Suitability Analysis for Determining Potential Agricultural Land Use by the Multi-Criteria Decision Making Models SAW and VIKOR-AHP (Case study: Takestan-Qazvin Plain)

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ABSTRACT

Suitability analysis is a prerequisite for sustainable agricultural production and it involves evaluation of the environmental parameters. The development and creation of appropriate points for this land use without considering environmental capability will result in the appearance of several ecological, economic, and social problems. The Multi-Criteria Decision Making (MCDM) Models were used for solving such problems. Takestan-Qazvin region is one of the biomes that have difficulties due to lack of a systematic administration on environmental resources. This research was done in the framework of the ecological model and by using multicriteria decision making methods such as Analytic Network Process (ANP), Simple Additive Weighting (SAW) and Vlse Kriterijumska Optimizacija I Kompromisno Resenje - Analytical Hierarchy Process (VIKOR-AHP)in GIS environment with the aim of choosing the suitable locations for agricultural land use in Takestan-Qazvin Plain. However, the purpose of this study was twofold: first, it was aimed at determining the ecological capability of agricultural land use by using ANP and SAW methods. Second, the suitable agricultural alternatives in this region were ranked using the integrated VIKOR and AHP models. In these methods, the ratings and the weights of the criteria are known precisely. Ecological factors such as physical and biological parameters and economic - social factors were chosen as the major criteria affecting the agriculture land use. The research indicated that north parts of the study area were not suitable for agricultural development. Finally, the conclusion showed that the application of decision making models could be useful in environmental capacity evaluation of agricultural land use.

Keywords: Analytic network process, Ecological evaluation, Environmental criteria, GIS, Simple additive weighting method.

INTRODUCTION

Suitability analysis has been referred to as one of the most useful tools provided by GIS (McHarg, 1995). Malczewski (2004) describes this tool as "land suitability analysis assumes that there is a given study area and the area is subdivided into a set of basic units of observations such as polygons (areal units) or raster. The landuse suitability problem involves evaluation and classification of the areal units according to their suitability for a particular activity. Agricultural sustainability refers to the ability of a farm to produce food indefinitely, without causing irreversible damage to ecosystem health (Asadi *et al*., 2013). Nevertheless, agricultural land suitability analysis is a prerequisite to achieve optimum utilization of the available land resources for sustainable agricultural production (Nisar Ahamed *et al*., 2000). Agricultural land suitability classification

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based on indigenous knowledge is vital to land-use planning– the systematic assessment of environmental capability alternatives for land use and socio-economic conditions in order to select and put into practice those land uses that will best meet the needs of the people while safeguarding resources for the future (FAO, 1993). Therefore, land evaluation is an integrated process for evaluating potential land productivity and land suitability for varied purposes.

Since agriculture has enormous environmental impacts on peri-urban regions, it is necessary to evaluate agricultural land use. Thus, it has been shown that identification and mapping of ecological factors are important to agricultural land suitability classification. It is even more useful when they are integrated with scientific methods of land evaluation, which can be achieved effectively through application of the Analytic Network Process (ANP), Simple Additive Weighting (SAW), Vlse Kriterijumska Optimizacija I Kompromisno Resenje-Analytical Hierarchy Process (VIKOR-AHP) and geographic information systems (Sicat *et al.*, 2005). Many traditional Multi-Criteria Decision Making (MCDM) methods are based on the additive concept along with the independence assumption, but each individual criterion is not always completely independent (Leung *et al.*, 2003; Shee *et al.*, 2003). To solve the interactions among

elements, the ANP was proposed as a relatively new MCDM method by Saaty (1996). The ANP is a mathematical theory that can deal with all kinds of dependence systematically (Saaty, 1996). The SAW, which is also known as weighted linear combination or scoring methods, is a simple and the most often used multi attribute decision technique. The method is based on the weighted average.

The VIKOR method was developed to solve MCDM problems with conflicting or non-commensurable criteria. This method assumes that compromising is acceptable for conflict resolution. Although the method is a popular method applied in multi-criteria analysis (MCA), it has some problems when solving MCDM problems (Chang, 2010). The objective of the present study was to evaluate the arable land suitability using the decision making models such as ANP, SAW, and VIKOR. In this paper, we determine agricultural land suitability classifications using case spatial data sets from Takestan-Qazvin Plain.

