

Abedini, Asghar; Khalili, Amin

Article

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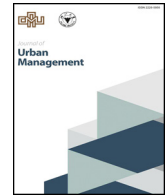


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Determining the capacity infill development in growing metropolitans: A case study of Urmia city

Asghar Abedini^{a,*}, Amin Khalili^b

^a Department of Urban Planning, Urmia University, University Boulevard, Sero Road 1/5 KM, Faculty of Architecture, Urban & Art, Urban Planning Department, Urmia, Iran

^b Department of Urban Planning Urmia University, University Boulevard, Sero Road 1/5 KM, Faculty of Architecture, Urban & Art, Urban Planning Department, Urmia, Iran



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ABSTRACT

Growing population and increase of urbanization have created a phenomenon called urban sprawl in major cities of the world that have imposed many environmental and economic consequences on cities. Recent researches have shown that Urmia urban development process has always been as urban sprawl during the last years and there is an essential need to reduce this process. Therefore, the aim of this study is to determining the capacity of Urmia city areas and identifying a suitable plot for infill development. By investigating the current situation of Urmia, and the policies of smart growth attitude, urban infill development policy was selected as a good solution to deal with Urmia sprawl. The prone and potential areas have unique features for urban infill development which their identification and separation depend on various factors. Selection of all factors is not possible for conduction of research, so, in the present study, nine parameters resulted by the descriptive-analytical method, based on the past studies and other scholars' experiences, Experts comments, information and existed indicators in the region. Evaluate the indicators, face to face interviews (using a researcher-made questionnaire) have been performed by experts in the field too. Determine the importance coefficient of the parameters, the analytical-hierarchy approach used. Finally, the provided informational layers entered the appropriate mathematical models and integrated based on the logic governing these models. The current study based on the current OWA approach to overlap the layers and the maps were simulated and prepared in scenarios. Results show a large area of Urmia is suitable for urban infill development and major parts with the potential of this development is located in region 3 and one respectively. Also, region 4 is at a proper level regarding access to examined indexes.

1. Introduction

The world's population and urbanization are growing rapidly, as today's 54% of the world's population lives in cities, and in the next few decades, the world will witness unprecedented growth in cities, especially in developing countries. It is expected that by the year 2050, 2.5 billion people will add to the world population and the urban population of the world will reach 66%, while in the 1950s it was only 30% ([World Urbanization on prospects, 2014](#)). These numbers (percentage of urbanization) in Iran, which is emerging as a developing country with rapid urbanization, has risen from 28% in 1921 to 74% in 2015. As a complex and dynamic phenomenon, the city has always undergone physical, social, economic, and even political and cultural changes, and such widespread

* Corresponding author.

E-mail addresses: As.abedini@urmia.ac.ir (A. Abedini), Amin.Khalili91@yahoo.com (A. Khalili).

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developments are influenced by the growing urban population (Seyfoddini, Pour Ahmad, Darish, & Alvar Dehaqani, 2014). Due to the increasing urban population, especially the increasing population of metropolises, urban growth is unavoidable. The expansion of the city, called urban sprawl, is a phenomenon that has occurred in the last half-century, not only in developed countries but also in developing countries (Mokhtari, Hosseinzadeh, & Safari, 2014). Urban sprawl can lead to multiple problems, such as demographic and structural constraints, increased infrastructure costs, and the loss of rural lands. Such growth is contrary to the principles of sustainable development (Babaie Aghdam, Ahar, Gheysari, & Tahmasebi, 2017; Ooi & Le, 2013; Ziyari, Hataminezhad, & Torkamani niya, 2013). The unfavorable economic and environmental effects of urban sprawl have prompted urban planners to seek strategies to counteract these effects. In this regard, decision makers and urban planners consider infill development as practical solutions to the urban sprawl, which increases the density and restores undesirable neighborhoods (Abbasi & Nikniya, 2013; Chiroma, Adamu Harir, Bukar Abba, & Audu Gani, 2017; McConnell & Wiley, 2012; Mir moqtadaei, Rafieian, & Sangi, 2010; Razavian & Samadi, 2016). Reduce the dispersed development burden of lands; an infill development is used. The infill development causes the existing gaps in the community to be filled, and this development plays a vital role in utilizing the existing potential of the city and protecting pristine land and preventing urban sprawl (Saeidi Rezvani and Kazemi, 2011; Ali Akbari & Akbari, 2018; US EPA, 2014). Indeed, infill development can be seen as a response to external development; a process that has led to the recession and the abandonment of the central regions of the cities from urban development (Steinacker, 2003; Tabibian & Ghani, 2015). Therefore, the main framework of this growth is the optimal use of land and the redevelopment of Inner city areas. This is especially important in the land abandoned within the cities or the remnants of past uses (Rafieian, 2010; Hataminezhad, Mahdi, & Mahdian Behnamiri, 2013).

Also, it will invest in existing infrastructure and reduce the need for new and costly infrastructure. Although much of the existing infrastructure needs to be restored and improved, the cost of repair is much lower than the cost of constructing the new infrastructure (Mir moqtadaei et al., 2010; McConnell and Wiley, 2012; Chiroma et al., 2017). In fact, in this pattern of development, the goal is to place the city and its infrastructure in the process of continuous growth considering the needs of the city's day and the contemporary citizens (Ziyari, Pourahmad, & Hamzehpour, 2016). In other words, the development infill development is a development in parts that have been far from the development process during the continuous development of the city (Fig. 1) (Rafieian, Barati, & Aram, 2010). Therefore, successful infill development tries to consider the existing facilities and construction in the future (Rahimi, 2013; Saeidi Rezvani et al., 2013).

