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Spatial analysis of urban land use access to urban green spaces
Case Study: Zone 6 of Ahvaz City, Iran

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Abstract: Present research has been accomplished using descriptive-analytical methodology, aiming to spatial analysis of urban land use access to urban parks and green spaces in zone 6 of Ahvaz city. In this research, a number of 13 existing urban land uses along with urban green space and park land uses of zone 6 were selected. At the next stage, real classified values of each land-use with respect to urban green spaces have been analyzed using municipality legislated distances to parks and urban green spaces and time and space classification according to these distances through “MOD” analyst in ArcGIS software. In order to evaluate final distribution of urban green spaces in relation to urban land uses, Fuzzy TOPSIS were applied. The results demonstrated that residential land-use according to the amount of valuated area tends to be more suitable in terms of accessibility to urban green spaces compared to the other land uses. On the other hand, final results of spatial analysis of accessibility to green spaces showed that northern and central areas of zone 6 have more suitable access to the green spaces.

Keywords: Green space, Mod analysis, urban land uses, Ahvaz

1. Introduction

Green space as an essential and integral component of configuration of the cities plays an important role in urban spaces and deficiency of green spaces can cause serious problems in urban life (Majnoonian, 1995:6). In order to have a healthy city in terms of economy and the health of citizens, urban green spaces are considered essential (Arnberger & Eder, 2007: 6). Urban green spaces (UGS) form an integral part of any urban area and quantity and quality of UGS is of prime concern for planners and city administrators (Gupta & et al., 2012:325).

In regard to rapid growth of urbanization, it is expected that about 65 percent of the world's population would live in urban areas by 2025 (Kong & Nakagoshi, 2006:147-148). As a direct consequence of such accelerated urban growth, there is increasing pressure on urban areas leading to the urban greens in cities being diminished even though they are the lungs of cities (Gupta et al., 2012:333). Urban Green spaces in today densely populated cities have become important. There is a concern about the lack of such spaces in the cities due to taking advantage of wastelands for housing development (Rafiee, 2009:437).

Today, not only decorative parameters of urban green spaces but also various functions and their importance of these spaces a factor of urban sustainable development are considered (Bell et al., 2007: 104). Green spaces play important functions in urban environments. Reducing air pollution, providing shade and habitat for arboreal birds, producing oxygen, providing shelter against winds, recreational and

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aesthetic qualities and architectural applications are the main functions of urban green spaces. The pressure for additional housing and business demands in towns and urban areas alters existing urban green spaces even more in the route to development (The World Resources Institute, 1996) (Rafiee, 2009:431). Different functions of green spaces are necessary for improving urban life quality of citizens. Considering the amount of time and distance traveled to access these spaces in today populated cities reveals the necessity and importance of urban green spaces more than past regarding contemporary urban realities, such as heavy traffic, pollution and lack of space for social interaction (Comber et al., 2008:105). Although the existence of urban furniture, parks, and green spaces are not enough for creating sustainable model of the city, the efficiency of urban green spaces widely depends on its overall structure as a part of green space of metropolitan areas and its performance in urban spaces where people are using them (Sanesi & Chiarello, 2006:125).

Therefore, distribution study of parks and urban green spaces as one of the main urban sustainable development indicators in Ahvaz city, which is one of the metropolitans of Iran, is important and fundamental study, identifying limitations and deficiencies, as well as planning in this regard can bring a better future for the city. Zone 6 of Ahvaz city which is case study of the research is considered as the most populous metropolitan area with a population of 290,000 people. In addition to population density, existence of workshops and industrial plants in the southern region, and urban physical development to the west and beyond the limited boundary in the form of residential dormitory in the west and residential towns in southern areas are among factors that make urban planning and distribution study of urban green spaces in this area essential to grantee comfort, health, and social vitality of the citizens.