MATERIALS AND METHODS

Study Area

The study area was the Takestan-Qazvin Plain, which is spread over 206,000 ha, located in central part of Iran at 36° N to 36°
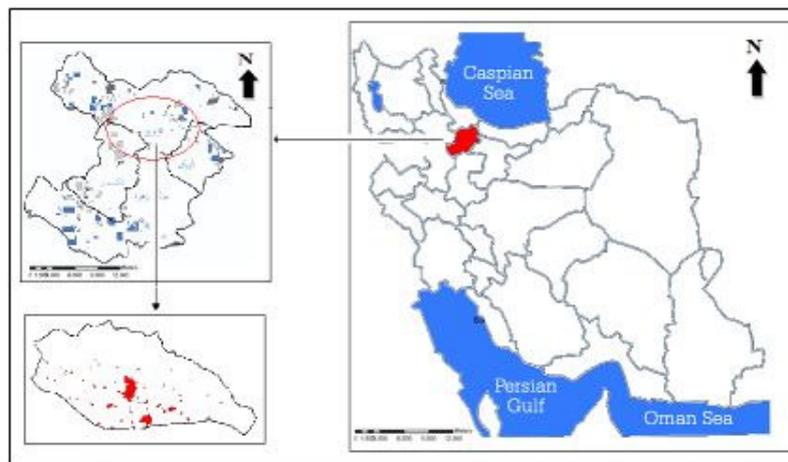

Figure1. The position of Takestan-Qazvin Plain in Qazvin Province of Iran.

30' N latitude, and 49° 30' E to 50° 30' E longitude, as shown in Figure 1.

Analysis and Data Classification

To achieve the goals of this research, common techniques of planning and management were studied and assessed, while GIS tools and a planning and management combination model (Grant, 1998) were selected for evaluation. The parameters studied are as follows:

- Physical parameters: Landform (slopes and elevation), Water resources (underground and surface water), Soil (soil type, texture, drainage, depth, fertility and erosion), and Climate (precipitation, humidity and temperature)

- Biological parameters: Vegetation density, wildlife (zoning of protected area).

- Socio-Economic parameters: Population, literacy, employment, centrality (the distance of urban points), crop area, accessibility type.

Slope and elevation maps were prepared from topographic maps of the National Cartographic Center, Hydrology and water data were obtained from the Ministry of Energy. The basis for vegetation map was obtained from the Planning and Management Organization; soil map was provided by the Soil and Water Research Institute; and the information about the protected area in Qazvin plain was obtained from Department of the Environment in Qazvin Province. The plan map of Qazvin region and public census maps were provided by Statistical Center of Iran (population and road networks) and accuracy of obtained maps was estimated with field inspection and similar-scale maps were prepared using GIS. Analysis process and data classifications for achieving environmental units at the studied area were obtained by overlaying the prepared maps and recognition was performed with GIS.

Then, a proper ecological model for evaluating the suitability of the studied area for agricultural land use within the Iranian special ecological models frame (Makhdoum, 1999) was prepared based on existing data, indicating the special conditions of the study region on a six-rank valuation scale (extremely high, high, medium, low, very low, and not suitable zones) for agricultural land use.

Suitability Analysis by Using MCDM

The MCDM is frequently used to deal with conflicting problems in management (Ou Yang *et al*., 2009). Therefore, multi-criteria analysis is effective for determining the best solution among several alternatives according to multiple attributes or criteria. Factor analysis is a statistical method which integrates a large number of variables that have intricate relationships (Chu *et al.*, 2013). In recent years, multiple criteria optimization has been widely applied in environmental resource management (Bryan and Crossman, 2008; Chung and Lee, 2009).

Since there are several criteria for evaluating the agricultural land use, multi-criteria analysis was applied as a technique for solving these problems in this study. The objective of this research was to analyze land suitability based on multi criteria decision making using ANP, SAW, and VIKOR-AHP. The process for the evaluation, determination and selection of appropriate agriculture points in the study area included the following steps that are presented in Figure 2.