Currently, infill development in many metropolises has a significant share in the areas where construction is carried out. Many companies and organizations are moving towards infill development, as they have realized the benefits of being close to the urban centers. Low cost of infrastructure and rental and sales costs to infill development projects helps these projects to be useful for developers, infill development projects to support the environment and increase the quality of life in cities (Rahimi, 2016). Also, paying attention to infill development (densification) without considering development policies can have disadvantages; For example, Mustafa et al. (2018a, 2018d) highlighted that the spatial planning policy oriented towards densification without expansion led to significantly higher flood damage.

Urmia is one of the most important historical and growing metropolises of Iran, which has been overgrowing in recent years (Zebardast & Shadzaviyeh, 2011). Also, the study of the evolution of the population in the city during the five decades leading up to this time indicates that the people of the town is continuously increasing This continuous increase in population has led to the growth of this city sporadically, and as a result, we see an urban sprawl phenomenon in the Urmia city. Urban sprawl in this city has led to the creation of thermal islands, the destruction of agricultural lands and gardens, environmental pollution (air, water, soil, etc.), endangered animal and plant habitats, and destroyed the natural environment of villages around the city, increased costs of urban infrastructure, transportation costs, and so on. (Abedini, Mossayebzadeh, & Shokrani, 2015; Abedini & Khalili, 2017; Mobaraki, Mohammadi, & Zarabi, 2013). The dispersed growth of the city of Urmia shows the necessity of using all the existing capacities of the city. For this purpose, it is necessary to achieve sustainable urban development by filling the existing tissues of the city, increasing the density and changing the use of old buildings and brownfields. The selection of suitable and desirable plots for infill development is

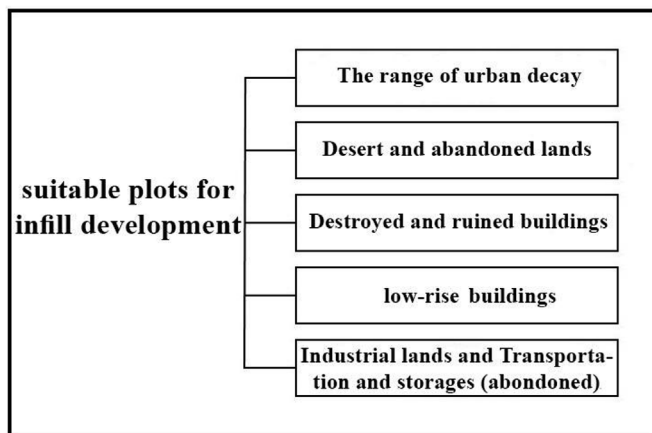


Fig. 1. Types of suitable plots for infill development.

significant, and identification of these plots requires an adequate understanding of the factors and components associated with infill development (Mir moqtadaei et al., 2010). The present research will attempt to identify useful factors in the implementation of infill development, and an accurate examination of these factors will determine the appropriate criteria for selecting the optimal plots for infill development in growing metropolitans. Therefore, the critical question of the present research is which of the Urmia city areas are more potent for infill development? Thus, the purpose of this study is to identify the capacity of Urmia and determine suitable plots for infill development.

2. Literature review

As noted above, to reduce the adverse effects of urban sprawl growth, an infill development policy can be a desirable strategy. In the following, we will refer to studies in this field:

In the context of implementation and application of infill development, Mir moqtadaei et al. (2010) and Dadashpour, Taqvaei, and Qane (2014) Point out that the selection of indices for implementation of infill development is significant and emphasize that the application of infill development in Iran's cities is possible and lucrative. In the following, Saeedi Rezvani and his colleagues (2013) examined and selected the appropriate indicators for implementing infill development, and stated that the land and non-built land, lands with industrial, transportation and storage land use in residential buildings, demolished buildings And abandoned, etc., can be used to achieve the goals of the infill development approach.

In international research, the importance of using infill development can also be seen. In a study conducted in 2012, Chrysochoou and colleagues emphasized that the GIS could play a crucial role in identifying suitable plots for infill development (Chrysochoou, 2012). Kamal also continues to integrate multi-criteria analytical methods with the GIS and completes previous research. In her study, she concludes that the use of more indicators and the integration of multi-criteria methods with GIS in identifying the appropriate plots for infill development can be advantageous (Kamal, 2014). Also, Mustafa et al. (2018b, 2018c) have been studying the relationship between low density and infill development and simulation infill development. The results of their research indicate that the density is mainly occurring in areas where there are dense neighborhoods while areas with low densities retain their low density over time. Besides, they point out that physical and local factors play a significant role in infill development.

Studies have shown that new and innovative techniques are not addressing infill development. Therefore, the present research is attempting to apply and use multi-criteria evaluation techniques with the geographic information system which is nowadays prevalent in most parts of the world to implement the infill development in Urmia city.

3. Materials and methods

Order to understand the issue, the first step is to examine the infill development. And definitions, standards, legal documentation, etc. have been used to arrive at a theoretical view in theory. This is applied research. Therefore, using theories, they are determined to answer the critical questions of the study and achieve the goals. This is applied research. So, using theories, we are trying to accomplish the purposes of the research. The information and data are collected through the library method, referring to organizations, departments and field observations (Fig. 2).

