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RESEARCH PAPER

Developing a Land Suitability Model for Cereals in the Algerian Sahara Using GIS and Hierarchical Multicriteria Analysis

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Abstract

Koull, N., Helimi, S., Mihoub, A., Mokhtari, S., Kherraze, M.E., and Aouissi, H.A. 2022. Developing a Land Suitability Model for Cereals in the Algerian Sahara Using GIS and Hierarchical Multicriteria Analysis. Int. J. Agric. Nat. Resour. 36-50. Determining land suitability is a preliminary procedure to define and determine land fitness for a given type of production. A suitability analysis performed with inadequate methods will not guarantee a successful or significant process. The current attempt to consider new strategies and techniques for the Algerian agricultural systems comes as a part of a process of reflection that aims to understand the land resource planning process for agriculture, specifically in Ouargla, Algeria. The aim of the study is also to present a process that is based on the use of geographic information systems (GIS) and hierarchical multicriteria analysis; this process has demonstrated its relevance to the understanding of complex spatial problems. The suggested approach provides an information reference for the construction of soil suitability maps for cereals in N'Goussa at Ouargla. Farming factors, such as the slope, soil characteristics, electrical and road networks, and land occupation, were integrated into the soil suitability map for cereals by using the geographic information system. Multiplying the weighted coefficients linked to these factors allows for a global land suitability map. The obtained results allow for the prioritization of the sites into four classes: high suitability, moderate suitability, low suitability and unsuitability. In fact, 60.06% of the total area is moderately suitable for cereals.

Keywords: Algeria, arid area, cereal, Geographic Information Systems, GIS, hierarchical multicriteria analysis, land suitability.

Introduction

The reasonable development of a territory requires thorough knowledge of the physical characteristics of the land. However, these intrinsic data are not sufficient. This is because agricultural production is particularly dependent on land characteristics (Morelle & Lejeune, 2000; Tuğrul, 2019). Therefore, it is necessary to consider the suitability of the land for the planned uses.

The effectiveness of land suitability analysis has been universally acknowledged. According to Falasca et al. (2012) and Baroudy (2016), land suitability analysis is a key approach to promoting sustainable agricultural development and

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scientific planning of land use. Land suitability is significant for sustainably performing agricultural production. Moreover, the analysis identifies the key factors that limit the production of a particular crop and allows decision-makers to develop a crop management system to increase land productivity and protect soil resources from degradation. According to the Food and Agriculture Organization (FAO), "Land suitability is a function of the crop's needs and soil's characteristics, and measures how the qualities of a land unit correspond to the requirements of a particular form of land use" (FAO, 1976). The organization also states that suitability analysis of agricultural land is a prerequisite for realizing the optimal use of the available soil resources for sustainable agricultural production. FAO adds that land suitability varies by crop in each part of the field due to soil properties, starting position, and land use. Furthermore, the FAO claims that it is mandatory to classify and manage land units based on the most efficient environmental factors (FAO, 1990).

It is undeniable that assessing land features is crucial for land use planning, as it allows decision-makers to create the best crop management system. However, a large number of environmental factors makes the assessment of land-use suitability increasingly complex for ensuring sustainable land use (Bandyopadhyay et al., 2009; Akinci et al., 2013). Its complexity also comes from the many parameters that must be considered for land valuation (Stewart, 1968; Fastellini & Schillaci, 2020). Land suitability can be determined by assessing climate, soil, and topographic components and understanding the local biophysical constraints (Aouissi et al., 2021). Thus, using the assessment methods of multicriteria analysis and GIS is efficient in situations where many variables are involved, and where each must be weighed against the relative importance of its effect on the optimal growth of a crop.

Many methods, generally divided into hierarchic and parametric approaches, have been developed for the assessment of land suitability (Karimi et al., 2018). Due to number and intensity of limitations, the Storie and square root methods are the most commonly used methods (Rabia & Terribile, 2013). Comparative evaluations of the different land suitability methods have been presented. However, the results of different land suitability methods are generally similar.

Land suitability assessment is a useful tool for creating a sustainable development strategy (Akpoti et al., 2019). It is a spatial multicriteria decision problem because it is linked to the systems where various factors interact. Evaluating the complexity of such a problem requires the use of powerful methods, techniques, and analysis tools, such as GIS and multicriteria decision-making, that can manage and analyze spatial data of various natures and origins, as in the case of this study.

One of the most useful features of GIS is the ability to layer different layers or maps. However, this superposition procedure does not consider the scenario where variables do not matter (Janssen & Rietveld, 1990). Carver (1991) considers multicriteria analysis to be an approach that can help to cope with these limitations (Carver, 1991). According to Jankowski et al. (2001) and Guarini et al. (2018), the objective of using multicriteria analysis models is to find solutions for decision-making problems with multiple variants that can be evaluated using decision criteria.