The Simple Additive Weighting Method

The SAW is probably the best known and most widely used multi attribute decision technique (Azar, 2000). In this paper, the SAW method is suggested to solve suitability evaluation problems using the multi-criteria decision-making process. The method is based on the weighted average. An evaluation score is calculated for each alternative by multiplying the scaled value given to the alternative of that attribute with the weights of relative importance directly
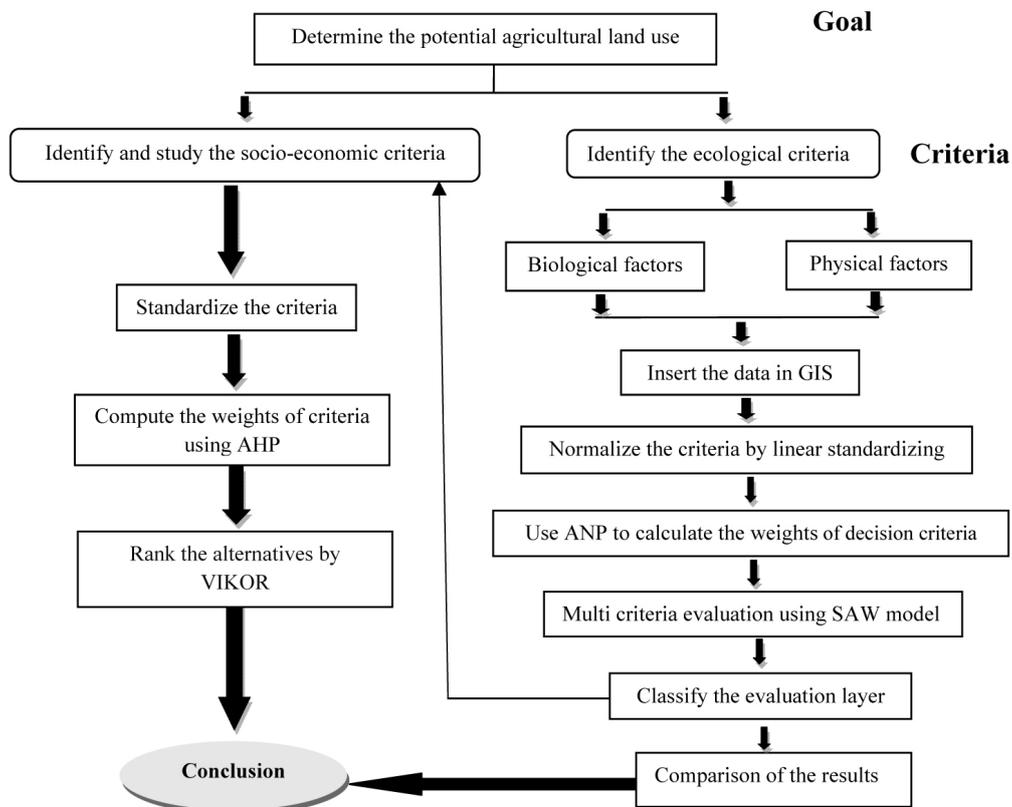
Figure 2. Main stages of the research**.**

assigned by decision maker followed by summing of the products for all criteria. The advantage of this method is that it is a proportional linear transformation of the raw data, which means that the relative order of magnitude of the standardized scores remains equal (Afshari *et al*., 2010). The SAW process consists of these steps:

Step 1: Calculating the Weights of Decision Criteria

In this step, the ANP process is used to evaluate the weights of the criteria. Saaty (1996) proposed the ANP as a new MCDM method (Wu, 2008). This method is a mathematical theory that can systematically overcome all kinds of dependence. The ANP method includes two major phases: in the first phase, pairwise comparisons for each of the dependency relationships are performed to generate the relative importance weights, and in the second phase, the supermatrix calculation is split into three minor parts: the

formation of the supermatrix, the normalization of the supermatrix, and the convergence to the solution. The converged supermatrix can reveal the information of the relative priorities for each of the alternatives (Tsai and Chou, 2009; Saaty, 1996). This ANP model is solved using the SuperDecisions software. The model can be described in the following steps (Ou Yang *et al*., 2009):

1. Creating the Analysis Model

In this stage, the effective criteria constitute a network structure in the final decision making (Figure 3).

2. Pairwise Comparisons

The pairwise comparisons of the elements within each cluster are conducted to form pairwise comparison matrices. In doing so, the valuation scales recommended by Saaty (1996) are ranked as follows: 1 is of equal importance, 3 is of moderate importance, 5 is of strong importance, 7 is of very strong or
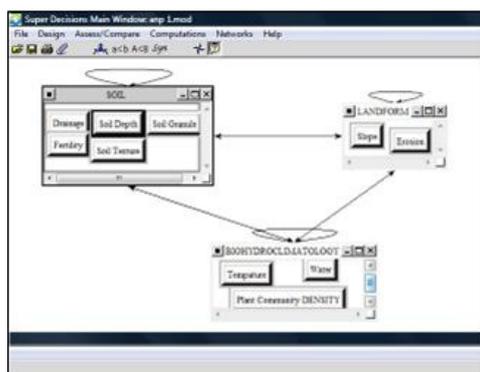
Figure 3. Relationship structure among the criteria.

demonstrated importance, and 9 is of extreme importance. Even numbered values are placed between the above importance levels. Reciprocal values e.g. 1/5, 1/7 refer to, respectively, less important, strongly less important, and so on. After the conclusion of the pairwise comparisons, the relative importance weight for each component is calculated by using MATLAB software, and with A as the pairwise comparison matrix, the weights are evaluated through the expression $Aw = l_{max}w$.