Areas with potential for infill development have unique characteristics, and their identification depends on several factors. It is not possible to select all of these factors for conducting research. Therefore, in the present study, according to past research and other researchers' experiences, expert opinions, information and indices in the region, and the motivation to complete previous research, distance indicators from health centers Educational Centers and Business Centers (Florida Department of Community Affairs, 2003; Municipal Research & Services Center of Washington, 1997; Saeedi Rezvani, Davoudpour, Fadavi & Sarvar, 2013; Suchman, 2008); Indicators of Distance from Green Spaces and Religious Centers (Suchman, 2008; Saeedi Rezvani & Kazemi, 2011; Dadashpour, 2013) and indicators of slope and distance from the center of the city (Florida Department of Community Affairs, 2003; Saeedniya, 2004; Rafeian et al., 2010) as well as distances between public transit stations and distances from major roads (Municipal Research & Services Center of Washington, 1997; Florida Department of Community Affairs, 2003; Suchman, 2008; Rafeian, 2010; Saeedi Rezvani & Kazemi, 2011). And Dadashpour, Taqvaei & Qane, 2014 were selected.

In the present study, maps, satellite, and statistical data were used to determine the parameters and spatial units collected according to the experiences and opinions of the various experts and their impact on determining the areas susceptible to infill development were classified and incorporated into appropriate mathematical models. In the present study, models and methods such as fuzzy logic and an AHP-OWA method have been used to overlap the layers, which are discussed below.

The first step is to normalization the indicators. (Lorandi et al., 2010). To normalization the values of variables and criteria by studying and examining the above methods, in line with the purpose of this research, the proposed method by Eastman, the fuzzy normalization method has been used. In this method, normalization of factors is performed using fuzzy sets on the scale between real numbers {0-1} or {0-255} bits (Motakan, Shakiba, Pourali, & Nazmfar, 2008). In the present study, the range of {0-255} is used due to the optimization of computations with computer systems (Drobne & Liseč, 2009; Farhodi & Nemati Kotnaei, 2010). TerrSet2015 software has been used to fuzzy the criteria. This software allows the use of different membership functions. Further, the Euclidean map of the criteria and the fuzzy map of the criteria can be seen using these functions (Table 1 and Fig. 3).

3.1. Weighing the criteria

After selecting and fuzzing the criteria, combine them as information layers, weigh each of them in proportion to their importance

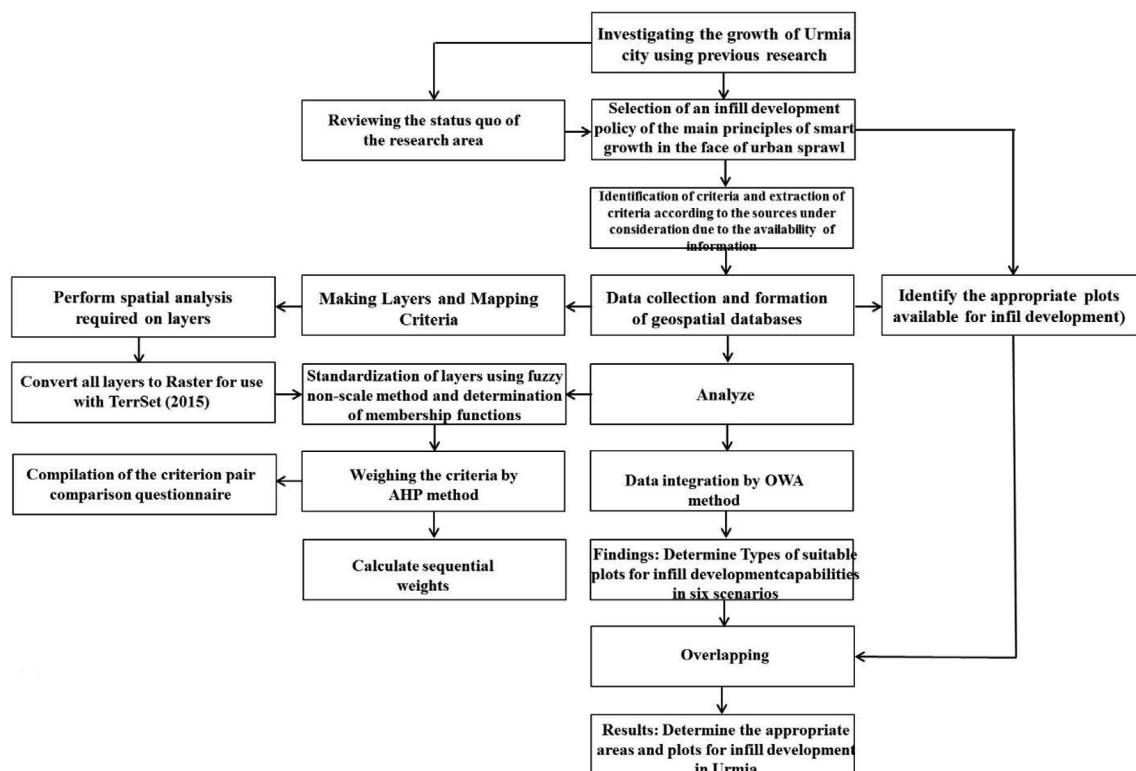


Fig. 2. Conceptual model of research.

Table 1

Limit and type of fuzzy function for normalization of criterion maps in fuzzy logic.

