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ASSESSMENT OF LAND SUITABILITY FOR AGRICULTURAL PURPOSES USING REMOTE SENSING AND GIS OF AL SALAM DISTRICT IN MAYSAN GOVERNORATE, IRAQ

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Abstract

The study was conducted in Al-Salam district in Maysan Governorate, which is defined geographically between the longitude of '46° 30'0', 'E4710'0, and latitudes 31 ° 40'0', 31 ° 15'0 'N for assessing land's suitability for cereal and pasture crops. Satellite image taken from the Landsat-8 satellite captured in 2017 with eleven spectral bands and made the necessary corrections.Four Varieties were identified in the study area, drilling one pedon in each variety and morphological description was performed. The results of the evaluation showed the suitability of lands for growing cereal crops to the presence of three varieties, which S1(very suitable) Within soil series DM97 formed approximately 23.76% of the total erea, And S3 (moderatly suitable) in soil series MM11 and DM95 than formed 6.03 and 32.48 % respectively of soils in the study area. As for S4 (few suitable) included the soil series MM9, which constituted approximately 21.14 % of the total soil. The results shows three varities of the land suitability for pasture crops which S2 within soil series DM97 formed 23.76% of the total soil series and S3 in soil series MM97 and DM95 were formed 6.03 and 32 respectively and N within soil series MM9, formed approximately 21.14% from study area.

Keywords: Land Suitability, remote sensing, GIS

Introduction

Many equations, systems and guides have been established to evaluate and classify lands for agricultural purposes, some of which are dependent on soil characteristics (Sys, 1972), others on soil and climate characteristics together (Sys, 1980), and a third on production manual (FAO, 1976). Also, these systems differed in number, type and factors intensity each of the soil or climate. The basic principle of the systems that evaluate the land is to clarify the difference between the requirements for the use of the land and the natural resources of the land and the characteristics of different uses have different requirements, in addition to determining the suitability of the land is necessary for the purposes of permanent land use, in return it is necessary for what is required to develop programs Land Improvement and Management (Al-Ani, 2002). The land evaluation systems have varied, as there are generally two main types, the first represents qualitative assessment and the second is quantitative assessment and the qualitative variation of the suitability of the land differs from the quantitative assessment that the first does not include the production and costs account and in general, the quantitative evaluation is done in distinguishing the items on the basis of digital economic capabilities with that qualitative evaluation can It is based on several quantitative data on the yield and required inputs. Although the qualitative assessment is still in use, the quantitative assessment, which was developed by the Food and Agriculture Organization of the United Nations, is one of the best systems in the world to accomplish land classification (Al-Ani, 2002). Khiddir(1986) introduced some simple statistical methods in the mathematical systems proposed by Sys (1980). Al-Rubaie (1986) came up with a new separation between the cereal and pasture lands based on the FAO (1976) system and the proposed formula from Before Sys (1972) using properties and characteristics of the land.

Heywood *et al* (2002) mentioned that one of the advantages of geographic information systems related to land valuation is the great potential for spatial analyzes and automatic production of maps in an ability to process and analyze data and from many sources such as land use maps, contour line, climate and vegetation cover and that the use Geographical information systems was the best in the land assessment process compared to the manual method of performing this process, that because of the possibility of a major error as well as it facilitates the way to remove potential spatial errors due to data collection processes from its various sources and periodic updates to it, it is an excellent way to store large volumes of data and given the limited studies linking remote sensing and geographic information systems with the mechanism of some capability classification systems for lands to produce Some cereal crops in Iraq and different climatic regions.

The study aimed to prepare maps to assess Land Suitability for agricultural purposes of Al Salam district in Maysan Governorate, using geographical information systems and remote sensing technologies

Material and Methods

The study was conducted in Al-Salam district on the Petra River in Maysan Governorate, which is defined geographically between the longitude of '46° 30'0', 'E4710'0, and latitudes 31° 40'0', 31° 15'0 'N with a total area of 781.559100 km^2. Soils of this area formed as a result of sediments transported from the Tigris River and its main branches, Part of the Mesopotamia basin. The region is characterized by the presence of palm groves and the most important economic crops grown in an area (wheat and barley) as well as the presence of natural plants such as reeds, papyrus and spiny plants. The region's lands are irrigated from the Petra River branching from the Tigris River and Figure 1 shows the location of the study.Satellite image was used through the USGS website, with a recent visualization obtained in the year 2017 of a study area from Landsat / 8 of the sensor (OLI) Operational Land LMager and Table (1) showing the spectral bands used in the study and their wavelengths.