This type of analysis has been performed in many studies in recent decades. It was applied to predict and develop land valuation models. The analytical hierarchy process (AHP) developed by Thomas Saaty (1980) was used in northern Iran (Kazemi et al., 2016), India (Zolekar & Bhagat, 2015), and Turkey (Akinci et al., 2013), and it was used more recently in the USA (Fang & Partovi, 2021) and Germany (Gompf et al., 2021) for the same purpose.

In the arid region of Ouargla, the main field crops are cereals (wheat, barley, and maize). These crops have developed significantly in recent years with increasing acreage and yields. The sustainability of cereals crops in arid conditions requires the management of natural resources, including water and soil. This may be achieved by using the land suitability analysis.

The aim of this study is to use the multicriteria analysis method to determine the most suitable areas for cereal production in N'Goussa town in Ouargla.

Material and Methods

Study Area

The study was conducted in N'Goussa town, located in the region of Ouargla. N'Goussa is in a large basin of the lower valley of Oued M'ya, which is located in the southeast of Algeria. It is 22 km north of Ouargla. It covers an area of approximately 2907 km^2 (32°08'27" north and 005°18'30" east, Figure 1). As with the Algerian Sahara, the Ouargla region is characterized by a desert climate. A significant thermal amplitude and strong and bright sunshine characterize this type of climate (Khadraoui, 2005; Nievola et al., 2017), with annual average sunshine time of 3,000 h and scarce precipitation that exhibits considerable annual variability (Ozenda, 1991). From 2007 to 2017, the average annual precipitation did not exceed 39 mm, and the average annual temperature was 23.7 °C, with a minimum of 12.25 °C in January and a maximum of 35.89 °C in July. The annual average relative humidity ranged from approximately 40%, and the average wind speed was 5.5 m/s. N'Goussa is a cereal hub where typical farmers have harvested extraordinary yields (yields that exceed 70qx). The total agricultural area is 262743 ha, or 4.62% of the total area registered in 2016 (A.S.D, 2018).

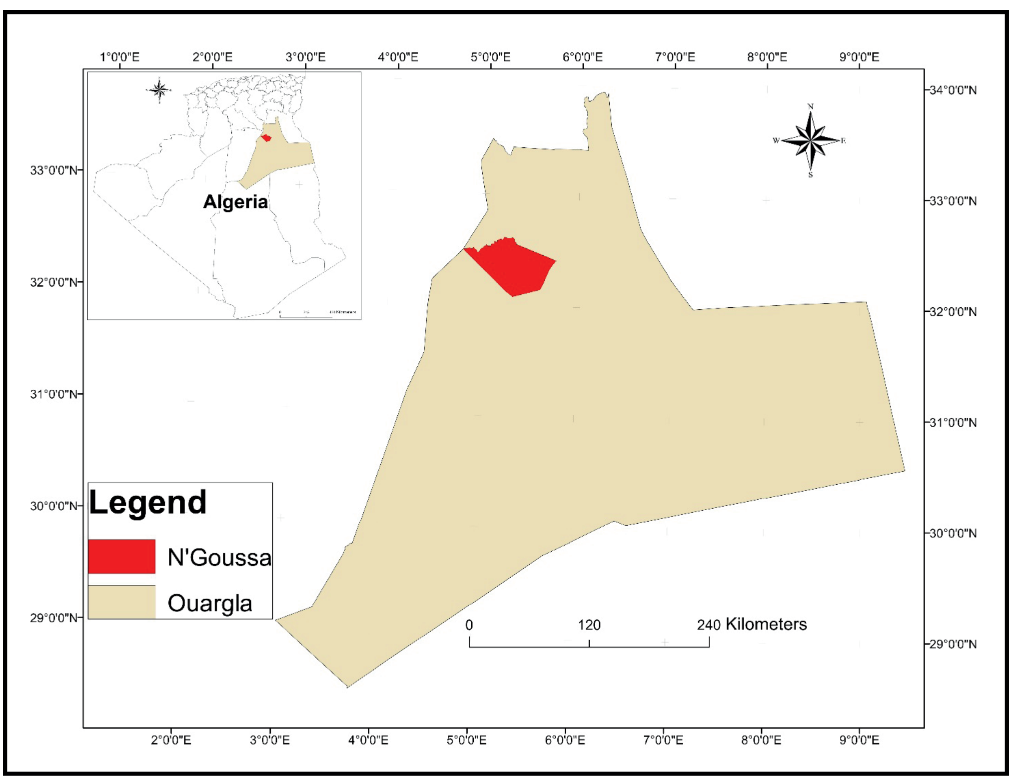

Figure 1. Location of the study area in Northeast Algeria.