Map layers (metrics)	Type of phase function	The effect of the phase function	Threshold or control points	
			a or c	b or d
Distance from public transport stations (m)	Sigmoidial	decreasing	300	800
Distance from Health Centers (m)	Sigmoidial	increasing- decreasing	100	1600
Access (distance from main roads) (m)	Linear	decreasing	0	maximum
Slope (degree)	Sigmoidial	decreasing	0.5 and 8	2 and 32
Distance from green spaces (m)	Sigmoidial	decreasing	400	1500
Distance from educational centers (m)	Sigmoidial	decreasing	500	2000
Distance from commercial centers (m)	Sigmoidial	decreasing	150	800
Distance from the city center (m)	Sigmoidial	decreasing	1000	5000
Distance from religious centers (m)	Sigmoidial	decreasing	500	2000

by using one of the weighting methods. The weight of each of them should be determined in proportion to their importance by using one of the weighting methods. In the present study, after reviewing quadratic weighing techniques, ranking method, scoring method, balancing analysis method and paired comparison method, the authors used the paired comparison method because a paired comparison can provide an organized structure for group discussions (Drobne & Lisec, 2009; Ghanbari & Ghazi Asgar, 2011). The paired comparison method determines the weight of each criterion and analyzes the relative relation between the criteria (Çalışkan, 2013). This methodology is presented in a hierarchical process. Therefore, so, after determining the hierarchical structure of this research, for the implementation of the paired comparison method, ten questionnaires were prepared, and were provided to 10 experts and university professors. At first, each criterion was compared, and the relative importance of each pair of ratios was entered into the Saati binary matrix according to the scoring between 1 and 9. All processes related to the calculation and weighing of the criteria in the HP model were done with the EXPERT CHOICE software. The comparisons showed that $CR \leq 0.1$ incompatibility, which is consistent with the judgments and the concept of accepting weights is calculated (Eastman, 2015a, 2015b). Fig. 4 shows the computed weights.

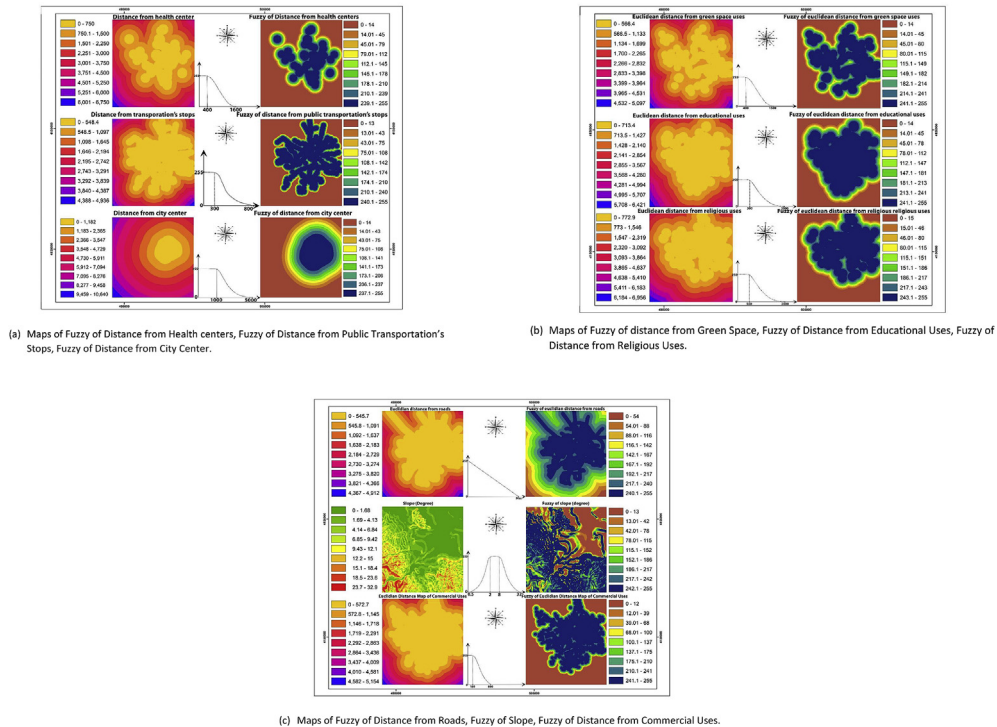


Fig. 3. (a–c): Standardization of Criteria Maps using Fuzzy method.

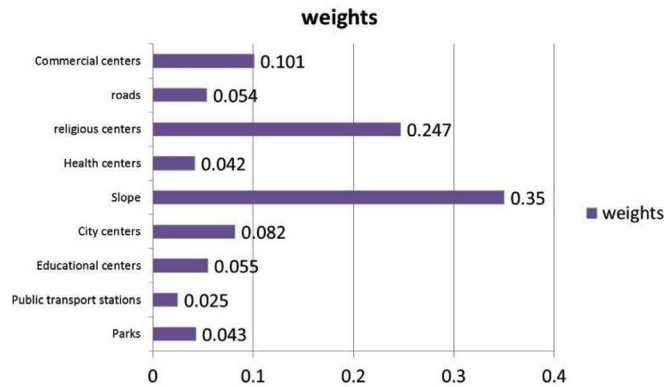


Fig. 4. Weights of criteria.