Where, l_{max}, is the largest eigenvalue of A; w, refers to the eigenvectors for the principal Eigen value l_{max}, which is also the priority vector of the elements.

For data consistency, a consistency index (CI) and consistency ratio (CR) must be examined: $CI = (l_{max} - n)/(n-1)$, where n refers to the number of components listed in the pairwise comparison matrix; and CR is calculated by dividing CI with a random inconsistency (RI) value. The RI value can be found in most AHP and ANP reference books. The pairwise comparison matrix will be consistent when $CR < 0.10$. The comparison weights can also be obtained by AHP/ANP software such as Expert Choice.

3. Formation of an Unweighted Supermatrix through Pairwise Comparisons

The supermatrix is formed by using the priority vectors of each pairwise comparison matrix.

4. Obtaining the Weighted Supermatrix by Multiplying the Normalized Matrix

Normalization is used to derive the weighted supermatrix by transforming each column to sum exactly to unity.

5. Calculating the Overall Priorities with the Limiting Process Method

The weighted supermatrix can be raised to limiting powers until the supermatrix has converged and become a long-term stable supermatrix to get the global priority vectors, also called weights.

Step 2: Standardize the Decision Matrix

The decision matrix (m×n) includes m alternatives and n criteria. Calculating the normalized decision matrix for positive criteria:

$$n_{ij} = \frac{r_{ij}}{r_j^{max}} \quad i=1,\ldots, m \; j=1,\ldots, n \qquad (1)$$

And for negative criteria:

$$n_{ij} = \frac{r_j^{min}}{r_{ij}} \quad i=1,\ldots, m \; j=1,\ldots, n \qquad (2)$$

Step 3: Evaluate the Decision Criteria

The procedure for combining the criteria for this analysis in the form of a weighted linear combination can be expressed in the following equation (Eastman, 2006):

$$A_i = \sum w_j x_{ij}$$

Where, x_{ij} is the score of the ith alternative with respect to the jth criterion, w_j is the weight of jth criterion. In the next stage, agricultural land use classes are distinguished on the evaluation map by using histogram, break values, average and standard deviation of suitability values.

Integrated VIKOR and AHP Method

The MCDM provides an effective framework for comparison based on the evaluation of multiple conflict criteria (Vahdani *et al*., 2010). The VIKOR method was developed as a MCDM method to solve problems with conflicting or non-commensurable criteria (Opricovic and Tzeng, 2004). In the proposed methodology, the decision makers' opinions on the relative importance of the selection criteria are determined by an AHP procedure.

First, alternatives with agricultural suitability are selected to random form using Thiessen function in ArcGIS. Then, ecological, socio-economic criteria are weighted and alternatives are ranked using the integrated VIKOR-AHP method. The compromise-ranking algorithm of the traditional VIKOR has the following steps (Chang and Hsu, 2009; Ou Yang *et al.*, 2009; Chang, 2010).

Step 1: Structure of the Decision Matrix

Denote *m* alternatives under consideration as A_1, A_2, ..., A_m, the n evaluation criteria as C_1, C_2, ..., C_n, and the rating of each alternative as A_j, $j = 1$, ..., m versus criteria C_i, $i = 1$, ..., *n* as f_{ij} matrix (Table 1).

Step 2: Normalizing the Original Rating Matrix

The original rating matrix is transformed into a normalized weight-rating matrix with the following formula:

$$f_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{m} x_{ij}^2}} \quad i = 1, 2, \ldots, n;\ j = 1, 2, \ldots, m \quad (3)$$

Step 3: Determining the Best f_i^* and the Worst f_i^- Values of All Criterion Functions, $i = 1, 2, \ldots, n$.

Assuming the ith function represents a benefit:

$$f_i^* = \max_j f_{ij} = \max [(f_{ij}) | j = 1, 2, \ldots, m] \quad (4)$$

$$f_i^- = \min_j f_{ij} = \min [(f_{ij}) | j = 1, 2, \ldots, m] \quad (5)$$

Alternatively, assuming the jth function represents a cost:

$$f_i^* = \min_j f_{ij} = \min [(f_{ij}) | j = 1, 2, \ldots, m] \quad (6)$$

$$f_i^- = \max_j f_{ij} = \max [(f_{ij}) | j = 1, 2, \ldots, m] \quad (7)$$

Step 4: Compute the Values S_j and R_j, $j = 1$, 2, …, m

$$S_j = \sum_{i=1}^{n} w_i \left(f_i^* - f_{ij} \right) / \left(f_i^* - f_i^- \right) \quad (8)$$

$$R_j = \max_i [w_i \left(f_i^* - f_{ij} \right) / \left(f_i^* - f_i^- \right)] \quad (9)$$

Where, S_j and R_j represent the utility measure and the regret measure, respectively, for the alternative x_j. w_i are the weight of ith criterion and is derived using the AHP in Expert Choice software, which represents the relative importance of criterion.