The study area was truncated after the administrative boundaries were obtained from the Maps Production Department of the General Authority for Surveying in the Iraqi Ministry of Water Resources. Then the engineering correction and digital processing was performed using the Arc map 10.4.1 computer software. Spectral packages with the highest Optimum Index Factor (OIF) were chosen, then the fully corrected satellite image was explained. Depending on field visits to the study area and the results of unsupervised and supervised classification, as well as field investigation, type and density of vegetation and the topography map, as well as the nature of agricultural exploitation and the method of managing the area's soils and the work of drilling holes using Auger, four locations representing the largest soil units were selected

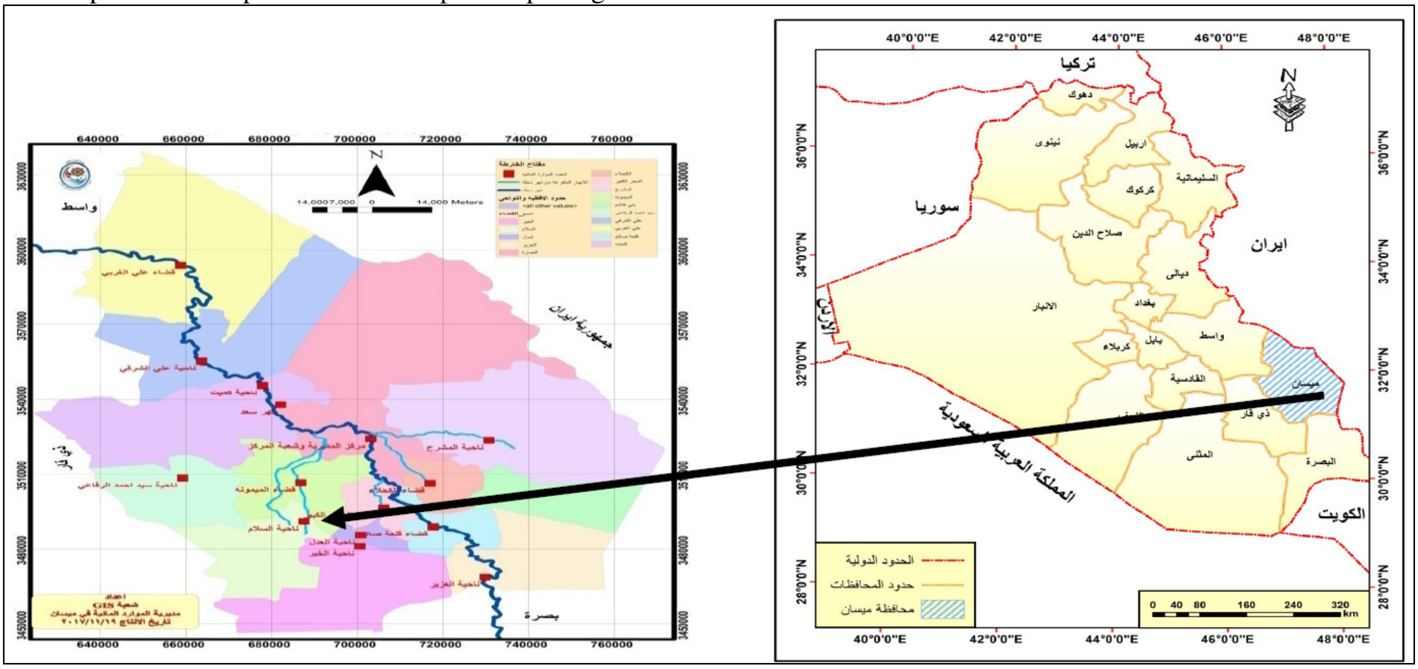

Fig. 1: Location of study area

Table 1 : spectral bands used in the study and their wavelengths.

Landsat 8-OLI			
distinguish spatial m	Band type	Wavelength um	Band NO
30	Green	0.600-0.525	3
30	Red	0.680-0.630	4
30	NIR	0.90-0.76	5

The study area was truncated after the administrative boundaries were obtained from the Maps Production Department of the General Authority for Surveying in the Iraqi Ministry of Water Resources. Then the engineering correction and digital processing was performed using the Arc map 10.4.1 computer software. Spectral packages with the highest Optimum Index Factor (OIF) were chosen, then the fully corrected satellite image was explained. Depending on field visits to the study area and the results of unsupervised and supervised classification, as well as field investigation, type and density of vegetation and the topography map, as well as the nature of agricultural exploitation and the method of managing the area's soils and the work of drilling holes using Auger, four locations representing the largest soil units were selected

Accordingly, four pedons were drilled, and these morphology characteristics were estenmaiteed according to the principles mentioned in the Soil Survey Staff (1993).

