SUITABILITY ANALYSIS OF URBAN NEIGHBORHOOD PARKS USING GIS TECHNIQUES

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Abstract- It is the process to determine whether the land resource is suitable for some specific uses and to determine the suitability level. The case study area is the district located at the eastern part of Tabriz city, which is district 2 of 9 districts of Tabriz city. This Study area occupies an area of about 3148 hectares in Tabriz city. This paper uses GIS and tools in assessing the suitability of Neighborhood parks of city of Tabriz in east Azerbaijan in Iran. The first objective of this paper is study of Neighboring, Compatibility, accessibility and other physical factors effective in suitability of Neighborhood parks of study area, the second objective is evaluating of parks Distribution in study area and The third is study of social factors that effective in suitability of Neighborhood parks. In result, the studies suggest that 36/4 percent of Neighborhood parks of study area are completely compatible with adjacent land uses, also study of suitability of Neighborhood parks suggest that 46/6 percent of these parks are in high suitability status, 27/3 percent are in moderate and 9/1 percent are in low suitability situation.

Keywords- Suitability, Geographical Information System (GIS), Multi Criteria Analysis (MCA), Analytical Hierarchy Process (AHP), Tabriz City, Neighborhood Park.

I. INTRODUCTION

Land suitability analysis is the process of determining the fitness of a given tract of land for a defined use (Steiner, Mc Sherry et al. 2000). Progress in computing sciences, including Geographical Information Systems (GIS) and Multi Criteria Decision Analysis (MCDA) can help planners handle this complexity. The recent literature is replete with proposals combining GIS and MCDA which meet the above mentioned objectives either partially or entirely (ShatteriMansor, 2006, p: 3)

II. MATERIALAND METHODS

The techniques adopted in the various approaches of decision analysis are called multi criteria decision methods (MCDM). These methods incorporate explicit statements of preferences of decision-makers. Such preferences are represented by various quantities, weighting scheme, constraints, goal, utilities, and other parameters. They analyze and support decision through formal analysis of alternative options, their attribute, evaluation criteria, goals or objectives, and constraints. MCDM used to solve various site selection problems (Badri 1999, Korpela and Tuominen 1996). AHP is one of useful (MCDM) methods for decision making that applied in assessment of suitable area for different land uses that. This method is able to combine whit GIS tools and applied in suitable analysis. The AHP, developed by Saaty (1988), is based on a pair-wise comparison of the indicators. By applying the AHP, several identified indicators could be ranked based on the preferences made by several involved parties. In this paper we attempt to apply methods combine with GIS tools for suitability analysis process. According to figure, one the criteria that applied in this paper involve described in 10 factors. Detailed methodology is also graphically presented in figures. each step is (Figure1):

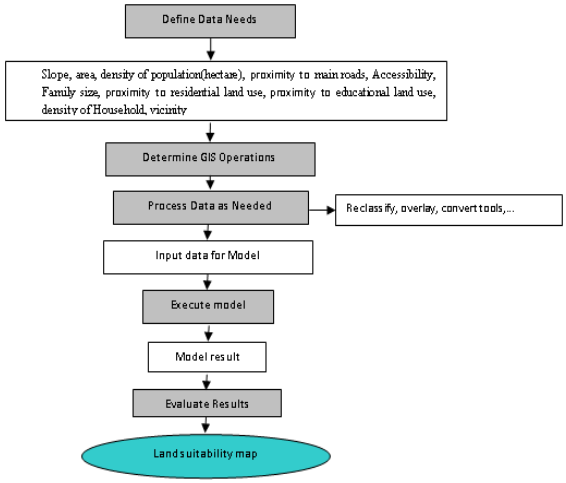


Fig.1. Flowchart and tools applied in Neighborhood parks suitability analysis

In this study we applied pair wise Comparison Matrix for weighting of criteria. The Pair wise comparisons method was developed by Saaty (1980) in the context of the Analytical Hierarchy Process (AHP).This method involves pair wise comparisons to create a ratio matrix. As input, it takes the pair wise comparisons of the parameters and produces their relative weights as output.

