Journal of Civil Engineering and Urbanism

Volume 2, Issue 6: 226-234 (2012) ISSN-2252-0430

Optimum Location of Neighbourhood Parks in Bonab City Using Analytic Network Process (ANP)

Rahim Sarvar[1], Asghar Rashidi Ebrahim Hesari* [2], Mir Najaf Mousavi[3], Hasan Orooji[4]

[1] *Associated Prof, Department of Geography in Islamic Azad University- Shahre Rey Branch, Iran, Email: Sarvarh83@gmail.com*

[2] *Corresponding Author's: Graduate Student in Geography and Urban Planning Kharazmi University, Iran,Email:b.rashidi61@yahoo.com*

[3] *Associated Prof, Department of Geography in Urmia University, Iran, Email:mousaviyy@yahoo.com*

[4] *Graduate Student in Geography and Rural Planning Kharazmi University, Iran*

*Corresponding author's Email: b.rashidi61@yahoo.com

ORIGINAL ARTICLE

ABSTRACT: The study aims at qualifying the new sites, which are consistent with the relevant construction standards, for building neighbourhood parks. Accordingly, the Analytic Network Process (ANP) was employed. In this technique, the relationships among various elements and clusters are examined with the aim of finding the optimum site. Hence, the eleven elements namely land area, population density (people per km2), household density, household dimension, slope, the distance between the site and the residential, cultural and educational centres, access to major thoroughfares and roads, the distance away from rivers and watercourses, the distance away from the present parks and green spaces. Decision-Making Trial and Evaluation Laboratory (DEMATEL) method was used to define the relationships among the mentioned elements and then the pair wise comparisons were conducted using questionnaires. Finally, Super Decisions was used to measure the final coefficients of all elements. The spatial information of all elements including their impacts on park building were classified using Arc GIS and then the weights gained from ANP were applied to them and eventually the final map was depicted. The results suggests that some parts of districts 1, 4, 7, 9, and 13 in Bonab City are the best sites for building neighbourhood parks which must be considered in the urban planning projects.

Keywords: Neighbourhood parks, Bonab, Analytic Network Process (ANP), green spaces, optimum location

INTRODUCTION

The industrial growth and increasing population of cities have led to formation of the speculative buildings in which provision of health issues, sufficient lightening, healthy air, and recreational spaces is not emphasized deservedly. On the other hand, the necessity to develop new urban applications, essential to meet the ever-increasing needs of citizens, gradually has decreased the share of green spaces in the cities which in turn is followed by the limited urban population's accessibility to the nature. Inter alia, the urban green spaces such as parks, forests, street and/or indoor trees (Thaiutsa et al., 2008), the remnants of patches of native vegetation and biodiversity in cities (Moertberg and Wallentinus, 2000) and generally the urban land with the manmade vegetation (Saeednia, 2010) are important in terms of several aspects such as accessibility and attractiveness level (Herzele and Wiedemann, 2003), relationship with the nature and providing environmental facilities for citizens (Comber et al., 2008) and their effectiveness in mitigating urban environmental problems (Majnonian, 2005). There is a direct relation between the necessity and the increased rate of urbanization, particularly in the developing countries (Thaiutsa et al., 2008), the increased urban population and population concentration in urban areas (Kong and Nakagoshi, 2006); seemingly, we will witness the population growth in cities in the near future (Zhang, 2009). Green space development is ranked as one of the five important urban uses (Teymouri, 2010).

The urban parks play social, economic and ecological roles on the one hand; tanking advantage of the capacity of treating psychological diseases, urban parks can provide a favorable environment for rearing children, developing social integration, keeping tranquility etc. on the one hand, they are also considered as an indicator for improving the life space quality and social development, on the other hand (Balram, 2005). Undoubtedly, both the green space and the urban parks must be sorted as the most basic factors effective in maintaining the natural and human dimensions of life in

To cite this paper: Sarvar R, Rashidi Ebrahim Hesari A, Mousavi M.N, Orooji H.2012. Optimum Location of Neighbourhood Parks in Bonab City Using Analytic Network Process (ANP) . *J. Civil Eng. Urban.*,2 (6): 226-234.
Journal homepage http://www.ojceu.ir/main/

the contemporary world (Esmaili et al., 2008). They also are treated as the main indicators used to evaluate the developed state of a country (Balram and Dragicevic, 2005; Mcpherson, 1994), thus they will be helpful in purification of human being's body and soul if they are planned properly. As one of the most important urban services in public spaces, the urban parks play significant roles in improving social cultural, economic and environmental circumstances of the urban areas. Such spaces have been considered in parallel with the growth and agglomeration of the urban areas located in various societies and different strategies have been devised and used for locating and distributing them properly across the urban environments (Ghorbani, 2011). Thus it can be said that as a part of the urban space with enriched environmental, skeletal, social and cultural dimension parks, open spaces and the urban environment (Mcpherson, 1994) play important roles in enhancing and improving the urban living quality (Kantor and Unger,2010; Chiesura, 2004; Majnonian 2005; Kantor and Unge, 2010) and (Haji Alizadeh et al., 2012), providing a favorable condition for citizen (Wolf, 2004); bringing recreation and entertainment (Rabare et al., 2009), paving the way for enjoying aesthetic chances (Kong et al., 2007); improving the urban climate (Nowak and heisler, 2010), enriching biodiversity, preventing soil erosion, absorbing rainfall and pollution, decreasing urban heat islands' impacts (Comber et al; 2008), particularly in the developing countries which contain a number of the world's metropolitan areas (Thaiutsa et al, 2008). They also provide a space for fulfilling the social and cultural negotiations (Thompson; 2002), upgrading the social groups (Germann-Chiari and Seeland, 2004), integrating the social life, promoting welfare, raising children, treating certain diseases (Balram and Dragicevic, 2005) and urban valuable participations which are followed by social, economic and environmental interests (Xizhang, 2009).