1-1- Research Objectives

The present paper aims to analyze spatial access of urban land-uses to urban green spaces in the zone 6 of Ahvaz city which has been followed within these two secondary purposes:

- Determining the status of urban land-uses to urban green spaces in the zone 6 of Ahvaz
- Specifying suitable and unsuitable directions to access to the urban green spaces of zone 6

2- Definitions, concepts, and theoretical principles

1-2- Urban Green Space

Urban green space is sort of urban land-use surfaces with vegetation made by humankind including social and social and ecological feedbacks (Saeednia, 2000:29). Urban green spaces are divided into three categories: Public, semi-public, and private (Esmaeeli, 2002:12). Urban green spaces (UGS) constitute parks, gardens and recreation venues, informal green spaces such as river or sea fronts, green spaces surrounding historical sites, railway corridors and indigenous vegetation types. Urban habitats such as derelict industrial sites and overgrown gardens have also been considered as UGS (Gupta et al., 2012:325). Urban green space (UGS) is defined as all publicly owned and publicly accessible open space with a high degree of cover by vegetation, e.g. parks, woodlands, nature areas and other green space. It can have a designed or planned character as well as a more natural character (Schipperijn, et al., 2010:26). Urban green spaces are considered as open spaces with significant amount of vegetation and are mostly semi-natural areas (Galloway, 2002:583). Urban green spaces are viewed as the last remnant of nature in urban areas, and typically perform important functions, including maintaining biodiversity, preventing soil erosion, absorbing rainwater and pollutants, and mitigating urban heat island effects (Kong & Nakagoshi, 2006:148).

Natural environments, or 'green spaces', have been associated with a wide range of health benefits. Natural or green environments positively influence people's self-perceived health, levels of

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overweight and obesity, longevity and risks of all-cause and circulatory disease mortality. Possible causative mechanisms behind the green space and health relationship include the psychologically and physiologically restorative effects of nature, the facilitation of social contacts and the provision of opportunities for physical activity, though not all studies find associations between green space and physical activity. Visual access to green space may, in itself, provide a salutogenic effect (Richardson & Mitchel, 2010:568).

The relation between green space and health is also becoming visible on political agendas. Many recent national and local health policies, as well as city planning policies, are mentioning the positive effects of the use of green space. Some of these policies include clear aims for increasing or improving the use of green space, as primary means of utilizing the health benefits from green space (Schipperijn & et al., 2010:25).

The point that must be considered in urban green space planning is that all the factors effecting on the use of green space can be interacted with each other and a solution that might work in a situation might not be effective in another situation. This is the reason that urban planners and green space managers should be aware of potential problems in different locations as well as suggestions and solutions in this regard. In developing countries such as Iran, in which population growth and rural-urban migration rates are higher compared to developed countries, urban planning has faced with many restrictions because of municipal interventions which is happening mainly in these countries. Hence, planning for future urban green spaces is encountered many problems (Lindholst, 2008:79). Green spaces are able to create many social and cultural concepts in the minds of citizens by providing a sense of place (Randrup & Persson, 2009).

Research has shown that there is a relation between accessibility to urban green space and the reports of health status and survival rate in metropolitan areas (Lindsey et al., 2001:334). Rapid urbanization and increased leisure time make people more aware of urban green space, and there is an increasing realization that it is difficult to live without some contact with nature. Even though they become more urban in their way of life, the desire for contact with nature will continually increase rather than decrease (Miller, 1997). At the same time, governments are beginning to recognize the importance of healing the rift between humans and nature. Green space is becoming an important measure in judging the ecological sustainability of urban areas. Urban green spaces can also provide considerable socioeconomic benefits, such as providing amenity-recreation venues, reducing work-related stress (Kong & Nakagoshi, 2006:148).

UGS provide numerous benefits to urban residents by acting as urban lungs – absorbing pollutants and releasing oxygen, provide clean air, water and soil, and balances city's natural urban environment. These areas function as a visual screen and act as noise barriers and avoid too much spatial uniformity. It has been proved in many researches that green areas help individuals to recuperate from physical and mental stress Hartig, 1996; Takano, Nakamura, & Watanabe, 2002). Mcpherson (1992) assessed the environmental and health benefits of UGS and found investment in UGS at par with monetary benefits of other capital investments. At neighborhood level, the availability of green spaces effects the environmental quality, helps in stress restoration, enhances feeling of social safety, increases social interaction and property values and also provides a play space for children's physical and mental development (Gupta & et al., 2012:325). Thus, the urban outdoor spaces have exceptional environmental importance with regard to their contribution to the reduction of various types of pollution and to the improvement of microclimatic conditions. Furthermore, urban open spaces make positive contributions to human health and well-being and they lead to an important contribution to human thermal comfort in exterior spaces (Georgi & Dimitriou, 2010:1401).