Samples were taken from pedons to the laboratory and analyzes to determined some physical and chemical properties, the methods described in Black (1965) were used to estimate the soil texture and pH was measured in the soil suspension 1: 1.Electrical conductivity measured in soil saturated paste using the method described in Page (1982) and calcium carbonate and organic matter estimated by methods described in Jackson (1958). Gypsum was estimated by the method of precipitation with acetone as described in Richards (1954). And Table 2 shows the average of some soil properties of the pedons representing the soil units of the study area

Table 2 : Average of some soil properties of the pedons of the study area

Pedon NO	Series Symbol	PH	EC (d/m)	Texture Class	Lime (%)	Gypsum (%)	ESP (%)	Drainage Class	Soil depth	O.M%
P1	DM97	7.49	3.12	Sic	35.38	0.24	15.42	Moderate	100	1.18
P2	MM11	7.91	14.85	Sic	29.02	1.16	33.76	Moderate	100	1.30
P3	MM9	7.80	32.77	SicL	29.56	1.77	38.88	Moderate	100	0.63
P4	DM95	7.78	14.79	SicL	36.05	0.21	27.07	Moderate	100	0.64

Then assessing the land suitability by multiplying the evaluation estimates of the different characteristics of the land together for the purpose of obtaining the final estimate of the land assessment through which the land suitability class is determined according to the formula:

CS=A*B*C*D*E*F*G*H*I…………..(Sys,1980)

CS = soil viability for growing economic field crops

A: Texture index
B: Calcium Carbonate
C: gypsum
D: salinity
E: sodium saturation
F: Internal Drainage
G: Soil Depth
H: Evidence for the pedon Evolution
I: weathering evidence expressed in terms of soil evolut

Table 3 shows the land suitable for Cultivation cearal and pasture crops.

Table 3 : Land suitable for Cultivation cearal and pasture crops

Sutability value	Symbol	Class	Degree
90<	S1	Very suitable	Class 1
75-90	S2	Suitable	Class 2
50-75	S3	Moderately suitable	Class 3
25-50	S4	Low suitable	Class 4
25<	N	Non suitable	Class 5

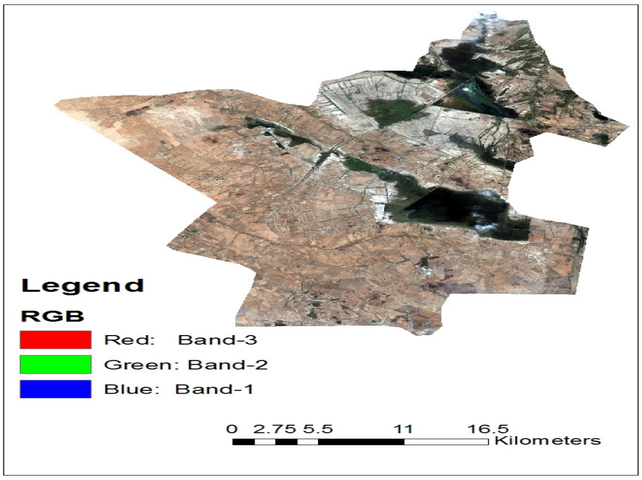

Fig. 2 : Satellite visibility of the study area

Result and Discussion

Assessment of Land Suitability for cultivation cereal crops

The results in table 4 and figure 3 indicated that there are three varieties of lands in the area under study which are very suitable (S1), and this included the soil series DM97 occupies an area of about 18567.36 ha, or approximately 23.76% of the total study area (Table 5). The soils of this series are characterized silty clay texture, decrease electrical conductivity values and sodium adsorption ratio with moderate drainage and high lime content, as the yield capability of this series ranged up to 90% .As for the soil series MM11 and DM95 series characterized silty loam to a clay loam with increased electrical conductivity value and medium drainage. The lime and adsorption sodium were relatively high percentage and this led to a decrease in the productive capability of these two soil series and there were ranging from 59.85 -62.84% respectively. These values put these two soil series within moderatli land suitable, as occupy an area of 4714.11 and 25387.92 ha, or approximately 6.03 -32.48%. Of the total areas (Table 5), either the MM9 soil series had a silty clay loam, With increase in electrical conductivity and sodium adeorption ratio, and moderatly drainage, This is the main reason that led to a decrease in its productivity, as it ranged from 26.46%, and these soil series classified as low suitability, occupies an total area approximately 21.14% (Table 5)