An ideal park which is highly consistent with its surrounding applications and usages can be influential in increasing the living quality and improving the economic status of cities (Lotfi et al, 2011). It also is able to facilitate production of goods and provision of services through promoting investment, employment and education and at the same time provides ecosystem services and facilities (Lotfi et al., 2011). On the other hand, the connection between parks and communicating ways are considered as the necessities defined for a neighbourhood park (Lotfi et al., 2011).

As a medium-sized city of the West Azarbaijan province, Bonab City has faced the [high] population density phenomenon over the time. The high population density along with concentrated economic, industrial and commercial activities has caused numerous environmental difficulties and problems. Therefore, construction of green spaces and neighbourhood parks can be effective in mitigating such difficulties and in enhancing the attractiveness of the space to the residents.

In this study, it has been tried to describe the importance of using geographic information systems (GIS) in land uses through focusing on urban green spaces locating in Bonab City. Research, documentary, descriptive, analytical methods as well as field studies have been taken advantage of in order to collect all necessary data and store them in our database. Then, relying on the GIS potentials the best lands for building new green spaces have been ranked in five groups, namely very good, good, intermediate, poor and very poor. The results demonstrated the strength and potential of the GIS in land use location regarding the broad data.

Analysis of the green space distribution manner (Neighbourhood Park) in a certain limitation and setting the proper areas across the certain borders for building neighbourhood parks constitute pivots of the study. Accordingly, the Analytic Network Process (ANP) has been applied. The independencies and relations among the factors and criteria of our study led us to find ANP as the best option for the research; on the other hand by providing a systemic condition, ANP is the best method for reaching our favourable results. ANP is treated as one of the strongest methods in multi-criteria decision makings, as its application has been maximized during the past years across the scientific centers.

Regarding the fact that the most target of the urban planning is promoting health, welfare and aesthetics, the urban green space location is a key factor in providing the residents with a desirable and favourable urban space. Therefore, the final target of the study is as follows:

Specification of factors which are effective in locating of neighbourhood parks and urban green spaces and the manner of combining them in ANP and GIS with the aim of developing a proper pattern for locating the best site for building parks in the predefined limitation;

Evaluation of parks distribution pattern and identification of the neighbourhoods, located at the predefined limitation, without green spaces;

Offering solutions to enhance applicability and to decline general costs and to refine decision makings on the urban parks locating issue;

Offering solutions to bring about tranquillity and welfare for all walks of life and hence assisting fulfilment of the social justice throughout cities

BACKGROUND

Historically locating parks and green spaces had been challenged many times by a number of researchers. Alexis Comber et al. (2008) examined access to the urban green space in an English City using the Network Analysis in the GIS. They compared accessibility of various religious and ethical groups in terms of the standard criterion, which was a part of the British Government guidelines on supporting the green space. Combining GIS, Fuzzy-TOPSIS and AHP methods, Lotfi et al. (2011) had dealt with the urban parks locating in neighbourhood unit scale. Accordingly, they used various criteria such as accessibility to primary and secondary road network, downtown, and the distance away from the present parks etc. Oh and Jeong (2007) studied the spatial distribution of the Seoul's urban parks. They took advantage of AHP for analyzing the accessibility of passers to Seoul's parks. In their study, Urban Parks and Recreational Services, Nicholas and Shepherd (2001) used GIS technology with the aim of analyzing the accessibility and equality right throughout the neighbourhood park system. They used demarcation method to specify utilities and population ratio in the selected regions. They also applied ANP for measuring the actual displacement distance alongside the street to the neighbourhood park. Relying on GIS, Mahdi Mohammadi and Ali Akbar Parhizgar (2009) analyzed the spatial distribution and location of the urban parks in strict No.2 of Zahedan City. The results showed that there were not sufficient neighbourhood parks in the studied region. Moreover, the current parks were unbalanced in terms of observing the hierarchical system of the urban fabric. Abdi in his study, location and modeling the urban green space distribution (Neighbourhood Park) in District 1 of Sanandaj City concluded that the available parks failed to meet demands of residents of district 1 of Sanandaj City both in terms of location or frequency and land area. He used analytic hierarchy process (AHP) and overlapping model in his study. The results indicated that the AHP model offers more reasonable and analytic indicators for the regions have been defined as optimum sites for constructing parks (Abdi, 2006). FaribaSotoudehnia and Alexis Comber (2001) began to quantify the perceptual and physical accessibility to the urban green space via integration of GIS, participatory Map in Leicester City, Britain.

LOCATION

The specified location for this study is Bonab Township located in Iran. The city is one of 61 urban points located in East Azarbaijan Province which is located at west wing of Maragheh Township and south Lake Urmia. The area of the city is 778.79 km. It's located at 6.54-37.10N latitude and 45.30-46.00E longitude. Its population density is increasing because of great flood of people who migrate there and it has a young population. According to the census carried out in 2006, about 76586 people live in Bonab City. It has been divided into three main urban districts and 13 urban neighbourhoods (Figure1).