3.2. Order weights

The sequential weights first modify the effect of the standard weights in the composition of the layers. Then control the overall level of balance (Eastman, 2015a, 2015b; Motakan, Shakiba, Pourali, & Ebadi, 2009); The order weights first modify the effect of the weight of parameters in the composition of the layers and then control the overall level of balance (trade-off) (Eastman, 2015a, 2015b; Motakan et al., 2009); And by changing the order weights, different forms of combined maps can be obtained (Malczewski et al., 2003). Several methods for determining order weights are proposed. In the present study, the highest (maximum) entropy method proposed by Hagan was used (Bilibio, Hensel, & Selbach, 2011; Sugumaran & Degroote, 2010). After standardizing the layers by a fuzzy method and determining the weight of the importance of the criteria and calculating the OWA weights, OWA method was used in the Terrset software to combine the layers. OWA methodology is a new technique of multi-criteria decision-making techniques developed in the field of fuzzy theories and has more flexibility and results with more reliable results (Feizizadeh & Blaschke, 2012; Malczewski et al., 2003). Since the introduction, this method has been successfully applied in many decision-making fields (Mokarram & Hojati, 2016). In this study, we calculated the order weights using the highest entropy method using the lingo software, determine the areas that are prone to infill development. Maps of 6 scenarios were created. These scenarios were categorized in 5 class from entirely unsuitable classes entirely suitable.

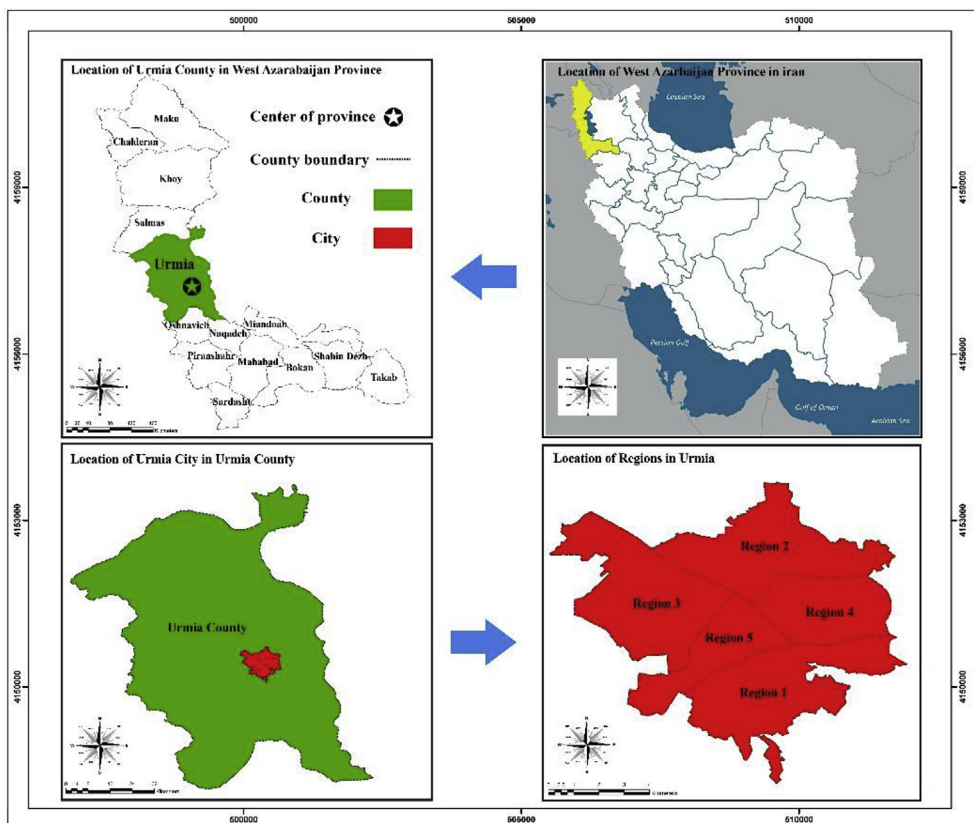


Fig. 5. Political-physical divisions.

4. Discussion and results

Urmia city, the capital of West Azarbaijan Province, has an area of 10548 ha, Located 18 km from the Lake Urmia (Mobaraki, 2013). Urmia consists of 5 districts. And in the census of 2016, it has 736224 inhabitants (Statistical Organization of Iran, 2016) (Fig. 5).

This section explores the appropriate plots for infill development in Urmia, Which initially we identified a variety of levels for infill development. And then, we overlap the suitable plots for infill development with these levels.

As shown in Table 2, 167726 pieces are located at infill development levels. Considering the biological, demographic, social and economic conditions of Urmia city and detailed plan, Plots above 200 square meters are acceptable for infill development. The number of plots mentioned is 67056 plots above 200 square meters, which is the highest number of 204079 plots in Urmia city. Therefore, the infill development for Urmia is entirely appropriate. It should be noted that the parts above 200 square meters were determined from the sum of parts other than worn out type 3 texture (urban decay). Because according to a detailed plan, fine-grained plots of type 3 worn texture (urban decay) will be aggregated. Therefore, Type 3 worn texture has a lot of potential for infill development.

In the following, we will examine the suitability of the components that we identified for intermediate expansion by the criteria mentioned (Figs. 6 and 7).

In the following, we examine the scenarios derived from the integration of the criteria OWA method.

Table 2
Types of suitable plots for infill development in Urmia city.