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Citizens' interest in and affection for public shade and ornamental trees reinforced the demand for broader forest and green spaces conservation initiatives. Such environmental awareness is increasing among people to achieve different objectives such as aesthetic purposes, entertainment, and access to the environment and clean air and a relatively quiet space (Richard, 2005:232). World health organization indicated that urban green space capita per person is 9 square meter to mitigate undesirable impacts on environment. Urban forests and green spaces are essential specifically for the health of the cities in developing countries which have the largest metropolitan areas in the world (Hillsdon & et al., 2006). In such countries and frequently in the cities with population less than 500000 in Asia and Africa, the roles of trees and urban green spaces have become important as growth rate of urbanization is increasing (Benedict & McMahon, 2006). Since the quality of the urban environment can be shown in its green spaces, if a city does not take into consideration green spaces, it would be changed into a disordered forest or a polluted city, which is vulnerable to climate, behavioral corruptions, and indices of life capability (Young, 2010:312). Since the quality of the urban environment can be displayed in its green spaces, if a city ignore the quality and quantity of green spaces it would convert into a messy forest or a polluted city which is vulnerable to the weather, behavioral corruption, and livability indicators (Young, 2010 :312).

3- Research Materials and Methodology

The present paper as a practical stud has been accomplished based on descriptive-analytical methodology. According to research objectives, accessibility status of a number of 13 selected land-uses in relation to urban green space land-uses and optimal direction of access in zone 6 of Ahvaz city has been spatially analyzed. The number of 13 land-uses in this research includes: residential, commercial, educational, cultural, administrative, industrial, military, sport and recreational land-uses as well as terminals, main streets, gas and fire stations. Maps related to the land-uses have been obtained from land-use map in the scale of 1:25000 of zone 6 of Ahvaz municipality. In order to analyze obtained layers, firstly, selected land-uses were classified according to approved standards of available distances to urban green spaces. At the next stage, classified layers of the land-uses were evaluated using spatial analyst tool and Mod analyst in the math section as well as underlying green space land-use as a raster or contrast value in GIS software. Afterwards, real residual values extracted from distance classified land-uses to green spaces were recognized. Finally, in order to spatial analysis of optimal directions of accessibility to urban green spaces in zone 6 of Ahvaz city, selected land-uses were given weight and analyzed using FTOPSIS model regarding the obtained values for the mentioned land-uses.

3-1- Research Case Study

Zone 6 of Ahvaz city is located in the western part of the city and west of Karun River, which is restricted to zone 2 from the north and eastern north, and to zone 4 from the south and eastern south. According to statistics, this area has a population of 290,000, which is considered as the most populated zone in the city. Zone 6 is mostly residential, and around 75 percent of urban lands consist of residential land-use (Zone 6 of Ahvaz municipality, 2012). Moreover, there are 17 parks and green spaces in this zone which have been mainly placed in the northern and north-eastern parts of the region.

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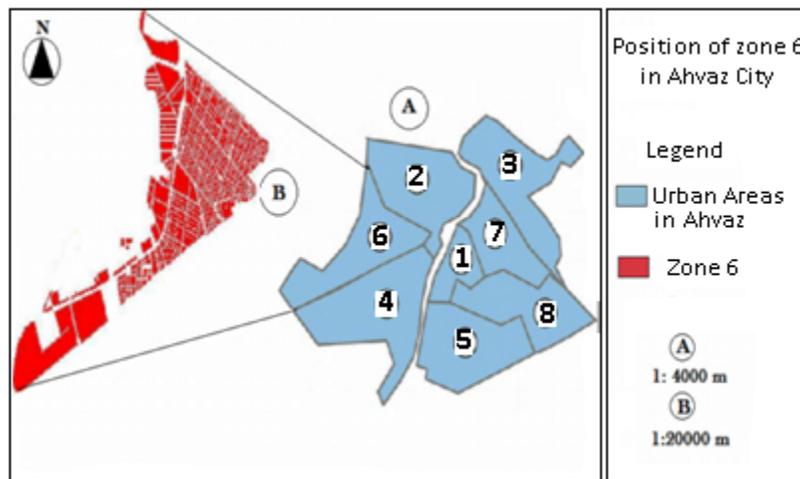