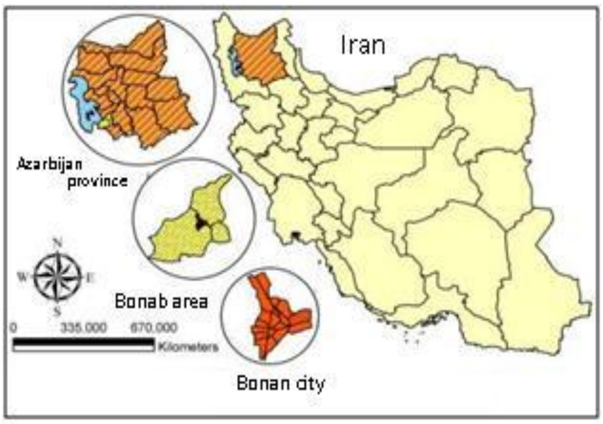


Figure 1: Bonab City Spatial Position and the Study Area

MATERIALS AND METHODS

Analytic Network Process (ANP) is a multi-criteria decision making technique which was proposed by Thomas Saaty as the most pervasive system for making governmental and non-governmental decisions (Tuzkaya et al., 2008; Garcia-Melon et al, 2009). The technique is helpful for those decision makings in which there are reciprocal relations and correlations among various decision making levels (e.g. purpose, criteria, sub-criteria and alternatives) (Farsijani, 2010). It was offered as a non-hierarchical network for collective analysis of all indicators which performs its task through specifying correlations and relations (Wolfslehner et al., 2005). Today, it is widely used in big decision makings and in the environmental, commercial, energy, transportation etc. evaluations (Khan and Faisal, 2008) and also in setting the optimum or undesired condition and for analyzing sites and facilities (Tuzkaya et al., 2008). In order to remove the AHP model's defect, ANP was proposed. The disadvantages of AHP model were: the relations among elements were unclear, options usually were prioritized based on their higher elements (Wolfslehner et al., 2005), there were unilateral relations among the decision making elements (Khan and Faisal, 2008), presence of independent options and criteria upon dealing with big decisions and difficult evaluation of the relations among the elements and criteria.

For developing an ANP model, one needs to identify the problem, to define criteria and sub-criteria and to specify the relations and their interactions (Wolfslehner et al., 2005). Soling problems using network drastically depends on the modeler talent and formation of the structure does not follow a special rule; hence solving any problem suffer a certain complexity (Qodsipour, 2008). In this method, initially the effective factors of the issue are organized in several clusters. All elements can be related either to the elements within each cluster or other clusters. In the meantime the decision making decision options can be related to the elements. The pair wise comparisons need to be conducted among all elements and the inter-related clusters (Tuzkaya et al., 2008). ANP can include main elements, important elements, intermediate elements and lower level elements. The pair wise comparisons are similar to AHP and based on the importance and preference of an element or a cluster to another element or cluster and they are ranked from 1 to 9 (Weichang, 2009). When the pair wise comparisons were conducted, sensitivity and adaptability are analyzed in order to assess the output sustainability against numerous deviations of evaluations (Whitaker, 2007)

In this study, we decided to use this method for locating the neighbourhood parks, thus, as the first step we have embarked on setting the criteria and indicators necessary in specifying clusters and elements. Initially the related elements to the neighbourhood parks were defined through fulfilling the field studies, querying the related authorities and using the previous studies. Relying on the thematic similarities, eleven main elements of the issue were divided into three clusters including the social, physical and spatial indicators.

Matrix1: Criteria and indicators for locating the neighbourhood parks

Indicators (clusters)	**Elements**
Physical indicators	Slope, land area
Social indicators	Population density, household density, household dimension
Spatial indicators	Accessibility to thoroughfare network; proximity to education centers; proximity to cultural centers; proximity to residential centers; distance away from the current green space; distance away of lands alongside the river and watercourse

The mentioned elements and clusters were entered in super decisions software and the relations and correlations among elements were defined and specified. Such relations and correlations among elements and clusters can be either reciprocal or unilateral. Decision-Making Trial and Evaluation Laboratory (DEMATEL) questionnaire and process were employed in order to enhance the study's validity which is necessary to determine the relations among elements and the filled questionnaires were used to measure the rate of the unilateral and reciprocal relations among various elements. A total of ten questionnaires were sent to the relevant experts and by which they were asked to compare the elements in the pair wise manner in a matrix and then valuate them in terms of their influence on each other from 1 to 5. After being normalized in Excel, the questionnaire results were processed by Matlab and finally the final results were extracted in Excel. Then, super decision software was used to apply such relations in clusters and elements; the results gained from DEMATEL process were applied on these clusters and elements and the preliminary weighting. Weighting and valuating are the main stages of ANP and in fact are account for doing the pair wise comparisons among elements and clusters. As mentioned before, in ANP the pair wise comparisons are conducted based on the control criterion, hence, an element or cluster may be treated as a control criterion only when its influence level has been verified in DEMATEL process.

The questionnaire process was used for weighting and conducting the pair wise comparisons. A total of 30 questionnaires were sent to experts and they were asked to compare clusters and elements in terms of their importance and preference rate (from 1 to 9) while considering the control criterion for each section. The results of the questionnaires were measured using Copeland model and program. After the final value of all comparisons were determined, the gained values and weights from questionnaires were transferred into super decision software and eventually the software used such weights to measure coefficient and final weight of the study through super-matrix process and normalizing it by clusters' weight. The weights are exactly the final weights of the elements which must be applied to the data layers in ARC GIS software for measuring the final location of the Bonab City neighbourhood parks. The last step is limited to working with ARC GIS software. In this step, layers of information of each element are classified and scored in terms of their importance in the loss location. Layers are classified and scored using the program. Eventually, for developing the final map of the neighbourhood parks, all the classified layers were combined using Raster Calculator tool and the final weights for each element, measured in ANP, were applied to the related layers.