Types of suitable plots for infill development in Urmia city	Levels	Number of plots
	Wasteland	9857
	Destructive pieces, devastated and abandoned	2384
	Low-rise residential units (1 or 2 floors)	146605
	Worn Type 3 texture	8880
	Total	167726
	Pieces above 200 square meters	67056

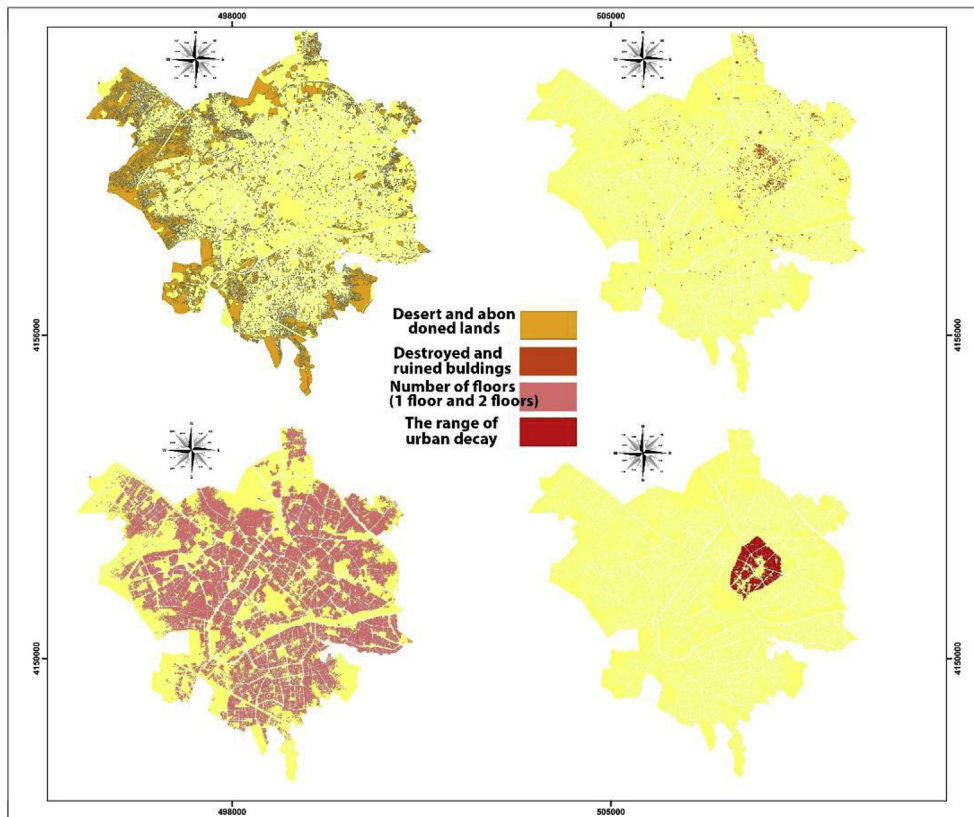


Fig. 6. Type of plots for infill development in urmia city.

4.1. Scenario 1: high level of risk -No tradeoff

This scenario is very similar to the OR operator. Thus this operator acts to be pretty optimistic and Determines many suitable areas. All areas in this operator are given a high rating. Therefore, the majority areas of Urmia city (84.05 km^2) in connection with the identification of suitable areas for infill development are in a class of entirely suitable (Table 3 and Fig. 8)

4.2. Scenario 2: high level of risk –some tradeoff

In this scenario with high risk, Some Tradeoff between factors also is applied. Therefore, the main areas of the city of Urmia are in the class of relatively suitable (40.33 km^2). Then in the class of entirely suitable (35.82 km^2) is classified (Table 3 and Fig. 8).

4.3. Scenario 3: average level of risk -full tradeoff

This scenario exactly likes to the WLC method. In this scenario, factors have equal weights, so the rating of the weights does not effect on factors aggregate operating. In this method, the full tradeoff is established between factors. This means in this scenario results are between AND and OR operators. In this section, 39.79 km^2 of the area of Urmia city is in the class of entirely suitable (Table 3 and Fig. 8).

4.4. Scenario 4: average level of risk -No tradeoff

In this scenario does not apply tradeoff between the criteria. Results located between AND and OR operators. This matter shows that the results are not without risk and are not quite risky. So in answer obtained 67.88 km^2 of Urmia, the major area of the city, are in a class of entirely suitable (Table 3 and Fig. 8).

4.5. Scenario 5: low level of risk –some tradeoff

In this scenario, the risk is low, so accuracy is high. This means the area on the output map is suitable that is in the number one factor also suitable. In this scenario the order weights in addition to defining the tradeoff, maintaining low risk. The present scenario

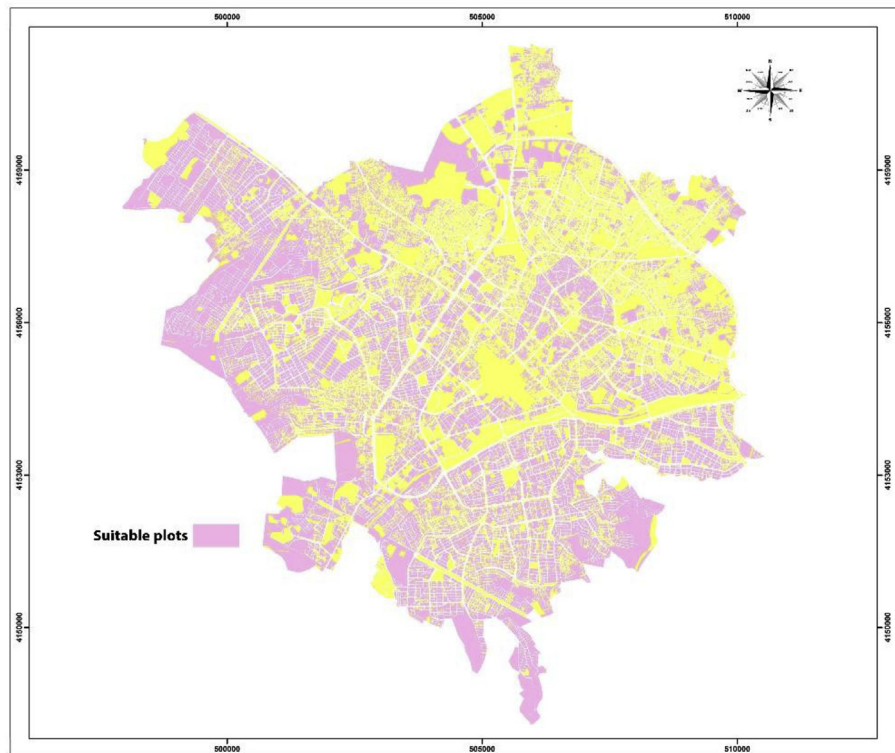


Fig. 7. Suitable plots for Infill Development in Urmia City.