Figure 1: Position of Zone 6 in Ahvaz city

The first complete iris recognition system was designed and patented by J.Daugman (Daugman, 1993). It was followed by a number of other works in the field of iris recognition. Many of these methods focus on proposing a new method, or optimizing for specific stages in the iris recognition.

4- Research Findings

In the stage of research data analysis, time and distance standards approved by municipality have been provided for the selected land-uses in relation to urban green spaces. In the second step, distance classification of the land-uses was performed regarding the available standards (Table 1).

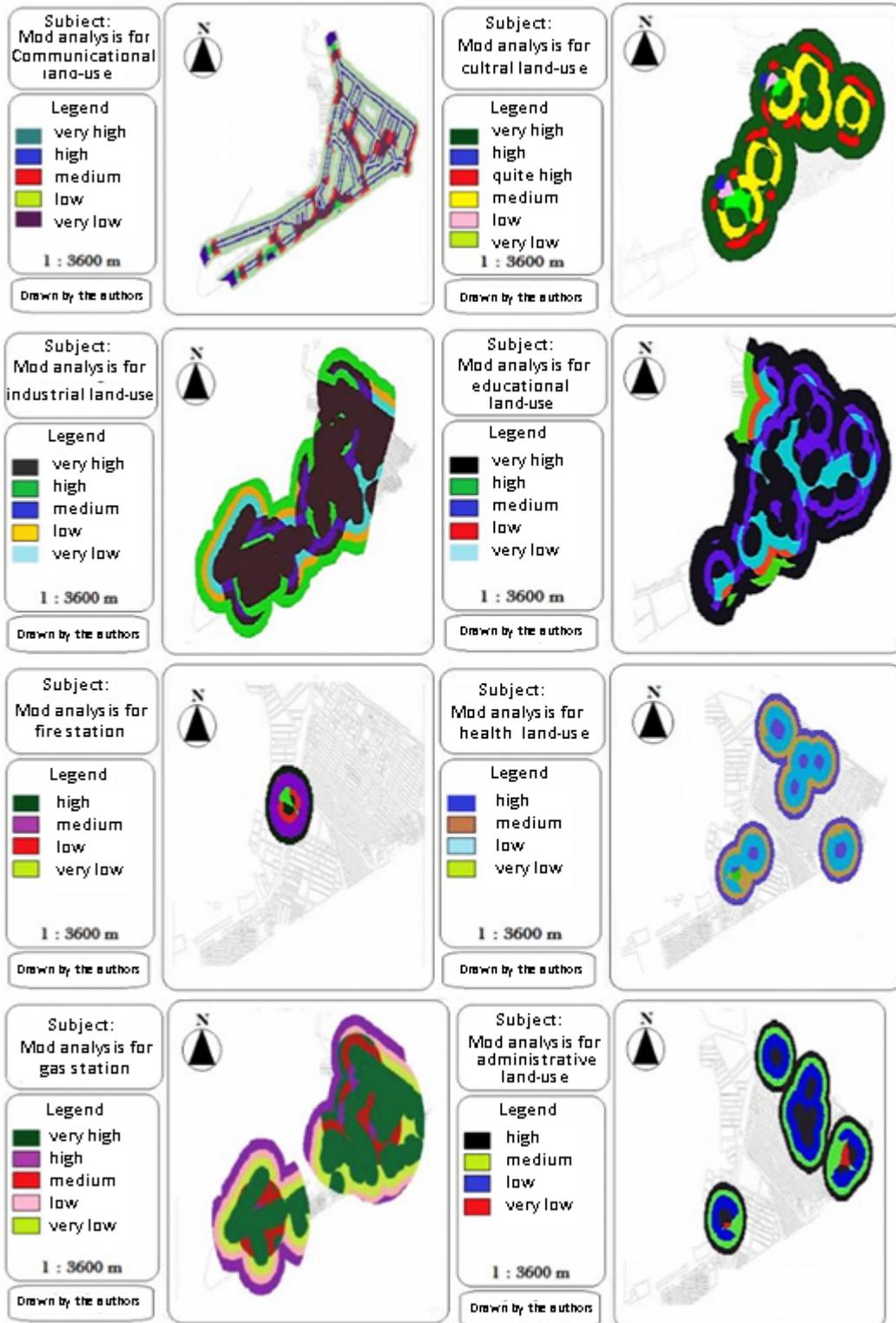
Table 1: Standard distances of urban land-uses to urban green spaces