RESULTS

As it was pointed out in the measurement process of ANP model, after determining the relations among criteria through questionnaires and determining the initial coefficient of each element using pair wise comparisons, which have been carried out based on the questionnaire, all coefficients of elements were collected in a super-matrix. Three types of super-matrices were measured for measuring the final coefficient: 1.non-weight super matrix, 2. weight super matrix, and 3. limit super matrix.

The weight super matrix is the sum of initial results gained from the initial matrices. Weight super matrix was provided in the Matlab software through normalizing of the arrays related to the non-weight matrix. Finally, all figures and values of the weight super matrix are multiplied in a fixed figure for providing the limit super matrix and it will be continued until a similar coefficient is found for all elements and options. The super matrix shows a fixed coefficient for all elements (matrix 1). After measuring the limit matrix, the last step for determining the final value and coefficient of the elements is started; in this stage the result of matrices of clusters is measured and the coefficients of elements and options are normalized in the limit super matrix using coefficient of clusters.

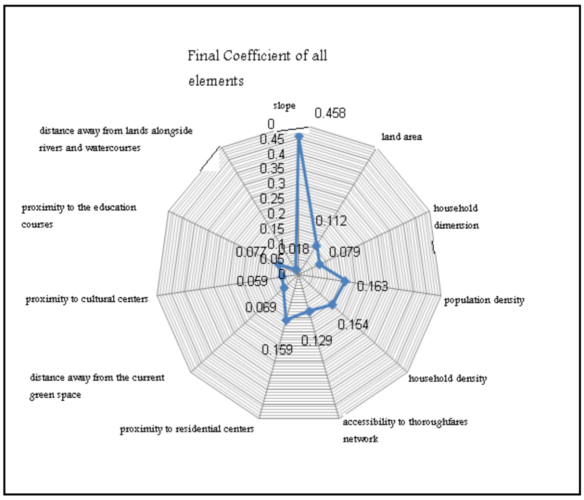


Diagram1. Final coefficient of all elements in ANP model

To cite this paper: Sarvar R, Rashidi Ebrahim Hesari A, Mousavi M.N, Orooji H.2012. Optimum Location of Neighbourhood Parks in Bonab City Using Analytic Network Process (ANP) . *J. Civil Eng. Urban*.,2 (6): 226-234.
Journal homepage: http://www.ojceu.ir/main/

Matrix2. The super matrix of all elements related to location of the neighbourhood parks of Bonab City

		Physical indicators		**Social indicators**			**Spatial indicators**					
		slope	Land area	Household dimension	Population density	Household density	Accessibility to thoroughfare network	Proximity to residential centers	Distance away from the current green space	Proximity to cultural centers	Proximity to education centers	Distance away from lands alongside the river and watercourse
Physical indicators	Slope	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
	Land area	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Social indicators	Household dimension	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136
	Population density	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208
	Household density	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0.169	0.169
Spatial indicators	Proximity to thoroughfares network	0.122	0.122	0.122	0.12	0.122	0.122	0.122	0.122	0.122	0.122	0.122
	Proximity to residential centers	0.112	0.112	0.112	0.112	0.112	0.112	0.112	0.112	0.112	0.112	0.112
	Distance away from the current green space	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076
	Proximity to the cultural centers	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
	Distance away from the education centers	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085
	Distance away from lands alongside the river and watercourse	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018

At the end of this procedure, the final coefficient for all elements was gained through the following super matrix and matrices of clusters measurements:

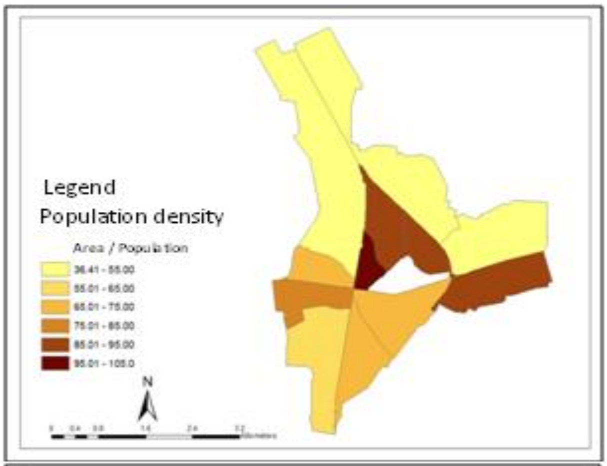
Matrix3. Matrix of clusters related to the optimum location of neighbourhood parks of the Bonab City

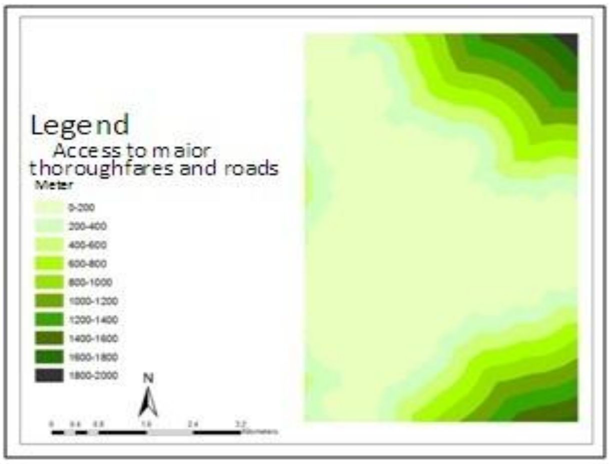
Final value for indicators' pair wise comparisons	**Social indicators**	**Physical indicators**	**Spatial indicators**
Physical indicators	0.172	0.512	0.012
Social indicators	0.391	0.512	0.261
Spatial indicators	0.453	0.012	0.754

