, J.(2009). A toolkit for the evaluation of land parcels for green space planning, Dept of Agricultural and Applied Economics, University of Georgia, Arthens, USA.

Jennifer, M (2012), "Environmental Design Research and the Design of Urban Open Space": A Study of Current Practice in Landscape Architecture, Masters Theses, Department of Landscape Architecture and Regional Planning, University of Massachusetts Amherst.

Kaczynski, A. T., Potwarka, L.R., &Saelens, B. E., (2008), Association of Park Size, Distance and Features With Physical Activity In Neighborhood Parks, *Am J Public Health*, 98(8): 1451 -1456.

Kaplan, R, Kaplan, S. and Brown, T., (1989), Environmental Preference: A Comparison of Four Domains of Predictors. Environment and Behavior, 21(5): 509-530.

Kshama, G., Sharma, K.P., Krishnamurthy, YVN., Ram, K., (2011), *Funtional Assessment of Urban Green Spaces- A GIS Analysis,*Paper presented at the 12thEsri India User Conference.

Mahdieh, A., Mustafa Kamal, M.S., Manohar, M., Suhardi, M., & Mehdi, S., (2010), The Role of Urban Green Spaces in Mood Change, *Australian Journal of basic and Applied Sciences*, 4(10): 5352-5361:ISSN 1991-8178.

Nigel, D., Carys, S.,Helen, W., (2002, May). Improving Urban Parks, Play Areas and Green Spaces, Urban Research Report, Department of Landscape, University of Sheffield.

Nurzuliza, J. (2012, 16-20 July). *How Urban Green Space Design Affects Urban Residents' Social Interaction*, Paper presented at the 7th Singapore Graduate Forum On Southeast Asia Studies 2012, Asia Research Institute, National University Singapore, Singapore.

Nurhayati, A.M., Manohar, M., Mustafa Kamal, M. S. &Azlizam, A. (2010), Assessing the Quality of Green Open Spaces : A review

Recreation Features Inventory. (1998, October 9). Procedures and Standards Manual, Ministry of Forest, Victoria, Canada.

Sofia, E. & Cristina, A. (2011, November). The Quality Of Bucharest's Green Spaces, Theoretical and Empirical Researches in Urban Management, 6(4), 45-58.

Uma Sekaran (2003). Research method for business: A skill building approach, 4th edition, John Wiley & Sons.