Table1: Pair wise Comparison Matrix, Source: Satty (1980)

Intensity of importance	Definition
1	Equal importance
2	Equal to moderate importance
3	Moderate importance
4	Strong importance
5	Moderate to strong importance
6	Strong to very strong importance
7	Very strong importance
8	Very to extremely strong importance
9	Extremely importance

Table2: Pair wise comparison matrix and weights of importance for the evaluation criteria1

factors	accessibility	Population density	Family size	Household density	compatibility	proximity to main road	proximity to residential area	proximity to education land use	slope	area	*weight*
accessibility	1	3	4	4	5	5	6	6	7	9	0.0773
Population density	1/3	1	3	3	4	5	5	6	7	8	0.2105
Family size	1/4	1/3	1	2	3	4	4	5	6	7	0.1379
Household density	1/4	1/3	1/2	1	2	3	4	5	6	7	0.1094
compatibility	1/5	1/4	1/3	1/2	1	2	3	4	5	6	0.3024
proximity to main road	1/5	1/5	1/4	1/3	1/2	1	2	3	4	5	0.0551
proximity to residential area	1/6	1/5	1/4	1/4	1/3	1/2	1	2	3	4	0.0398
proximity to education land use	1/6	1/6	1/5	1/5	1/4	1/3	1/2	1	3	4	0.0318
slope	1/7	1/7	1/6	1/6	1/5	1/4	1/3	1/3	1	3	0.0213
area	1/9	1/8	1/7	1/7	1/6	1/5	1/4	1/4	1/3	1	0.0146

According to table 1 that shows Pair wise Comparison Matrix the layers that applied in this analyst criteria layer maps have been show in following maps:

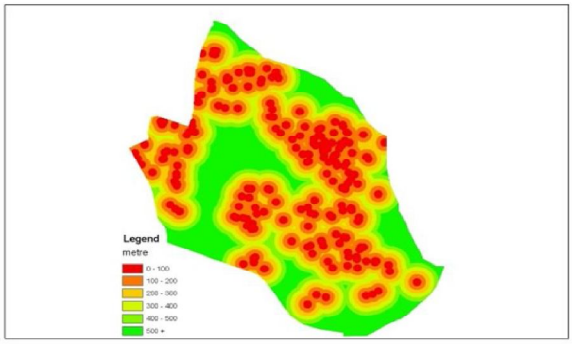
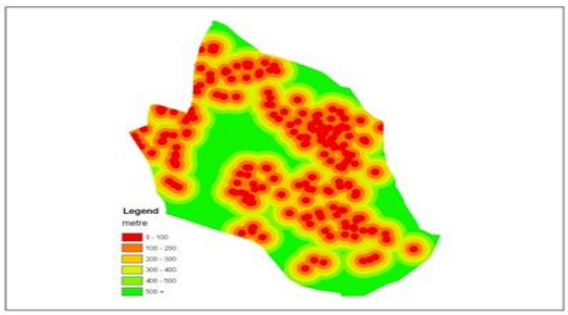
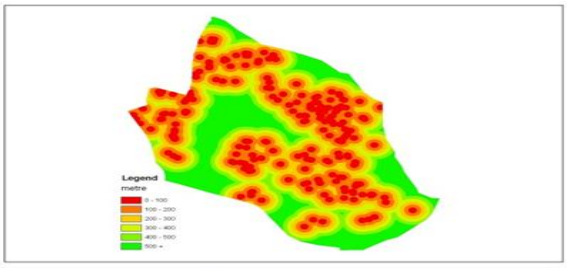