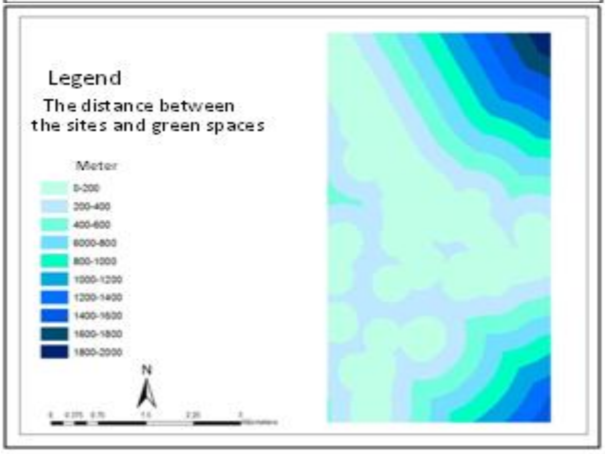
After measurement of the final coefficients for each element using ANP model, the coefficients need to be applied to the layer of information of each element and its final map must be depicted in ARC GIS software.

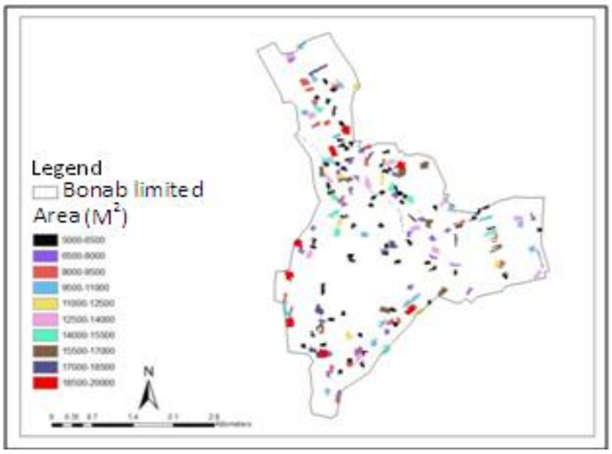
Accordingly, initially the layers of information were classified and equalized in terms of their value in order to conduct the final analysis across the urban neighbourhoods of Bonab City. Thus, the vector layer converted to Raster format. The slope layer was prepared from DEM map of Bonab City and was classified in three classes. The slope 2-15% is the best slope for building neighbourhood parks. The land area layer has been classified in three classes when it converted to raster. Blocks with 0.5 to 2 ha land area had the most roper condition for building the neighbourhood parks. Layers related to the social indicators cluster were provided calculating the population rate and number of households living in Bonab City neighbourhoods. For measuring the population density the population rate of each block was divided by the land area and was classified in 5 classes after being converted to raster layer. Regarding the social cluster, higher population densities are preferred to build neighbourhood parks. Likewise, the household density was measured through dividing number of households by the land area. In our study, higher household densities are preferred for building neighbourhood parks. It is the case for the household dimension layer. The spatial clusters layer was provided from the region's land use layer. Cultural, education, and residential uses were separated from the use layers and then were divided into five classes after converting to raster layer. Proximity to cultural, residential and education centers were considered as strength point for all three mentioned layers. Short distances to the cultural, residential and education centers were preferred for building the neighbourhood park. Layers of parks and the current green space, main roads, watercourses and rivers were also separated from the uses layer and were divided into five classes after being converted into the raster layer. For such layers proximity was treated as a negative point. Further distances from such uses were preferred for building the neighbourhood parks. Eventually, all of the classified layers were prepared as follows:

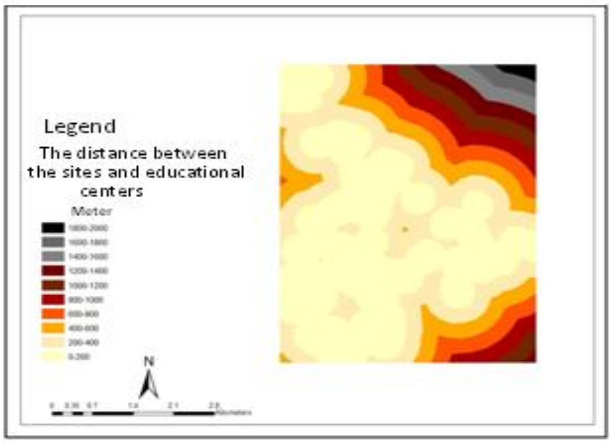
To cite this paper: Sarvar R, Rashidi Ebrahim Hesari A, Mousavi M.N, Orooji H.2012. Optimum Location of Neighbourhood Parks in Bonab City Using Analytic Network Process (ANP) . *J. Civil Eng. Urban*.,2 (6): 226-234.
Journal homepage http://www.ojceu.ir/main/

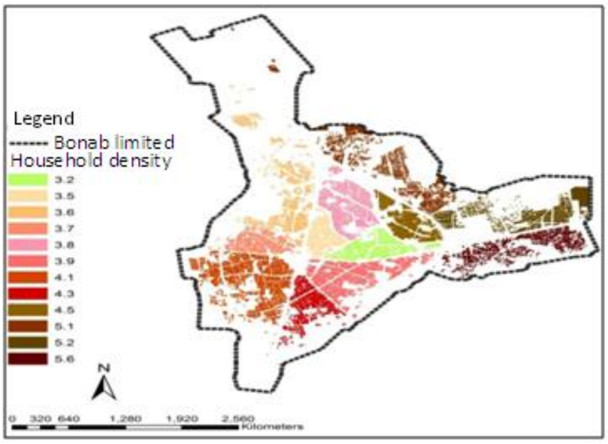

Legend
Population density
Area / Population
36.41 - 55.00
55.01 - 65.00
65.01 - 75.00
75.01 - 85.00
85.01 - 95.00
95.01 - 105.0
N