shows that 29.98 km² of the city of Urmia are in a class of entirely suitable and then with little difference of 29.80 km² located in a class of suitable. And a class of relatively suitable contain 19.67 km² of Urmia city in it. Thus it can be seen that the majority of the city of Urmia placed in the class of suitable class of entirely suitable (Table 3 and Fig. 8).

4.6. Scenario 6: low level of risk –no tradeoff

This scenario is similar to the AND operator in the Boolean method. Thus, this operator acts as a very strict and has a cynical view (Pessimistic look) to the matter. So in the result of this scenario rating of the suitability in many areas is decreased. And many areas (49.05km) is located in a class of entirely unsuitable (Table 3 and Fig. 8).

This study aimed to identify the suitable plots for infill development to achieve urban sustainability in Urmia city. What distinguishes the present research from previous studies is the method of work and measurement tools, which uses an updated method to explain the capacity of infill development in growing Metropolitans in Iran (Urmia). In this regard, the present study uses a new and more accurate model and method, and using indicators and more details on the scenario to reach the research objectives. Finally, the OWA method in combination with the AHP model provides more accurate results.

5. Conclusions

Findings from the measurement of the potential for infill development in Urmia show that the significant parts of Urmia have a good potential for infill development. Therefore, in this section, the overlapping of these desirable areas and suitable plots for infill development is discussed. It should be noted that Boolean logic acts rigorously, which results in the loss of information and fidelity in the analyze, and also the OR operator is very optimistic, and this leads to a large amount of locating, so in this section, these two operators have been ignored.

Considering the materials mentioned above, the findings of the research show that most of the plots with the potential for infill development in the four scenarios are mainly in region 1 and region 2 of Urmia. As in the low risk and some trade-off scenario, most of the plots in the entirely suitable class are in region 1 with an area of 4.5710 km², and then the plots in the entirely suitable class are in region 3 with an area of 3.5581 km². In the high risk and some trade-off scenario, the plots in the entirely suitable class are in region 3 with an area of 6166 km², and then the plots in the entirely suitable class are in district 1 with an area of 18,595 km² and In the average risk and no trade-off scenario major plots that have the potential for infill development are in entirely suitable class in region 3 with an area of 5943/6 km² and then in region 1 with an area of 5768/5 km². Also, in the average risk and the full trade-off scenario, most of the plots in the entirely suitable class are located in region 1 and then located in region 3. In quadruple scenarios, from relatively suitable to entirely suitable classes, region 3 with a large number of suitable developmental components has the

Table 3
Area of desirable areas in Urmia for infill development (km²).

Row	Desirability	Scenario 1: High Risk - No Balance	Scenario 2: High Risk - Some Balance	Scenario 3: Medium Risk - Full Balance	Scenario 4: Medium Risk - No Balance	Scenario 5: Low risk-some balance	Scenario 6: Risk Down - No Balance
Region 1	Entirly unsuitable	0	0.2179	0.2691	2.7328	0.2540	49.0514
Region 2	Relatively unsuitable	0.3658	2.1787	2.9048	2.1383	5.2785	11.3503
Region 3	Suitable	0.2436	6.4449	9.4659	3.6205	29.8046	9.3888
Region 4	Relatively suitable	0.6794	40.3332	32.5972	8.6224	19.6740	8.6486
Region 5	Entirly suitable	84.0508	35.8207	39.7670	67.8871	29.9879	6.5722