Step 5: Compute the index values Q_j, $j = 1$, 2, …, *m*

$$Q_j = v (S_j - S^*)/ (S^- - S^*) + (1-v) (R_j - R^*)/(R^- - R^*) \quad (10)$$

$$S^* = \min [(S_j) | j = 1, 2, \ldots, m] \quad (11)$$

$$S^- = \max [(S_j) | j = 1, 2, \ldots, m] \quad (12)$$

$$R^* = \min [(R_j) | j = 1, 2, \ldots, m] \quad (13)$$

$$R^- = \max [(R_j) | j = 1, 2, \ldots, m] \quad (14)$$

Where, *v* is the weight for the strategy of maximum group utility and $1-v$ is the weight of the individual regret. *v* is usually assumed to be 0.5 (Kackar, 1985; Opricovic, 1998).

Step 6: Rank the Alternatives by Sorting Each S_j, R_j, and Q_j Values in an Increasing Order

The less the value of Q_j is, the better decision of the alternatives. Since it provides a maximum group utility of the "majority" and a minimum individual regret of the "opponent", the obtained compromise solution is acceptable by decision makers (Opricovic and Tzeng, 2007; Tong *et al.*, 2007).

RESULTS AND DISCUSSION

Analyzing the criteria objectively involved using specific GIS techniques to break the analysis down into quantifiable

Table 1. The decision matrix.

Criteria	Alternatives					
	A_1	A_2	A_3	A_4	A_5	A_6
population	2248	3283		75121	92240	59661	7215
Literature (%)	75	78		87	94	90	89
Engagement (%)	43	46		54	63	59	57
Centrality	21.63	16		7.5	5.8	10.4	13.6
Accessibility type	5	10		14	6	10	10
Crop area (ha)	75	270		211	8	74	68
Agriculture capability	0.85	0.99		0.90	0.80	0.90	0.14

measurements. From the available 10 m interval contour map of the study area in ArcGIS, a contour Digital Elevation Model (DEM) (Figure 4) was generated, from which a grid DEM was derived and the slope data were obtained (Figure 5). The reclass tool is then used to reclassify all the variable data sets by the Iranian ecological model. Specific ecological models for agricultural land use evaluation are adopted using Structured Query Language (SQL), and in the next stage, the capability of each environmental unit was evaluated and mapped. However, the parameters in these methodologies will be interpolated and reclassified as a set rule for the suitability analysis of agricultural land use. Slope is one of the observed parameters in estimation of appropriate agricultural points. Slopes between 0-15% are suitable and that

includes 64% of the area. The temperature, humidity, and precipitation data were generated from climatic data (Figure 6), based on Excel spreadsheets and links to GIS layers for zoning. The research showed that the climate and water resources of the region were suitable for development. Soil is an important criterion in the evaluation of appropriate agricultural points, but its quality was not suitable for agriculture in north parts of the study area (Figures 7 and 8).

In this study, the ANP process was used to evaluate the weights of the criteria. Using the structure of Figure 3, the unweighted supermatrix, M was obtained (Table 2). This unweighted supermatrix includes interactions between clusters, e.g. there is inner dependence among perspectives (criteria). In the next step, normalization was
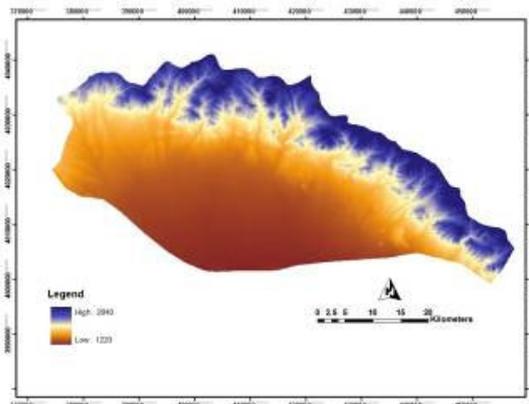