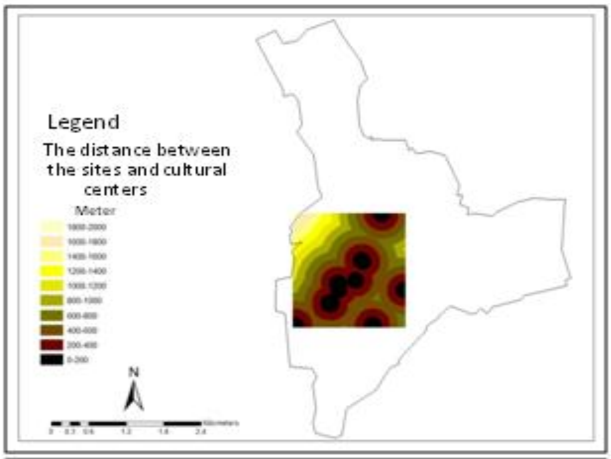

Legend
Access to major thoroughfares and roads
Meter
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
N

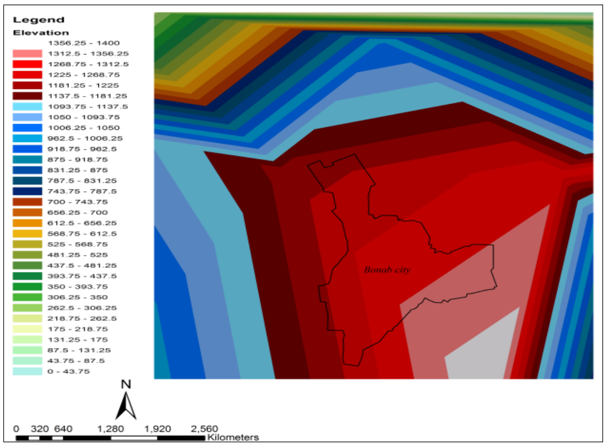

Legend
The distance between the sites and green spaces
Meter
0-200
200-400
400-600
6000-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
N

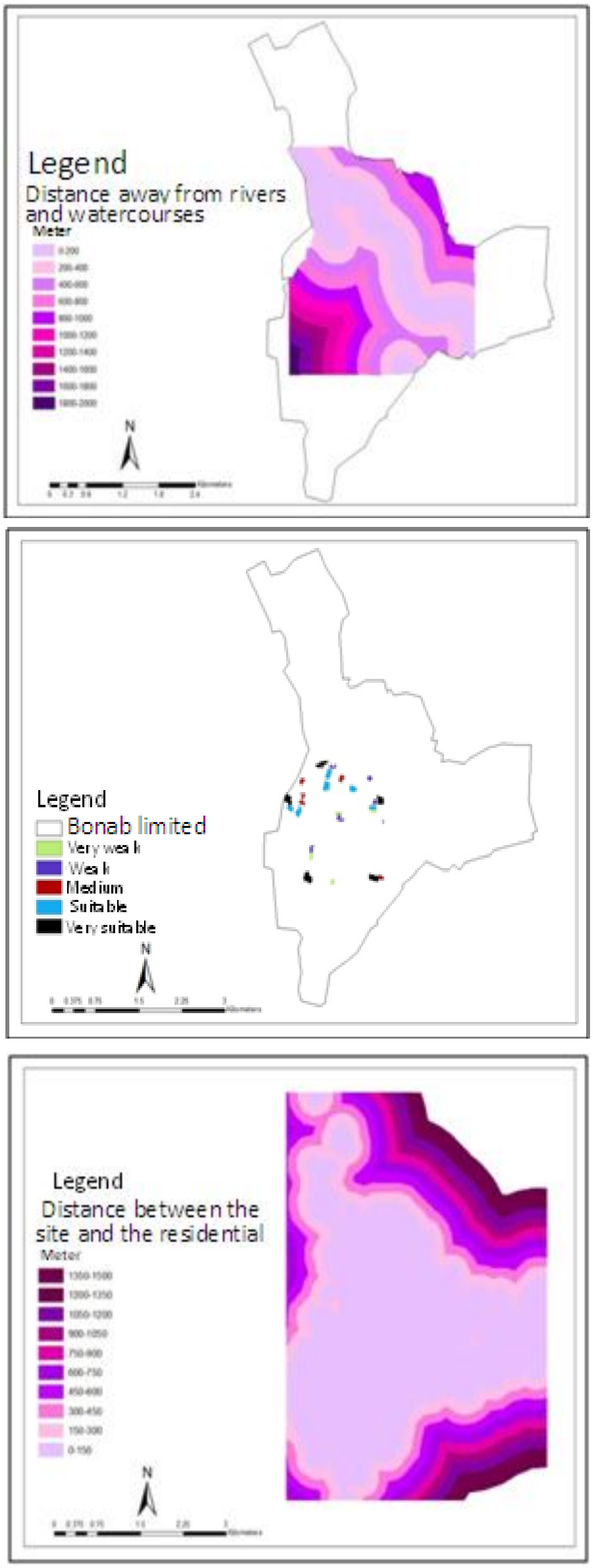

Legend
Bonab limited
Area (M2)
N


Legend
The distance between the sites and educational centers
Meter
N


Legend
Bonab limited
Household density
3.2
3.5
3.6
3.7
3.8
3.9
4.1
4.3
4.5
5.1
5.2
5.6
N
0 320 640 1,280 1,920 2,560
Kilometers