Methods

Multicriteria Hierarchical Analysis

The aim of applying this method is to determine the most suitable areas for cereal production in N'Goussa within Ouargla. The chosen method is reliable for real decision support systems. It exploits the functionalities offered by GIS for the structuring of data, the crossing of information layers, and the spatial analysis of different themes. It also includes a multicriteria hierarchical analysis approach (AHP), which allows for the assembly of a multitude of decision criteria into a single model. Then, to make a comparative evaluation of each pair of criteria and to calculate their weight for a comparative evaluation of each pair of options against each subcriterion. To develop a map of suitable land for cultivating cereals, the AHP method developed by Saaty was chosen (Saaty, 1980). The method has been suggested to be effective and has been used successfully in several areas. Examples include the study of the potential transformation of land use (Figueiredo, 2001), the management of the alluvial plain of Saint-Charles River in Quebec (Martin et al., 2003), and the choice of a parcel for the construction of new homes (Marinoni, 2005).

Identification of the Evaluated Factors (Criteria)

In this study, a multicriteria assessment by hierarchical analysis approach (AHP) was used to assess the suitability of land for cereals. In the existing literature, climatic, soil, and topographic factors have often been used for the assessment of land suitability. Admittedly, many factors can influence the growth and production of wheat; nonetheless, it is impossible to include all of them. In the Ouargla region, cereal production is not possible without irrigation. According to the local experts' and farmers' considerations, a list of factors have thus been selected to assess the suitability of land for cereal production. The list includes the following:

(1) Topography: altitude and slope;

(2) Soil properties: 30 soil samples were collected using a stratified random sampling method at the 30 cm layer for all the studied area; the analyzed physicochemical parameters were texture, soil salinity (extract 1/5), organic matter, soil pH_{Water}, gypsum, and total calcium carbonate;

(3) Land occupation;

(4) Electrical network;

(5) Road network.

Data collection and analysis

Topographical factors: The digital elevation model (DEM) (with a resolution of 30×30 m) of the study area comes from the USGS site. Other territorial factors, such as elevation and slope, were derived from the DEM (Figure 2). Slope degree is the most important factor for determining the type of agricultural practices and the state of irrigation, drainage, and erosion; generally, land that is more suitable for agriculture has a slight slope (Fu et al., 2011). This parameter is preponderant in agricultural practices and crop yield by influencing water content and soil temperature (Niezen et al., 1998; Neupane & Guo, 2019).

Land use: The land use data and the map (Figure 3) were interpreted from the Landsat 8 (30 m) image of May 2018, which was acquired from the USGS server using a supervised classification technique using ArcGIS 10.5. Then, Google Earth was used to correct the obtained land use data.

Electrical and road networks: The electrical and road networks were created by polygons using Google Earth images (Figure 3).

Soil properties: Thirty soil samples were collected using a stratified random sampling method at the 30 cm layer (the location and spatial distribution of the soil samples are displayed in Figure 3). Samples were air dried, and particles smaller than 2 mm were used for the soil analyses. The analyzed physicochemical parameters were granulometry (texture), pH, electrical conductivity, gypsum, total calcium carbonate, and soil organic matter content. The thematic maps of soil properties were provided by the inverse distance weighting (IDW) interpolation method using ArcGIS 10.5 (Figure 4).

Assessment of land suitability for cereals

1. Calculation of Importance Weights and Aggregation of Criteria

Multicriteria analysis using the AHP method is an effective tool for making a decision based on the linking of several criteria. Generally, a decision made by an actor (or a group of actors) who makes a choice between several solutions or scenarios is likely to solve an encountered problem or handle a particular situation (Roy & Bouyssou, 1993; Lehoux & Vallée, 2004). This method was created in 1970 by Thomas Saaty to optimize the presentation of resources when there are several criteria to consider.

According to Saaty (1990), this method is based on dividing the decision-making process into a hierarchical structure and a binary comparison