Figure .2.Proximity to educational land Use



Proximity to educational land use



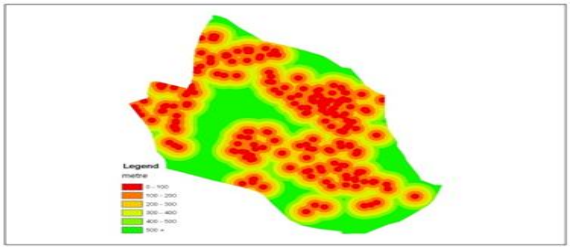


Figure.2. Criteria Layer Maps

Figure .3 Proximity to residential land use

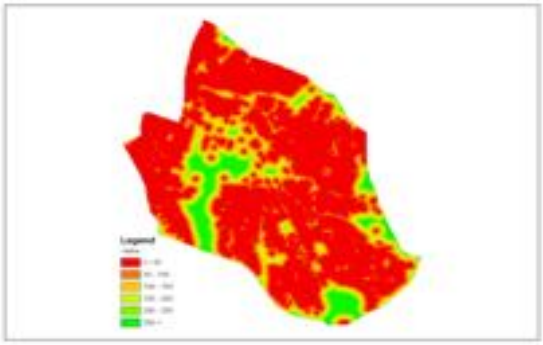


Figure .4 Proximity to mainroads

Figure .5 Family Size

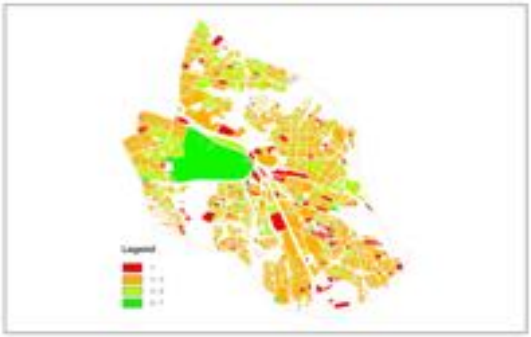


Figure .6.Area

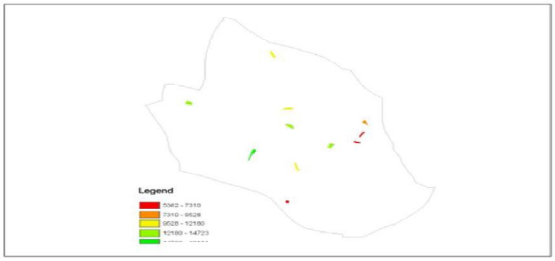


Figure .7.Household density

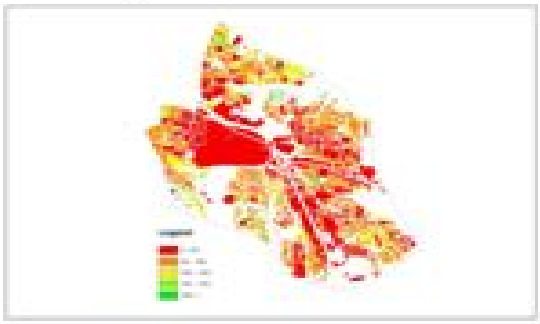


Figure .8.Population density

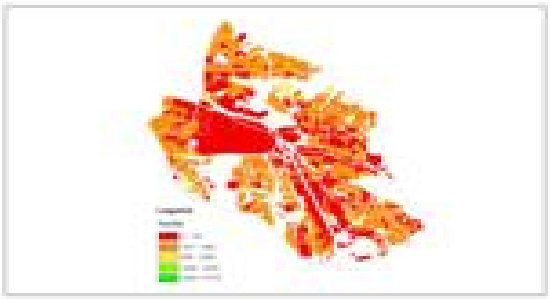


Figure .9.accessibility

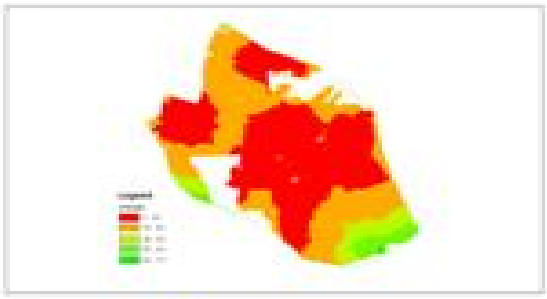
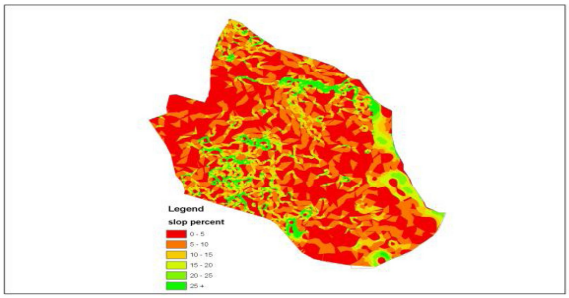


Figure .10.Compatibility

Figure .11.slope



AHP method is, at present, very popular in defining weight of alternative comparison actors. It was developed by (Saaty, 1980). Using pair-wise comparison matrix relative preference opinion of experts of all factors can be synthesized into a general weight of each factor.

Table3: Proximity to Educational Land use

No	range	score	class
1	0-100	9	Extremely suitable
2	100- 200	7	High suitable
3	200- 300	5	suitable
4	300- 400	3	Moderate suitable
5	400- 500	1	Less suitable
6	500 +	Nodata	Nodata

Table4: Proximity to main road

No	range	score	class
1	0- 50	9	Extremely suitable
2	50- 100	7	High suitable
3	100- 150	5	suitable
4	150- 200	3	Moderate suitable
5	200- 250	1	Less suitable

Table5: Household density

No	range	score	class
1	0- 50	1	Less suitable
2	50- 100	3	Moderate suitable
3	100- 150	5	suitable
4	150- 200	7	High suitable
5	200+	9	Extremely suitable

Table 6: Compatibility of land uses

No	range	score	class
1	High compatibility	9	Extremely suitable
2	low compatibility	7	High suitable
3	indifferent	5	suitable
4	Relatively non compatible	3	Moderate suitable
5	Less compatibility	1	Less suitable

Table 7: Accessibility (network analysis)

No	range	score	class
1	0 - 20	1	Extremely suitable
2	20- 40	3	High suitable
3	40- 50	5	suitable
4	50- 60	7	Moderate suitable
5	60 +	9	Less suitable