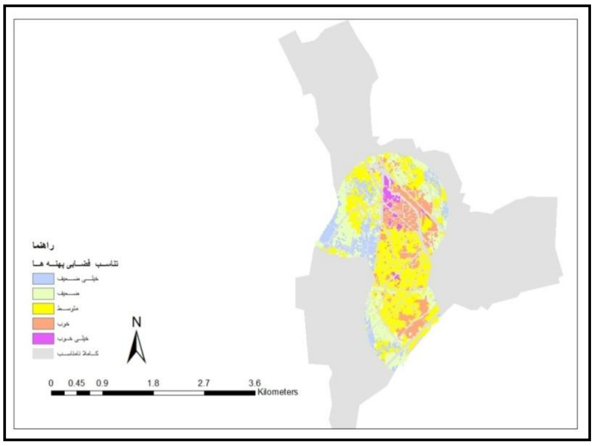

Legend
The distance between the sites and cultural centers
Meter
N


Legend
Elevation
1356.25 - 1400
1312.5 - 1356.25
1268.75 - 1312.5
1225 - 1268.75
1181.25 - 1225
1137.5 - 1181.25
1093.75 - 1137.5
1050 - 1093.75
1006.25 - 1050
962.5 - 1006.25
918.75 - 962.5
875 - 918.75
831.25 - 875
787.5 - 831.25
743.75 - 787.5
700 - 743.75
656.25 - 700
612.5 - 656.25
568.75 - 612.5
525 - 568.75
481.25 - 525
437.5 - 481.25
393.75 - 437.5
350 - 393.75
306.25 - 350
262.5 - 306.25
218.75 - 262.5
175 - 218.75
131.25 - 175
87.5 - 131.25
43.75 - 87.5
0 - 43.75
N
0 320 640 1,280 1,920 2,560
Kilometers



Maps (1-11).layers necessary for each element based on ANP model in ARC GIS environment

Finally all layers were combined and all coefficients measured by ANP model were applied and the final map for the optimum sites for building neighbourhood parks were provided in the Raster Calculator part of the ARC GIS software, as follows:



Map12. The optimum locations for building neighbourhood parks at Bonab City

CONCLUTION

Finding optimal and proper location for various urban uses and urban service rendering centers will decrease costs on the one hand and will increase quality of services and hence the efficiency rate on the other hand. Inter alia, the urban parks, as the most open and public spaces of cities, play considerable roles in improving the social, cultural, economic and environment condition of the urban areas. Such spaces have grabbed more attentions in parallel with growth of area and population of the urban regions in various countries; hence various strategies have been invented and used to locate and distribute them properly throughout the urban environments.

In this study, initially we classified the 11 following elements including land area, population density, household density, household dimension, slope rate, distance away from residential, cultural and education centers, accessibility to main roads and thoroughfares, distance away from rivers and watercourses, distance away from the current parks and green spaces into 3 clusters. Then DEMATEL model was used to determine the relations among the elements and the pair wise comparisons were carried out using questionnaires. Finally super decisionssoftware was employed to measure the final coefficient of all elements. Then ARC GIS software was used to classify the layers of information of all elements in terms of their influence rate on construction of the neighbourhood parks of Bonab City; the weights measured by ANP were applied to them and finally the final map for the proper locations for building the neighbourhood parks in Bonab City were prepared.

Comparing the green space per capita in Bonab City with 10.2 sq-m shows the lack of the green space in the city, as neither the spatial distribution of the neighbourhood parks nor the defined standards are in the good condition in the city. Thus, building the neighbourhood parks with the aim of enhancing the welfare level of residents, realizing the social justice and providing fair urban services and resources seems necessary.

Combining the final applied weights of the criteria gained from ANP model in GIS environment showed proper areas for locating neighbourhood parks at districts 1, 4, 7, 9 and 13 of the city. The mentioned districts enjoy high population density. Regarding the fact that the most important criteria for building a park or a green space is the population level and demand of users, for finding good location for parks the crowded centers must be stressed, particularly.