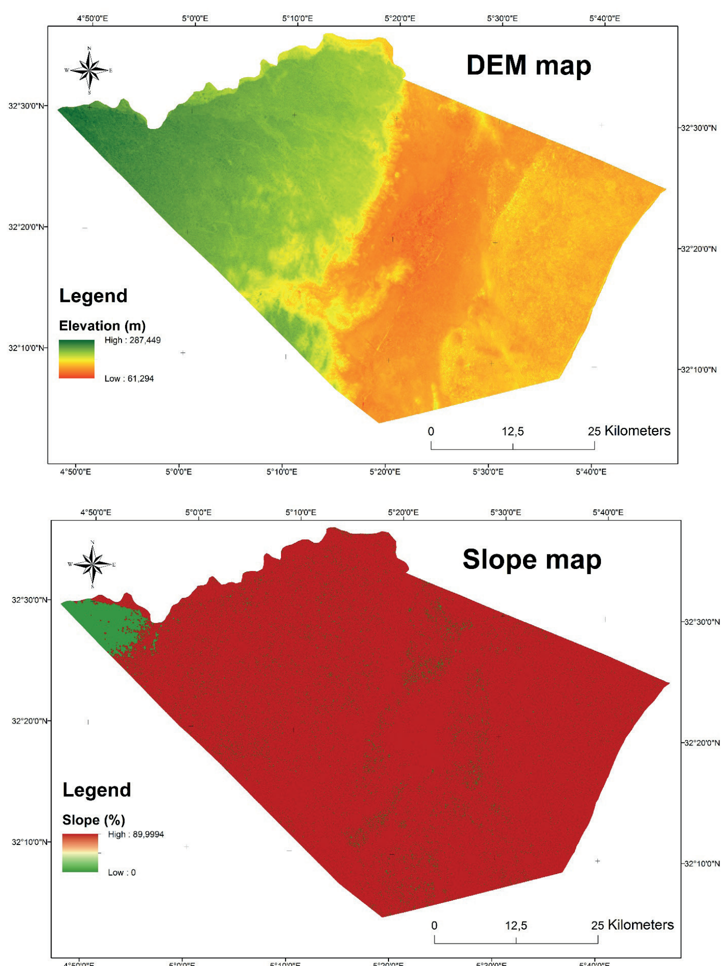

Figure 2. Topographic maps of the study area: DEM and slope maps.

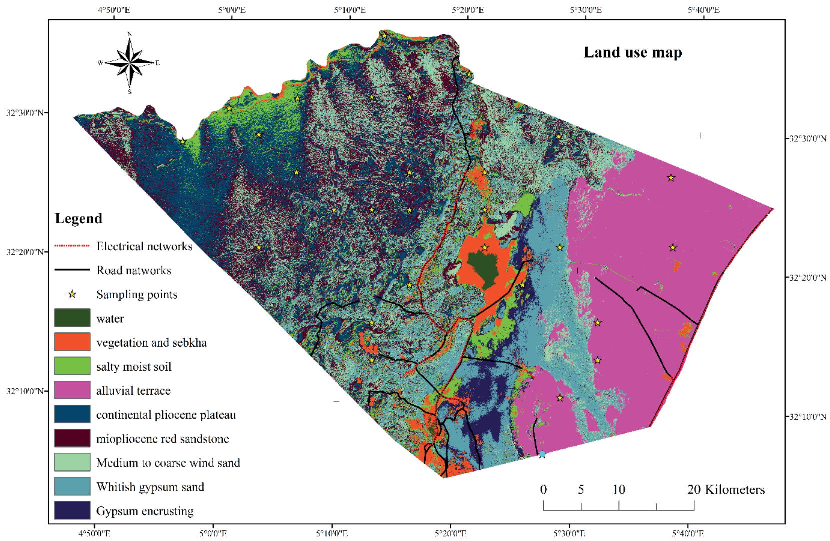

Figure 3. Map of the physiographic units in the study area.

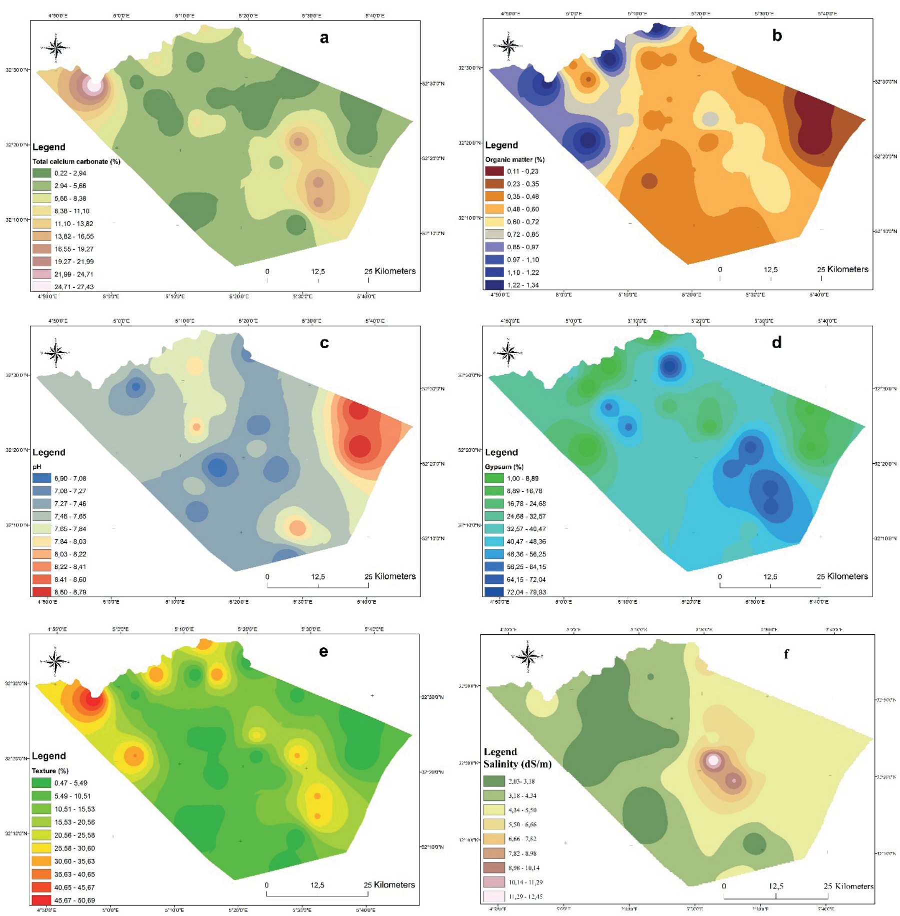

Figure 4. Soil property map of the study area: a:total calcium carbonate, b: organic matter, c: pH, d: gypsum, e: texture, and f: salinity.