Table 8: Proximity to residential Land use

No	range	score	class
1	0 - 100	9	Extremely suitable
2	100- 200	7	High suitable
3	200- 300	5	suitable
4	300- 400	3	Moderate suitable
5	400- 500	1	Less suitable
6	500 +	Nodata	Nodata

Table 9: Population density

No	range	score	class
1	0 - 150	1	Less suitable
2	150- 300	3	Moderate suitable
3	300- 450	5	suitable
4	450- 600	7	High suitable
5	600 +	9	Extremely suitable
1	0 - 150	1	Less suitable

Table 10: Family size

No	range	score	class
1	5- 7	9	Extremely suitable
2	3- 5	7	High suitable
3	1- 3	5	suitable
4	0- 1	3	Moderate suitable
5	0	restricted	Less suitable

Table 11: Slope

No	range	score	class
1	0- 5	9	Extremely suitable
2	5- 10	7	High suitable
3	10- 15	5	suitable
4	15- 20	3	Moderate suitable
5	20-25	1	Less suitable
6	25 +	restricted	restricted

Table 12: Area of existing Neighborhood parks

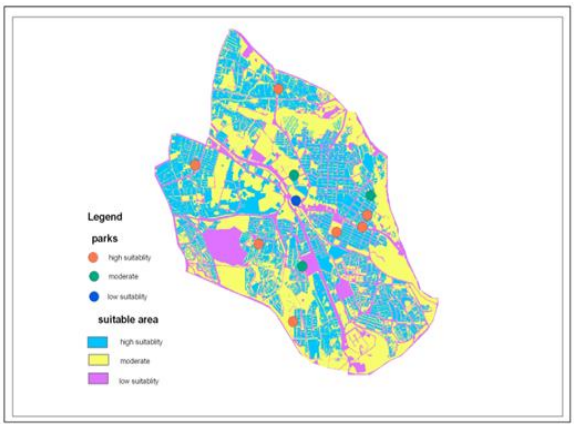
No	range	score	class
1	14723- 19161	9	Extremely suitable
2	12180- 14723	7	High suitable
3	9528- 12180	5	suitable
4	7310- 9528	3	Moderate suitable
5	5362-7310	1	Less suitable

III. STUDY AREA

City of Tabriz is located in East Azerbaijan province in country of Iran. This city includes 9 districts for supplying urban service area. In this paper study area include one district of 9 Tabriz city districts. This Study area occupies an area of about 3148 hectares. This area is district number 2 in Tabriz city

IV. EVALUATION AND ASSESSMENT OF NEIGHBORHOOD PARKS SUITABILITY

To combine weight, score and constraint coefficient of many criteria factors, MCA method was developed by (Carver, S.J., 1991) and used by many scholars, for instance (DurgaRao K.H.V., 2005). In model builder process the Reclassify these grid themes using the Reclassify tools Process. Models are represented as sets of spatial processes, such as classification, and reclassification and overlay techniques. Each of the input themes is assigned a weight influence based on its importance. The last step in the suitability model is to combine the reclassified outputs (the suitability maps) of Slope, area, density of population, Distance to main roads, Accessibility, Family size, Distance to residential land use, Distance to educational land use, density of Household and vicinity maps.



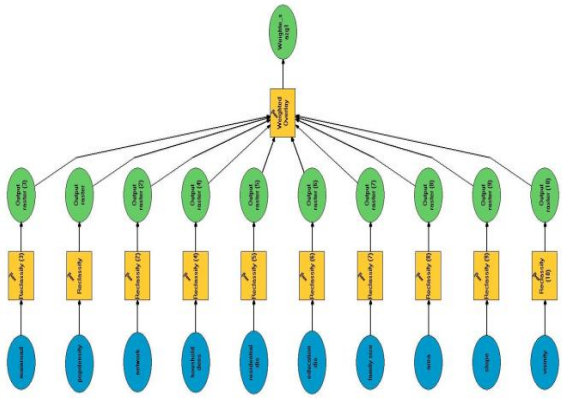


Figure.12. The Neighborhood parks land use suitability Model builder process.

CONCLUSION

The final suitability map is produced by combining all the maps together. Weights can be assigned at the same time as combining the suitability maps. The final suitability map for locating sites for the Neighborhood parks is shown below. The high

suitable parks are located in most suitable locations. and The least suitable parks are located in low suitable area.

Table 13: Neighborhood parks suitability

Park Name	suitability	Percent (%)
fadak	High suitable	64/6
zafraneye		
sahand		
nahalestan		
daneshamooz		
tooba		
zeytoon		
babataher	Moderate suitable	27/3
rjayishahr		
valiasr		
rahnemayi	Low suitable	9/1

Figure .13. Neighborhood parks Land use Suitability Map

According to result map of suitability analysis the following table (13) and figure (13) represents the suitability of each parks in district 2 of Tabriz city.

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