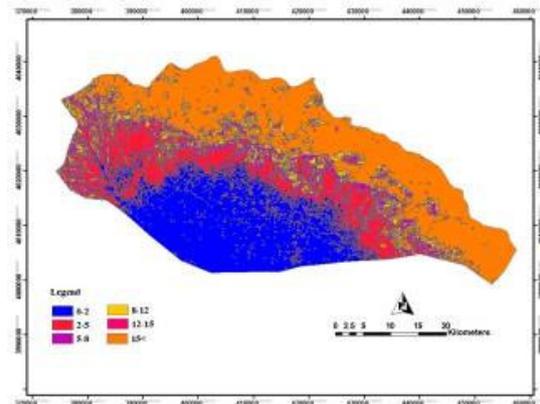**Figure 4.** Digital Elevation Model of the studied region.

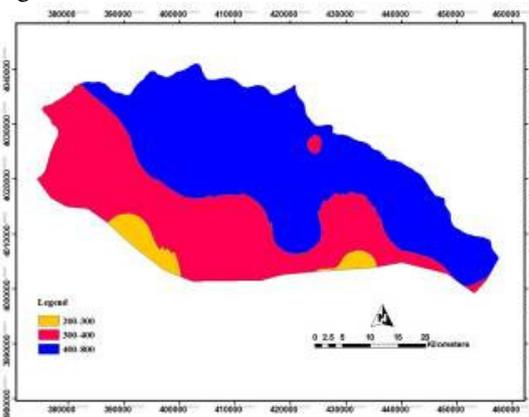**Figure 5.** Slope map of the studied region.

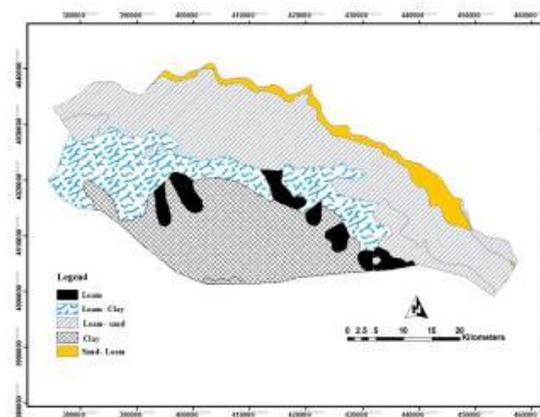**Figure 6.** Average precipitation of the studied region.

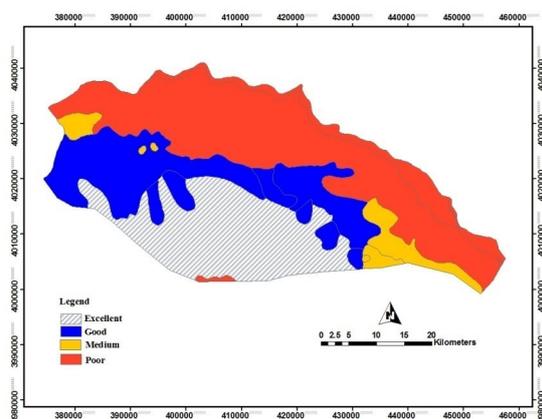**Figure 7.** Soil texture of the studied region.

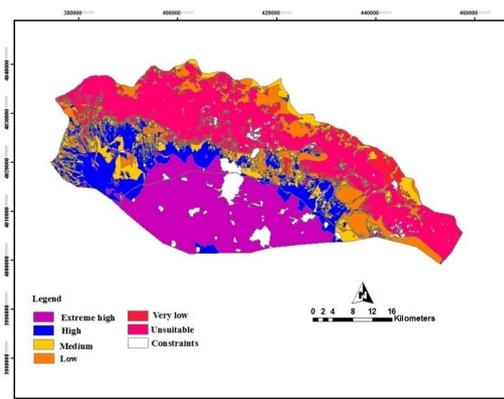**Figure 8.** Soil fertility of the studied region.

Figure 9. Evaluation model of land suitability for Potential agricultural Land use by Multi-Criteria Decision Making Model of SAW in the studied region.

Table 2. The limit supermatrix, M^L.