of the relative importance of criteria in relation to fitness for an overall objective. The approach to calculating the significant weights for each criterion includes the following steps:

1.1. Data Standardization and Decision Criteria Ranking

The fundamental objective is disaggregated into a set of criteria and subcriteria. On the one hand, the objective of the criteria is to construct a synthetic view of the decisions' context and to enable a relevant evaluation of the different design options. Certainly, ranking is a comprehensive and accurate reflection of the experts' needs in terms of values. On the other hand, each subcriterion was spread over a range of values between 1 and 10. Additionally, the factors were ranked on the basic scale suggested by Saaty (2000), with values from 1 to 10. Depending on the ten local experts' considerations, the values of the land suitability factors were determined (Table 1). The average of each factor's values was calculated after each expert had noted the factors with values that varied between 1 and 10.

1.2. The Balance of the Evaluation Criteria and Coherence Check

Hierarchization makes it possible to bring the various elements closer to a hierarchical level to determine their contribution to the comprehension of the phenomenon. The evaluation of this measurement is obtained by the integration of the expert opinions with the available knowledge in the field and the analyzed information stored in the database. The assignment of the weights takes place by means of a series of binary comparisons (even with pairs) between the criteria and under-criteria, all in their assignment of a weighting coefficient to constitute a matrix of comparison (Table 2). It is thus easier for a decision-maker to carry out binary comparisons than to take into account all the parameters of the problem. The AHP method constitutes a powerful and flexible tool of decision-making for complex multicriterial problems in which quantitative and qualitative aspects must be built in (Harker, 1989; Moretti et al., 2017). Using a statistical analysis per pair of comparisons, the ten local experts' opinions were used to determine the weight of the factors of evaluation of the grounds' aptitude. The weights range between 0 and 1 (Malczewski, 1999).

Table 1. Factor values.

Studied Factors	Values (1 to 10)
Texture	8
Slope	7
pH	7
Salinity	10
Gypsum	6
Total calcium carbonate	7
Organic matter	9
Land use	9
Road network	8
Electrical network	8

Thereafter, the matrix of the obtained comparison is standardized and compared to the affected degree of importance of each selected criterion so that the sum of the weights of all the considered criteria in the same analysis is equal to 1. The degree of importance assigned to each retained criterion in the final decision-making and calculated weighting are clarified in Tables 2 and 3.

The concept of coherence in the comparison per pair of Saaty (1980) is based on the respect of the transitivity of our judgment (Table 4). Thus, the index of coherence measures the reliability of the comparison expressed with coherent judgments. When the index of coherence becomes higher, the judgments expressed in the matrix of comparison become more incoherent, and vice versa. The index of coherence (IC) is expressed by Formula (1):

$$IC = (\lambda max - N) / (N - 1) \quad (1)$$

where N is the number of the compared elements and λmax is a computed value based on

Table 2. Stamp importance of the criteria.

Criteria	Texture	Slope	pH	Salinity	Gypsum	Total calcium carbonate	Organic matter	Land use	Road network	Electrical network
Texture	1	3	3	1/5	5	3	1/3	1/3	1	1
Slope	1/3	1	1	1/7	3	1	1/5	1/5	1/3	1/3
pH	1/3	1	1	1/7	3	1	1/5	1/5	1/3	1/3
Salinity	5	7	7	1	7	5	3	3	5	5
Gypsum	1/5	1/3	1/3	1/7	1	1/3	1/5	1/5	1/5	1/5
Total calcium carbonate	1/3	1	1	1/5	3	1	1/5	1/5	1/3	1/3
Organic matter	3	5	5	1/3	5	5	1	1	3	3
Land use	3	5	5	1/3	5	5	1	1	3	3
Road network	1	3	3	1/5	5	3	1/3	1/3	1	1
Electrical network	1	3	3	1/5	5	3	1/3	1/3	1	1
Total	15,2	29,33	29,33	2,89	42	27,33	6,8	6,8	15,2	15,2

Table 3: Stamp weighting of the criteria.