Land-use	Standard Distance (m)	Land-use	Standard Distance
Residential	150	Industrial	500-1000
Commercial	150	Educational	150
Health	150	Military	500-1000
Administrative	150	Gas Station	150-500
Cultural	150	Main streets	150-500
Sport and Recreational	50-150	Fire Station	150-500
		Terminals	150-500

Source: (Behzadfar, 2010: 69-78)

After distance classification layers related to the research land-uses using analyst tool and reclassify section, accessibility status of each land-use to urban green spaces was analyzed using Mod analyst in ArcGIS environment. At this stage, classified land-use layers in relation to green space land-use were evaluated in terms of distance by underlying green space land-use as a raster value to determine actual value of access overlapping. Results extracted from this step have been demonstrated in figure 2.

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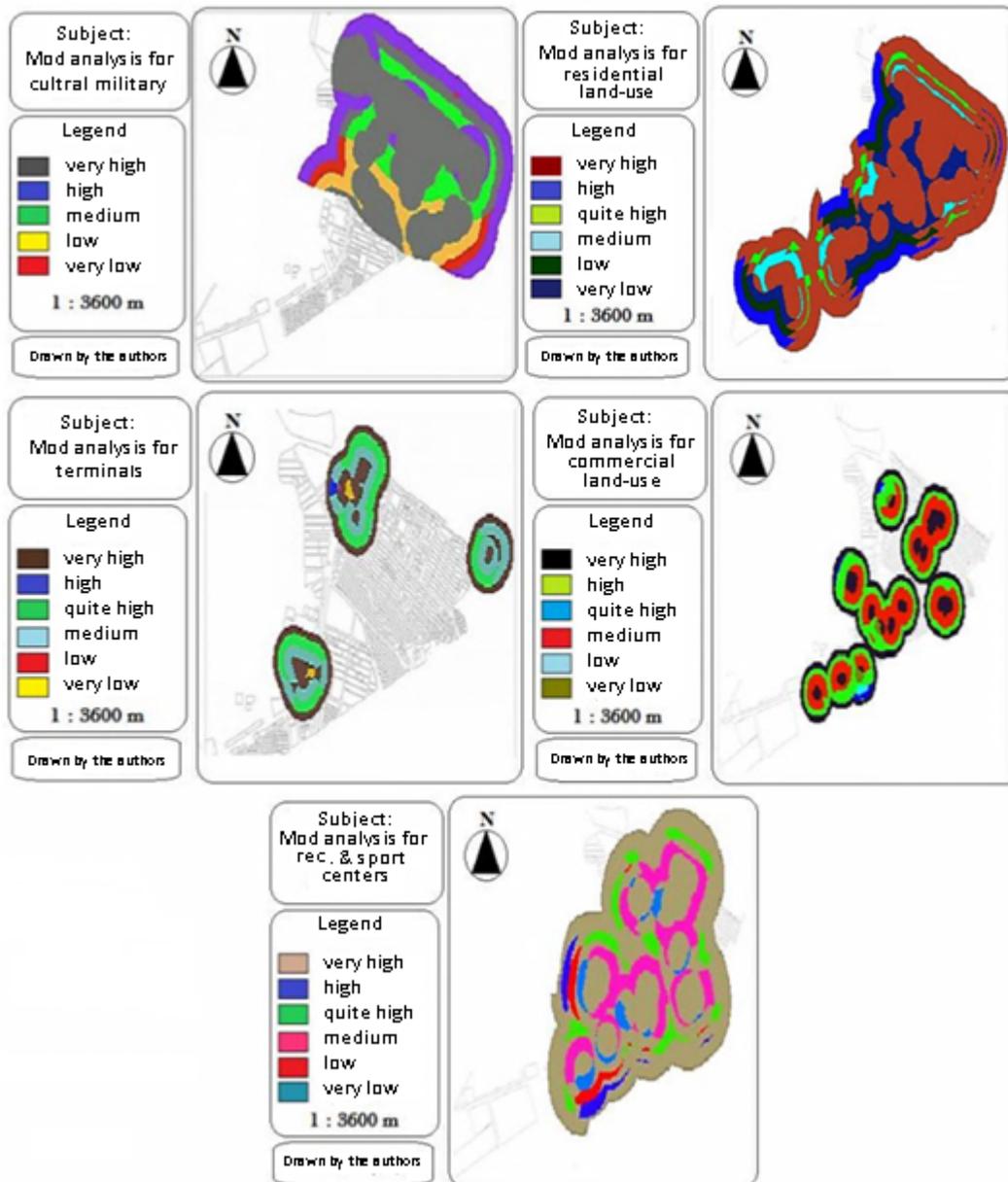