Clusters and Elements		C_1					C_2			C_3	
		e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}
	e_1	0	0	0	0	0	0.50	0.25	1	0.50	0
	e_2	0	0	0	0.33	0.50	0	0	0	0	0
C_1	e_3	0	0	0	0.33	0.50	0	0	0	0	0
	e_4	0	0	0	0.33	0	0	0	0	0	1
	e_5	0	0	0	0	0	0.50	0.75	0	0.50	0
C_2	e_6	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0	0.1	0.50
	e_7	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0	0.90	0.50
	e_8	0	0	0	0	0	1	1	0	1	0
C_3	e_9	1	1	1	1	1	0	0	0.50	0	1
	e_{10}	0	0	0	0	0	0	0	0.50	0	0

M^L = Limit Supermatrix

used to derive the weighted supermatrix, M^W by transforming each column to sum exactly to unity (Table 3). Then, the overall priorities were obtained from the limit supermatrix (Table 4). The final weight of the criteria was obtained by multiplying the limit supermatrix, M^L elements in final weight of cluster (Table 4). This ANP model was solved using the SuperDecisions software. Finally, the decision maker obtained a total score for each alternative by multiplying the scale rating for each attribute influenced by the weights based on their importance, then, summing with all the attributes.

Afterwards, by reclassifying, this study suggests that the land should be divided into

different zones on the basis of suitability for agriculture, i.e. extremely high, high, medium, low, very low and not suitable zones (Figure 9).

Ranking the Alternatives

This study finally used the VIKOR method to aggregate the ecological and socio-economic criteria to obtain the ranking index. In this stage, a number of points, with agricultural capability, were distinguished to random form using Thiessen function in ArcGIS (A_1, A_2, A_3, A_4, A_5 and A_6 polygons) (Figure 10). Then, the suitable alternatives for agricultural land use were

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Table 3. The unweighted supermatrix, M^a.

Clusters[b] and Elements[c]		C_1					C_2		C_3		
		e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}
	e_1	0	0	0	0	0	0.167	0.083	0.50	0.167	0
	e_2	0	0	0	0.216	0.323	0	0	0	0	0
C_1	e_3	0	0	0	0.216	0.323	0	0	0	0	0
	e_4	0	0	0	0.070	0	0.167	0	0	0	0.333
	e_5	0	0	0	0	0	0.167	0.250	0	0.167	0
C_2	e_6	0.199	0.199	0.199	0.216	0.070	0	0.167	0	0.033	0.167
	e_7	0.199	0.199	0.199	0.070	0.070	0.167	0.167	0	0.30	0.167
	e_8	0	0	0	0	0	0.333	0.333	0	0.333	0
C_3	e_9	0.603	0.603	0.603	0.213	0.213	0	0	0.250	0	0.333
	e_{10}	0	0	0	0	0	0	0	0.250	0	0

[a] Unweighted Supermatrix, [b]C_1= Soil; C_2= Landform, C_3= Biohydroclimatology.
[c] e_1= Soil fertility; e_2= Soil texture; e_3= Soil depth; e_4= Soil drainage; e_5= Soil granulation; e_6= Soil erosion; e_7= Slope; e_8= Vegetation density; e_9= Water quantity, e_{10}= Temperature.

Table 4. The weighted supermatrix, M^W.

Clusters and Elements		C_1					C_2		C_3			Weights
		e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}	
	e_1	0.146	0.146	0.146	0.146	0.146	0.146	0.146	0.146	0.146	0.146	0.150
	e_2	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.035
C_1	e_3	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.035
	e_4	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.018
	e_5	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.096
C_2	e_6	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.109	0.133
	e_7	0.164	0.164	0.164	0.164	0.164	0.164	0.164	0.164	0.164	0.164	0.200
	e_8	0.159	0.159	0.159	0.159	0.159	0.159	0.159	0.159	0.159	0.159	0.131
C_3	e_9	0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.169
	e_{10}	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.033

M^W=Weighted Supermatrix

ranked through integrating the agricultural suitability value and socio-economic criteria.

Alternatives are ranked using the VIKOR-AHP method with the data from Table 5 and

Figure 10. The proposed points for the ranking of alternatives in the studied region.

sets of weight values. The obtained results are presented in Table 6.

The ranking results in Table 6 indicate that alternative A_4 is the best ranked. The ranking list by VIKOR in declining order is A_4, A_3, A_2, A_5, A_1, and $A6$.

CONCLUSIONS

In this study, a MCDM methodology for land use evaluation was applied. In MCE, a GIS was used to combine biophysical and socio-economic characteristics for land evaluation and multi-criteria evaluation. The purpose of this study was to analyze certain spatial characteristics of the land in Takestan-Qazvin Plain by the use of a
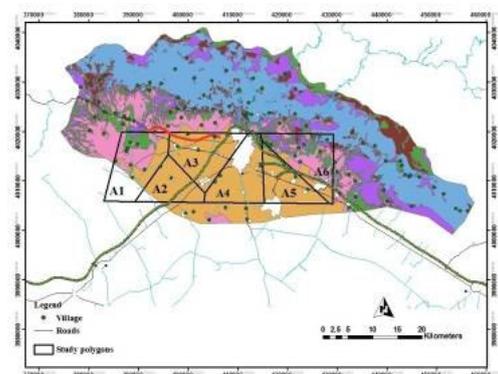
Table 5. Normalized decision matrix.