Criteria	Texture	Slope	pH	Salinity	Gypsum	Total calcium carbonate	Organic matter	Land use	Road network	Electrical network	Weighting
Texture	0,0658	0,1023	0,1023	0,0691	0,1190	0,1098	0,0490	0,0490	0,0658	0,0658	0,0798
Slope	0,0219	0,0341	0,0341	0,0493	0,0714	0,0366	0,0294	0,0294	0,0219	0,0219	0,0350
pH	0,0219	0,0341	0,0341	0,0493	0,0714	0,0366	0,0294	0,0294	0,0219	0,0219	0,0350
Salinity	0,3289	0,2386	0,2386	0,3454	0,1667	0,1829	0,4412	0,4412	0,3289	0,3289	0,3041
Gypsum	0,0132	0,0114	0,0114	0,0493	0,0238	0,0122	0,0294	0,0294	0,0132	0,0132	0,0206
Total calcium carbonate	0,0219	0,0341	0,0341	0,0691	0,0714	0,0366	0,0294	0,0294	0,0219	0,0219	0,0370
Organic matter	0,1974	0,1705	0,1705	0,1151	0,1190	0,1829	0,1471	0,1471	0,1974	0,1974	0,1644
Land use	0,1974	0,1705	0,1705	0,1151	0,1190	0,1829	0,1471	0,1471	0,1974	0,1974	0,1644
Road network	0,0658	0,1023	0,1023	0,0691	0,1190	0,1098	0,0490	0,0490	0,0658	0,0658	0,0798
Electrical network	0,0658	0,1023	0,1023	0,0691	0,1190	0,1098	0,0490	0,0490	0,0658	0,0658	0,0798
Total	/	/	/	/	/	/	/	/	/	/	1,0000

an average of the values of the matrix of the vectors of Saaty.

N= 10 and λmax = 10,314

The experiment established by Saaty (1990) made it possible to define the ratio of coherence as being the report/ratio of the index of coherence calculated on the matrix corresponding to the judgments of the actors and the random index (IA) of the same matrix dimension. The ratio of coherence can be interpreted as the probability that the matrix is supplemented by chance. It is given by Formula (2):

$$RC=IC/IA \qquad (2)$$

where IA is the random index fixed according to the number of criteria (Table 5).

According to Saaty, there is an inconsistency in the comparisons per pair when RC is higher than 0.1. Therefore, the matrix resulting from such comparisons will have to be reevaluated.

Table 4. Indices of coherences of the criteria.

Criteria	Coherence
Texture	10,45
Slope	10,22
pH	10,22
Salinity	10,87
Gypsum	10,34
Total calcium carbonate	10,14
Organic matter	10,86
Land use	10,86
Road network	9,57
Electrical network	9,57

Table 5. Random indices of Saaty (1980) according to the number of criteria.

N	10	11	12	13	14	15
IA	1.49	1.51	1.54	1.56	1.58	1.59

The comparison per pairs of criteria applied for our case of study and the calculations relating to the various parameters gave the following results:

$\lambda max = 10{,}314; IA = 1{,}49; IC = 0{,}0349; RC = 0{,}0234 < 0.1$

The ratio of coherence is lower than 0.1, which enables us to affirm that the judgments of appreciation of the criteria were coherent.

2. Land Suitability Assessment

Identifying different classes of land suitability in the studied area was performed according to the Food and Agriculture Organization's (FAO) classification system. In fact, the requirements of cereal crop cultivation were specifically taken into account, and the process distinguished four classes: not suitable, low suitability, moderate suitability, and high suitability (Table 6). Therefore, a land suitability map for cereal production was created by multicriteria decision-making analysis and the AHP method. The process consisted of combining the criteria and under-criteria of appreciation according to their weights to arrive at a composite decision. The technique of the most current aggregation method is the weighted average, which completely integrates all the considered criteria into a single criterion. It consists of multiplying each layer factor by its respective weighting coefficient. Then, these results are added to produce an index of synthesis located on a scale from 0 to 10. The mathematical formulation of the method is described by Equation (3) (Yoon & Hwang, 1995).

$$Vi = \sum_{j=1}^{\beta} aj * Wj \qquad \text{for i=1, 2,…, 10} \qquad (3)$$

where: $a_{ij} = a_i/a_j$.

With: a_i and a_j are the weighting coefficients evaluating the relative importance of the criteria;

Wj: the weight of each criterion;

Vi: index of synthesis.

This step was carried out individually for the ten decision factors to produce an index of synthesis. Once the ten decision factors were evaluated, a balanced linear combination was carried out after assigning a weighting coefficient with each factor of decision, and each factor of the soils' properties was classified according to cereals' edaphic conditions (Figure 5). ArcGIS 10.5 was used to calculate the weighting coefficient and elaborate the map of land suitability (Figure 6).

Table 6. Criteria for delineating land suitability of cereal crop.

Parameters	High suitability	Moderate suitability	Low suitability	Not suitable
EC (dS/m)	0-6	6-10	10-13	13 ≤ EC
Texture (clay %)	0-10	10-20	20-30	30 ≤ (clay %)
Gypsum (%)	0-5	5-10	10-25	25 ≤ Gypsum
pH	6-8	8-9	9-10	10 ≤ pH
OM (%)	2 ≤ OM	0.8-2	0.5-0.8	0-0.5
Total calcium carbonates (%)	0-5	5-20	20-30	30 ≤ Total calcium carbonates

Reference: Soltner (2005).