Figure 2: Access analysis of urban land-uses to green space land-use in zone 6 of Ahvaz city
Calculated and mapped by the authors, 2013

In Mod analyst and according to its definition, a layout would be extracted from overlapping secondary layer in relation to the base layer as well as cell by cell analysis and calculation of the real residual value including classification or primary weights of the mentioned land-uses. This would provide the user a better comparison between land-uses and the base land-use. In this analysis depending on land-use distribution in relation to each other and the previous classification, a new classification is presented which provides precise and detailed analysis. The more layer distribution or secondary layer is, the greater

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the number of valued classes is, and conversely, the less the distribution is, the less the number of classes is; however, the distances would be increased. According to the results (the results of figures 2 and 3), residential land-use has allocated more classification and a high value (very high) compared to the other land-uses regarding high distribution in the studied area and proximity to urban green spaces. This shows that accessibility to residential land-use is more than the layer base of green spaces in zone 6.

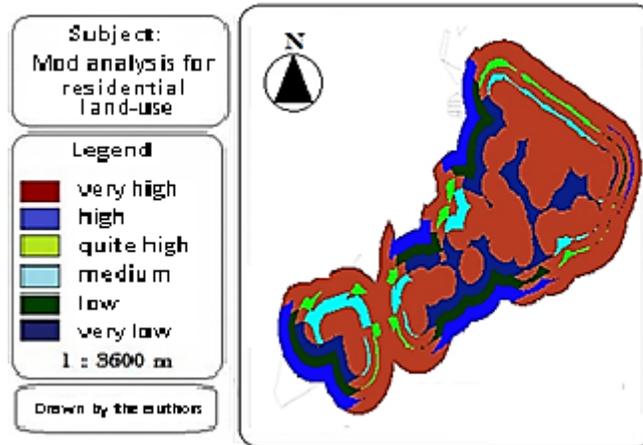


Figure 3: Access analysis of residential land-use to green space land-use in zone 6 of Ahvaz city
 Calculated and mapped by the authors, 2013

According to the results obtained from data analysis using Mod analyst, layer (land-use) evaluation was performed regarding their weight (value) analysis in the format of Fuzzy TOPSIS model in order to analyze accessibility spatially to urban green spaces in zone 6 of Ahvaz city. For this, weights or values given to the land-uses were defined regarding fuzzy verbal variables in the format of Fuzzy triangle numbers (FTN) (Table 2).

Table 2: Verbal variables in the format of Fuzzy triangle numbers to assess land-use value evaluation

Land-use Value	Fuzzy triangle numbers
Very poor	(1,1,3)
Poor	(1,3,5)
medium	(3,5,7)
Suitable	(5,7,9)
Very suitable	(7,9,9)

Source: Ataee, 2010, 71

After fuzzy binary comparison of land-uses to each other and negative and positive ideal solutions (D^+ & D^-) calculation as well as similarity index (CC_i), final value of land-uses with respect to their existing status in the area to access the green spaces were calculated according to the calculation steps of Fuzzy TOPSIS model using EXCEL software.