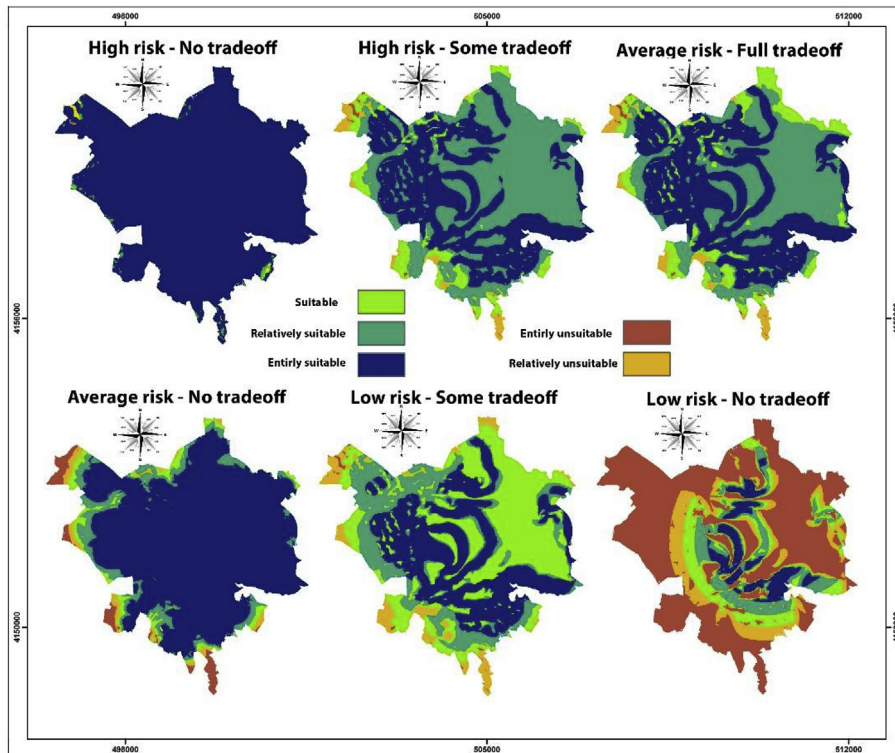


Fig. 8. 6 scenarios of areas susceptible to infill development in Urmia.

desired potential for intermediate expansion to other areas. In quadruple scenarios, from the relatively suitable to entirely suitable classes, Region 3 has the most number of suitable plots, so region 3 has the most desired potential for infill development to other areas. And after this region, Region 1 has the most number of suitable plots for infill development. Also, the results show that in the

Table 4
Plots with Potential for infill Development in Regions of Urmia city.

Region	Suitability	Scenario 2 High level of risk –Some tradeoff	Scenario 3 Average level of risk -Full tradeoff	Scenario 4 Average level of risk -No tradeoff	Scenario 5 Low level of risk –some tradeoff
Region 1	Entirely unsuitable	0.0284	0.7578	0.3571	0.0354
	Relatively unsuitable	0.6610	0.2987	0.8553	1.1957
	Suitable	1.1751	0.6042	1.2170	2.3902
	Relatively suitable	3.5269	1.3161	2.8971	2.2902
	Entirely suitable	5.1895	7.6055	5.5768	4.5710
Region 2	Entirely unsuitable	0.00	0.0016	0.0000	0.00
	Relatively unsuitable	0.0073	0.0832	0.0079	0.2126
	Suitable	0.3517	0.4817	1.0146	2.0068
	Relatively suitable	2.6399	0.8408	1.7781	1.3598
	Entirely suitable	1.6483	3.2108	1.8455	1.0675
Region 3	Entirely unsuitable	0.0888	0.6250	0.9309	0.0861
	Relatively unsuitable	0.4722	0.6714	0.5478	0.9613
	Suitable	1.3489	0.9794	1.3905	2.4317
	Relatively suitable	3.3030	2.1986	2.7881	4.3780
	Entirely suitable	6.2016	6.9418	6.5943	3.5581
Region 4	Entirely unsuitable	0.00	0.00	0.00	0.00
	Relatively unsuitable	0.00	0.00	0.00	0.00
	Suitable	0.00	0.00	0.0087	2.7999
	Relatively suitable	3.7397	0.0182	3.3598	0.5158
	Entirely suitable	0.3181	4.0396	0.6892	0.7420
Region 5	Entirely unsuitable	0.0185	0.3582	0.2739	0.0265
	Relatively unsuitable	0.1612	0.2342	0.3481	0.6377
	Suitable	0.8045	0.2928	0.7513	1.4433
	Relatively suitable	1.6816	0.3187	1.4046	0.4696
	Entirely suitable	1.5221	2.9859	1.6566	1.6105

scenarios, the existing plots in region 4 are not in entirely unsuitable and relatively unsuitable classes; this represents the optimal distribution of plots in region 4. (see Table 4).

One of the most important issues in the growing metropolitans is urban sprawl. Due to the considerable impact of a city's form on its stability, it is necessary to study and understand its various dimensions and guide it towards sustainable development. Land, the most important factor of development and how it is used, is one of the most important issues of urban planning. Urban development policies and the maintenance of land around cities have been a major challenge for urban planners in recent decades. And the infill development policy has a major focus on this issue.

This research uses the mentioned method, Provides scenarios for decision makers, planners and urban managers of Urmia. To the urban managers, taking into account the current conditions, Use these scenarios to prevent the urban sprawl in Urmia. In general, the results of this research can be summarized in two sentences and offer some suggestions for its effectiveness; 1- District 3 of Urmia has a large number of suitable plots for infill development and is located after this region, region 1 of this city. 2-Distribution of plots in region 4 is desirable. After recognizing the problem, analyzing and concluding, the authors of this research offer some suggestions to improve the status quo and move towards sustainable development in Urmia city. It is suggested that urban development organizations such as the municipality should monitoring and control the urban sprawl in Urmia city (Considering the growing urban dispersion over the past five years in Urmia). And it is utilizing appropriate management and infill development to prevent the city from spreading to the surrounding area of the city because the Urmia city has many potentials for infill development. Implementation of infill development in Urmia has huge economic benefits for the city and has environmental benefits as well. Urmia Municipality and Urban Management can also provide incentives for residents, especially in worn out buildings. By restoring old and destroyed buildings and repairing and repairing tissues, the cost of services can be significantly reduced. Also, urban management due to the low density of construction and population in Urmia attempts to increase density to reduce the expansion of the city to the periphery. It should be noted that reviewing urban plans and making them flexible, such as zoning laws, is one of the challenges of infill development. It is also suggested that disturbing and incompatible uses of historical textures (such as government offices, coal depots, industrial workshops, dyeing workshops, etc.) should be transferred from the area of the main city center to the outside It is advisable to use more factors in future research in this field if information is available.

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