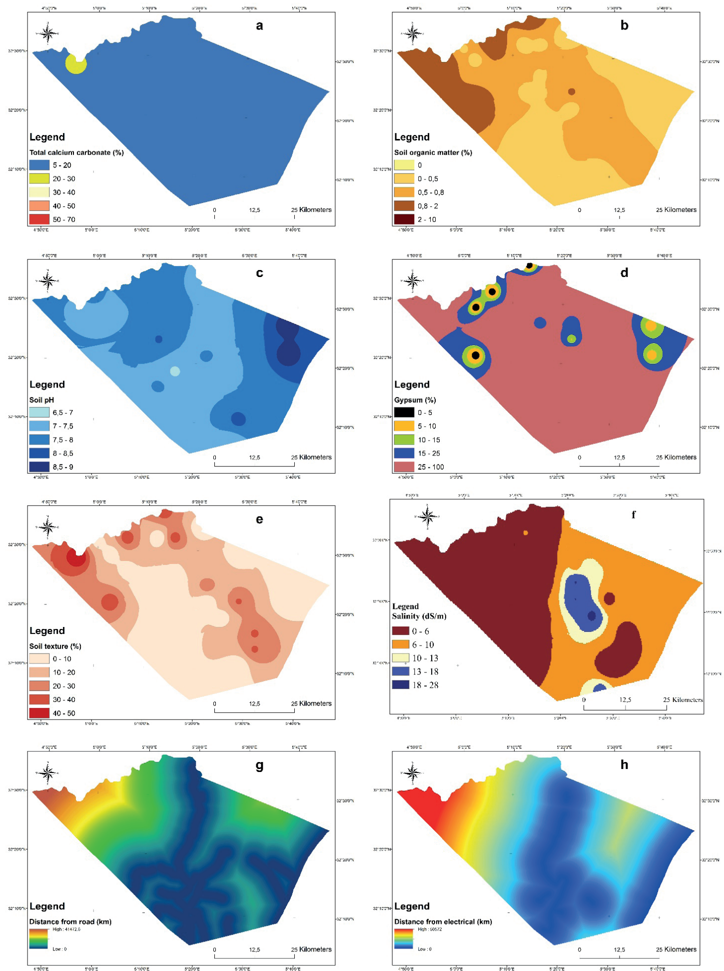

Figure 5. Classified soil properties and GIS: a: Total calcium carbonate; b: Organic matter; c: pH; d: Gypsum; e: Texture; f: Salinity; g: Euclidean distance from road, and h: Euclidean distance from electrical networks.

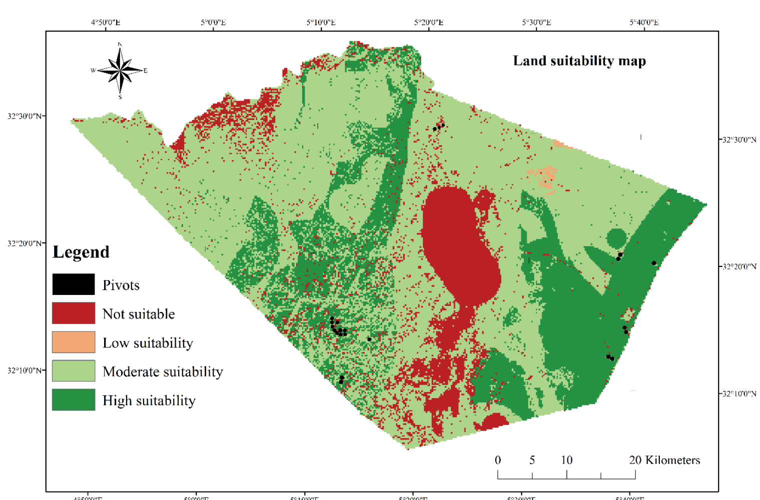

Figure 6. Land suitability classes of the study area.

Results

Based on the experts' pairwise comparisons and the weights of the factors, including soil characteristics, topography, electrical and road networks, and land use data, presented in Table 3, important details were revealed. The results showed that the best factor for evaluating land suitability was soil salinity, which had the highest specific weighting (0.3041). After this, soil organic matter and land use followed (0.1644 specific weighting for each factor). Soil salinity is lower than 6 dS/m in 50% of the study area (Figure 5.f), which is favorable for cereal agriculture. The results also (Figure 5.b) indicated that the soil organic matter was lower than 2%, which indicates soil poverty in organic matter. Suitable areas for cereal production were identified according to important salinity, organic matter, land use, texture, electrical network, and remote sensing data factors. All of the findings led to the generation of an optimal land suitability map using an overlay of 10 raster layers. The final land suitability map for cereal production in the studied area is presented in Figure 6.