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Table 3: Final value of urban land-uses access to urban green spaces in zone 6 of Ahvaz city

Land-use	Weight value	Land-use	Weight value
Residential	0.123	Educational	0.094
Commercial	0.066	Military	0.077
Health centers	0.059	Gas stations	0.07
Administrative	0.053	Main streets	0.071
Cultural	0.079	Fire stations	0.057
Recreational and sport	0.098	Terminals	0.063
Industrial	0.09	Total weight	1

Obtained weights were combined and analyzed in order to produce final output of spatial analysis of accessibility to urban green spaces in ArcGIS using “weight sum” in the section of analytical tools. Final output has been demonstrated in figure 4.

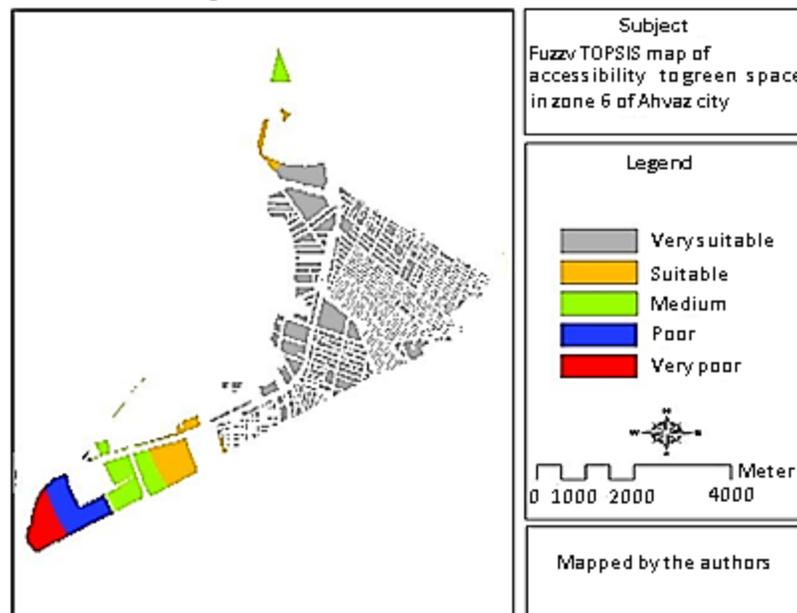


Figure 4: Spatial analysis of urban land-use accessibility to green space in Zone 6 of Ahvaz city
 Source: Calculated and mapped by the authors, 2013

Results extracted from Fuzzy TOPSIS model analysis and combining them in ArcGIS software (figure 4) shows that northern and central parts of the studied area have more suitable access to urban green spaces with respect to existing status and land-use distribution. The results also indicate southern and north eastern parts of the region are not suitable in terms of accessibility to urban green spaces. This is because of new industrial and residential units which have been established around the south of the area; while, creating green spaces in this area have been ignored. Indeed, figure 4 shows that as we move from southern area to the northern area, access status of urban land-uses to green spaces become more suitable.

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5- Conclusion

Nowadays, the concepts of design and optimal distribution of recreational places including green spaces have been recognized as an essential issue regarding population density and increasing urbanization. Providing proper planning for citizens' comfort and well-being is one of the basic urban planning principles which equipping and optimizing of proper urban spaces and services especially in the area of leisure and well-being of citizens is one of the best examples. Hence, in the present paper urban land-uses were evaluated in terms of their accessibility to green spaces in zone 6 of Ahvaz city. For this, firstly, a number of 13 different urban land-uses with underlying urban green spaces were evaluated using Mod analyst to determine access status to urban green spaces. The results at this stage of research show that residential land-use has more suitable access to urban green spaces compared to the other land-uses regarding the area and valuation level. The next step of the research was spatial analysis of accessibility to urban green spaces in which Mod analyst and FTOPSIS were used to analyze and evaluate urban land-uses. The results of this stage demonstrated that northern and central areas of zone 6 have more suitable access to the green spaces; however, southern areas are in poor conditions in terms of accessibility to the green spaces.

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