Criteria	Weights	Alternatives					
		A_1	A_2	A_3	A_4	A_5	A_6
population	0.614	0.017	0.025	0.563	0.692	0.447	0.054
Literature	0.268	5.625	5.850	6.525	7.050	6.750	6.675
Engagement	0.117	3.225	3.450	4.050	4.725	4.425	4.275
Centrality	0.667	0	0	5.625	4.350	7.8	0
Accessibility type	0.333	3.750	7.5	0	4.5	7.5	7.5
Crop area	0.250	0	0.002	0.002	6	0	0
Agriculture capability	0.750	6.370	7.420	6.750	6	6.750	1.050

Table 6. Ranking by VIKOR[a].

	Alternatives					
	A_1	A_2	A_3	A_4	A_5	A_6
S_j [b]	0.570	0.407	0.394	0.210	0.410	0.895
R_j [c]	0.165	0.163	0.154	0.103	0.154	0.461
Q_j [d]	0.350	0.228	0.206	0	0.218	1

[a] Vlse Kriterijumska Optimizacija I Kompromisno Resenje, [b] Utility measure, [c] Regret measure, [d] VIKOR index

suitability analysis model created in ArcGIS, in order to determine the suitable locations for agricultural use.

Using the ANP approach for selecting the suitable locations for Agriculture were selected by the explicit priority weights of among criteria using the ANP approach. The SAW method is proposed as a tool for preliminary analysis, which can provide valuable information about the evaluation. However, the benefits of land evaluation using GIS techniques led to estimates that 98,598.2 ha (about 50%) and 61,244.35 ha (30.76%) of the land had extremely high suitability to medium suitability, and no suitability, respectively, for agriculture. Parts of this land had no production potential or lacked agricultural values. This situation in high regions is due to high slope, elevation, and unsuitable soil conditions. To rank the alternatives, the VIKOR method was used. The results showed that the proposed methods were suitable and effective in real-world applications.

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آنالیز تناسب برای تعیین کاربری بالقوه کشاورزی با مدل های تصمیم گیری چند معیاره SAW و VIKOR-AHP(مطالعه موردی: دشت تاکستان- قزوین)

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چکیده

آنالیز تناسب پیش شرط تولید پایدار کشاورزی است و مستلزم ارزیابی پارامترهای زیست محیطی می باشد. توسعه و پیدایش نقاط مناسب برای این کاربری بدون توجه به توان زیست محیطی، مشکلات اکولوژیکی، اقتصادی و اجتماعی را به دنبال خواهد داشت. مدل های تصمیم گیری چند معیاره (MCDM) برای حل چنین مسائلی استفاده شدند. دشت تاکستان- قزوین یکی از سرزمین هایی است که به دلیل عدم مدیریت اصولی در رابطه با منابع زیست محیطی دارای مشکلاتی است. این تحقیق در چهارچوب مدل اکولوژیکی و با استفاده از روش های تصمیم گیری چند معیاره همچون فرآیند تحلیل شبکه ای (ANP)، روش وزن دهی ساده (SAW) و راه حل توافقی و بهینه سازی چند معیاره - فرآیند تحلیل سلسله مراتبی (VIKOR-AHP) در محیط GIS، با هدف تعیین نقاط مناسب برای کاربری کشاورزی در دشت مذکور انجام شد. در هرصورت، هدف این مطالعه دو چیز است: اول: توان اکولوژیکی کاربری کشاورزی با کمک روش های ANP و SAW تعیین شدند. دوم: گزینه های مناسب کشاورزی در این منطقه توسط مدل تلفیقی VIKOR و AHP رتبه بندی گردیدند. در این روش ها، درجه و وزن معیارها به دقت شناسایی می شوند. فاکتورهای اکولوژیکی همچون فاکتورهای فیزیکی و زیستی و پارامترهای اقتصادی- اجتماعی به عنوان معیارهای اصلی تأثیرگذار در کاربری کشاورزی انتخاب شدند. این تحقیق نشان داد که بخش های شمالی برای کاربری کشاورزی مناسب نیستند. سرانجام، نتایج نشان داد که بکارگیری مدل های تصمیم گیری در ارزیابی توان کاربری کشاورزی می تواند مفید باشد.