The four suitability classes, varying from very high suitability to not suitable, are shown in Figure 6. The not suitable class, which includes the salted grounds and the Sebkha, covers 13.36% of the studied area at 39302.57 ha. The low suitability class occupies only 0.25% at 741.03 ha. Compared to the others, the moderate suitability areas are more representative, as they occupy 60.06% of the area at 176636.46 ha. The moderate suitability zones occupy the western and middle parts of the studied zone. Furthermore, those classified with high suitability occupy only 26.31% of the total surface of the studied area. The analysis of this map clearly shows that moderate suitability areas for cereal cultivation remarkably occupy the large majority of the studied area, which presents enough plates for a useful type of agriculture that is characterized by low salinity.

Discussion

The mapping of favorable zones for cereals in N'Goussa was carried out using GIS and multicriteria analysis. To map soil properties, the IDW method was used (Figure 5). One of the advantages of IDW is its use of weighted averages to estimate unsampled locations as a linear combination of neighboring observations (Mirzaee et al., 2016). The determination of suitable land for special crop production is very important at many levels: increasing the yield and achieving optimal productivity on the land, developing resource management (soil and water), and safeguarding sustainable production and natural resources. In short, the assessment of land suitability is an important subject in agriculture and land science.

The method of space analysis based on criteria for the identification and choice of the site has already been proven to be consistent by various studies (Banai, 1993; Eastman et al., 1993; Lili Chabaane et al., 2002; Malczewski, 2006; Bensaid et al., 2007; Özkan et al., 2020). Therefore, the obtained results have a high validity, and their consistency depends on the precision of the data. Other studies have shown that the multicriteria method is the best method to determine agricultural land suitability in Algeria (Mendas et al., 2014) and in arid regions (Abdelkawy et al., 2010; Ostovari et al., 2019; Kurşun & Dengiz, 2020). In this study, soil properties were shown to be effective factors in developing a good land evaluation model. Thus, the results presented in Table 3 regarding soil salinity and soil organic matter play an important role in determining the suitable areas for production of cereals. Mendas et al. (2014) indicated that soil salinity and texture were the main factors affecting agricultural land suitability. Namely, the main factors that play an important role in obtaining high yields are texture, soil salinity, and soil fertility. The majority of the soil in the studied area was non-saline or soil with lower salinity (with CE < 6 dS/m). This explains the importance of the moderate suitability class (60.06%) and the high suitability class (26.31%).

Conclusions

In this study, land suitability analyses indicated that 86.37% of the studied area can be exploited for development (cultivation of cereals) presented by the plate and reg. The moderate suitability class is the most abundant, at 60.06%. The moderate zones occupy the center and the west of the study area. The unsuitable zones include the salted soil and Sebkha with 13.36%.

Furthermore, this study has also demonstrated the advantages to use GIS for preparing data and displaying results. GIS combined with multicriteria analysis offers possibilities for territory management, integrating all the parameters related to its durable development. The land suitability map of cereals that was created from this approach can nevertheless serve as a basic instrument for the prospection of sites for future cereal cultivation or development projects in the area. In general, GIS remains one of the best decision-making tools for project management. Strengthening the means to optimize the evaluation of development projects in an integrated and structured framework is one of the necessary elements to promote sustainable development.

The results of this study will enable decision-makers to make adequate decisions about durum wheat cultivation and extending sustainable land utilization using detailed spatial information from the land suitability map. Indeed, decision-makers are provided with all the necessary elements to make their own choices. To ensure better outcomes, it would be sufficient to have all the reliable and necessary data relating to the case study. These data are easily introduced to the system and can be updated at any time when necessary.

Resumen

Koull, N., Helimi, S., Mihoub, A., Mokhtari, S., Kherraze, M.E., y Aouissi, H.A. 2022. Integración de SIG y análisis jerárquico multi-criterio para analizar la idoneidad de la tierra para los cereales en la zona árida de Argelia. Int. J. Agric. Nat. Resour. 36-50. Este trabajo es parte de un proceso de reflexión que tiene como objetivo entender el proceso de planificación de los recursos de tierra para la agricultura en Ouargla, Argelia. Su objetivo es la presentación de un proceso, basado en el uso de sistemas de información geográfica y el análisis jerárquico de múltiples criterios, que ha demostrado su relevancia para la comprensión de problemas espaciales complejos. El enfoque es una referencia informativa a la construcción de mapas de idoneidad del suelo para los cereales en N'Goussa en Ouargla. Los factores agrícolas, como la pendiente, las características del suelo, la red eléctrica y de carreteras y la ocupación del suelo, se integraron en el mapa de idoneidad del suelo para los cereales utilizando el sistema de información geográfica. La multiplicación de los coeficientes ponderados vinculados a estos factores conduce a un mapa mundial de idoneidad de la tierra. Los resultados obtenidos permitieron priorizar los sitios en cuatro clases: alta idoneidad, moderada idoneidad, baja idoneidad y no idoneidad. De hecho, el 60,06% de las superficies totales son moderadamente aptas para cereales.

Palabras clave: Análisis multicriterios jerárquicos, Argelia, idoneidad de la tierra, cereal, sistemas de información geográfica, zona árida.

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