REFRENCES

1. Balram S, Dragicevic S. (2005). Attitudes toward urban green spaces: integrating questionnaire survey and collaborative GIS techniques to improve attitude measurements. Landsc. Urban Planning, 28:147-162
2. Chiesura A. (2004). The role of urban parks for the sustainable city. Landscape and Urban Planning, 68 : 129–138
3. Comber A, Brunsdon C, Green E (2008). Using a GIS-based network analysis to determine urban greenspace accessibility for different ethnic and religious groups. Landscape and Urban Planning, 86:103–114
4. Esmaili Sari A, LatifiOskoie N. (2008).Economic-recreational Valuation of Aunibn Ali Forest Park of Tabriz. Environmental Sciences and Technilogy Magazine, 39:208-217
5. Farsijani H, Malmir R, Hamzehi E (2010). Analyzing the implementation of on-time production system using ANP technique. management studies in Iran Magazine, 69: 165-183
6. Farajzadeh Asl M, Sarvar H. (2002). Management and location of the education centers using geographical information system. geographical studies periodical, 67
7. García-Melón M, Gómez-Navarro T, Acuña-Dutra S. (2009). An ANP Approach to Assess the Sustainability of Tourist Strategies for the Coastal NP of Venezuela. 5th International Vilnius Conference, EURO Mini Conference “Knowledge-Based Technologies and OR Methodologies for Strategic Decisions of Sustainable Development” (KORSD-2009) ,September 30–October 3, 2009, Vilnius, LITHUANIA
8. Germann-Chiari C, Seeland K. (2004). Are urban green spaces optimally distributed to act as places forsocial integration? Results of a geographical information system(GIS) approach for urban forestry research; Forest Policy and Economics,6: 3–13
9. Ghorbani R, pourmohammadi M, Beheshtiroi M. (2011). Analysis of the East Azarbaijan Urban Parks Typology using Granz Analytical Model, Regional Urban Studies Magazine, 8:19-38
10. Haji Alizadeh J , Rashidi A, Roshanroodi S., Kamal Alavi S.V., Zarafshan A. (2012). Spatial Green Spaces Distribution Analysis Using Spatial Correlation Analyze Models: A Bonab City Case Study. Online J. Civil Eng. Urban,2: 45-50
11. Herzele A, Wiedemann T. (2003). A monitoring tool for the provision of accessible and attractive urban green spaces; Landscape and Urban Planning,63:109–126
12. Kantor N, Unger J. (2010).Benefits and opportunities of adopting GIS in thermal comfort studies in resting places: An urban park as an example. Landscape and Urban Planning, 98:36–46
13. Khan S, Nishat FM. (2008). An analytic network process model for municipal solid waste disposal options. Waste Management,28:1500–1508
14. Kong F, Yin H, Nakagoshi N. (2007). Using GIS and landscape metrics in the hedonic price modeling of the amenity value of urban green space: A case study in Jinan City, China. Landscape and Urban Planning, 79:240–252
15. Kong F, Nakagoshi N. (2006). Spatial-temporal gradient analysis of urban green spaces in Jinan, China. Landscape and Urban Planning,78:147–164
16. Leghaie H, Tabari M. (2003). Safety management in parks and green spaces of Tehran (case study: district no. 3). environmental sciences and technology magazine, 19: 29-38
17. Lotfi S, Manouchehri A, Ahar H and Ramazani M. (2011). Pixel-based Site Selection of Local Park Using Integrated Method of GIS, FTOPSIS and AHP.Journal of Advances in Developmental Research,2:134-150
18. Majnonian H. (2005). A discussion on parks, green space and recreational centers. Parks and green space organization publication, Tehran Municipality
19. McPherson E. G. 1994. Using Urban Forests for Energy Efficiency and Carbon Storage. Journal of Forestry, 92: 36-41
20. Moertberg U, Wallentinus H. (2000). Red-listed forest bird species in an urban environment -assessment of green space corridors. Landscape and Urban Planning,50: 215-226
21. NaqshMohit Consulting Engineers. (2006). Bonab City Detailed Design Statistical Center of Iran, Population and Housing Census
22. Nowak David J, Hesiler Gordon M. (2010). Air Quality Effects of Urban Trees and Parks; national recreation and park association, Research Series, Publisher: Ashburn, VA : National Recreation and Park Association
23. Oh Kyushik, J. (2007). Assessing the spatial distribution of urban parks using GIS. Landscape and Urban Planning, 82 : 25–32
24. Parhizghar A.A, Mohammadi M. (2009).Site selection and spatial analysis of city parks distribution using geographic information system (A case study in Zahedan city; district II).Urban management, 23:17-27
25. Qudsipoor H. (2008).AHP, Amir Kabir University Publication, 6th edition
26. Rabare Rose S, Okecke R, Onyango G. (2009). The role of urban parks and socio-economic development: case study of KISUMU KENYA. heoretical and Empirical Researches in Urban Management, 12: 22 – 36
27. Rad B, Naderi M, Soltani A (2011). Clustering and ranking university majors using data mining and AHP algorithms: A case study in Iran; Expert Systems with Applications,38:755–763
28. Rahmani M. (2003). Analyzing the decision making trend in locating parks and open spaces and its influence in their security. SabzinehSharq magazine, third year,6
29. Saeednia A. (2010). organ green space, Municipality Green Book, Urban Studies and Planning Center, Ministry of Interior, 13th edition;
30. Teymouri R, RoustaiSh, AkbariZamani A, Ahadnejad M. (2010). evaluation of spatial-terrain proportion of the urban parks using GIS (case study: neighbourhood parks

of district 2 of Tabriz) geographical space magazine, 30: 137-168

31. Thaiutsa B, Puangchit L, Kjelgren R, Arunpraparut W. (2008).Urban green space, street tree and heritage large tree assessment in Bangkok, Thailand. Urban Forestry and Urban Greening,7: 219-229
32. Thompson C. (2002). Urban open space in the 21st century; Landscape and Urban Planning, 60:59–72
33. Tzoulasn K, James P.(2009), Peoples’ Use Of, And Concerns About, Green Space Networks: A Case Study Of Birchwood, Warrington New Town, Uk, Urban Forestry & Urban greening
34. Tuzkaya G, Onut S, TuzkayaUmut R, Gulsun B. (2008). An analytic network process approach for locating undesirable facilities: An example from Istanbul, Turkey; Journal of Environmental Management,88:970–983
35. Wolf Kathleen L. (2004). Public Value of Nature: Economics of Urban Trees, Parks and Open; Proceedings of the 35th Annual Conference of the Environmental Design Research Association, 88 – 92
36. Wolfslehner B, Vacik H, Lexer Manfred J. (2005). Application of the analytic network process in multi-criteria analysis of sustainable forest management; Forest Ecology and Management,207:157–170
37. Weichang C, Ruwu C, Chuchen H. (2009). Analytic network process decision-making to assess slicing machine in terms of precision and control wafer quality; Robotics and Computer-Integrated Manufacturing,25:641– 650
38. Whitaker R. (2007). Validation examples of the Analytic Hierarchy Process and Analytic Network Process, Mathematical and Computer Modelling,46: 840-859
39. Xizhang S. (2009). Urban Green Spaces in Guangzhou (China): Attitude, Preference, Use Pattern and Assessment; PhD Thesis, for the Degree of Doctor of Philosophy at The University of Hong Kong.