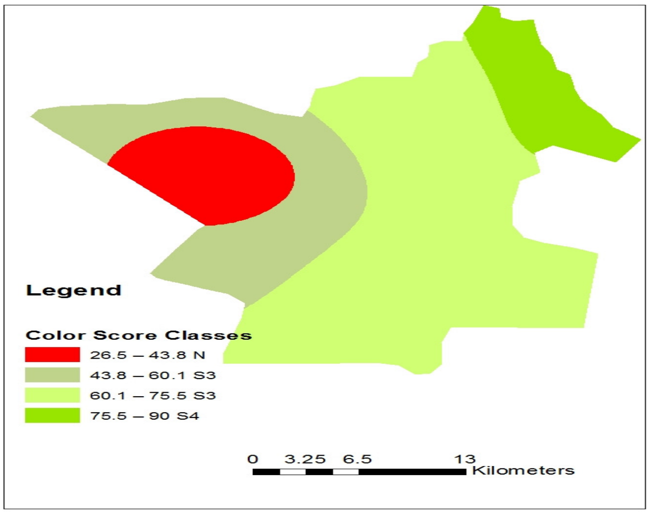

Fig. 3 : Spatial distribution of land suitability for cereal crops

Table 4 : Land suitability, and it rang for cultivation cereal crops

Class	CS	Wethering	Develop	Soil depth	ESP%	Draing	Ec(ds/m)	% $CaSO_3$	% $CaCO_3$	Taxture	Series
S1	90	Entisol Calcic	Weak OChric	100	15.42	M	3.12	0.24	35.38	Sic	
		1	1	1	1	1	1	1	0.9	100	DM97
S3	59.85	Entisol Calcic	Weak OChric	100	33.76	M	14.85	1.16	29.02	Sic	MM11
		1	1	1	0.7	1	0.95	1	0.9	100	
S4	26.46	Entisol Calcic	Weak OChric	100	38.88	M	32.77	1.77	29.56	SicL	MM9
		1	1	1	0.7	1	0.4	1	0.9	105	
S3	62.84	Entisol Calcic	Weak OChric	100	27.07	M	14.79	0.21	36.05	ScL	DM95
		1	1	1	0.7	1	0.95	1	0.9	105	

Table 5 : Productivity capability and land suitability class for cereal crops

Productivity capability * %	suitability	Land class	area %	Area (ha)	series
90	Very suitable	S1	23.76	18567.36	DM97
59.85	Moderately suitable	S3	6.03	4714.11	MM11
26.46	Low suitable	S4	21.14	16524.27	MM9
62.84	Moderately suitable	S3	32.48	25387.92	DM95

Assessment of Land Suitability for cultivation pasture crops

The results in table 6 and figure 4 indicated that there are three varieties of lands in the area under study which are moderately suitable (S2), and this included the soil series DM97.occupies an area of about 18567.36 ha, or approximately 23.76% of the total study area (Table 7). Productive capability of this soil series reached 81%, where had silty clay texturehigh value of lime with decrease of electrical conductivity and sodium adsorption ratio and moderate drainage Alii these reasons led to placing this soil series within land suitable. While the soil series MM11 and DM95 classified as, medium suitable (S3) cultivation of pasture crops with an area of 4714.11 and 25387.92 ha or approximately 6.03-32.48%. respectively of the total area (Table 7). The productivity capability reached 53.86-56.85%, This verity was characterized medium suitability due to the high values of electrical conductivity and sodium adsorption rat, texture of soils were ranged between silty clay and silty clat loam with high lime content and moderate drainage. As for the MM9 soil series that non suitable for pasture crops, its occupies an area of 16524.27 ha, or approximately 21.14% of the total area (Table 7). The characteristics of the soil series in silty clay loam texture with high values of electrical conductivity, lime ratio and sodium adsorption ratio which is the main reason that led to a decrease in the productive capability reaching 23.94%.

Table 6 : Land suitability, and it rang for cultivation pasture crops

Class	CS	Wethering	Develop	Soil depth	ESP%	Draing	Ec(ds/m)	$\% CaSO_3$	$\% CaCO_3$	Taxture	Series
S2	81	Entisol Calcic	Weak OChric	100	15.42	M	3.12	0.24	35.38	Sic	
		1	1	1	1	1	1	1	0.9	90	DM97
S3	53.86	Entisol Calcic	Weak OChric	100	33.76	M	14.85	1.16	29.02	Sic	MM11
		1	1	1	0.7	1	0.95	1	0.9	90	
N	23.94	Entisol Calcic	Weak OChric	100	38.88	M	32.77	1.77	29.56	SicL	MM9
		1	1	1	0.7	1	0.4	1	0.9	95	
S3	56.85	Entisol Calcic	Weak OChric	100	27.07	M	14.79	0.21	36.05	ScL	DM95
		1	1	1	0.7	1	0.95	1	0.9	95	

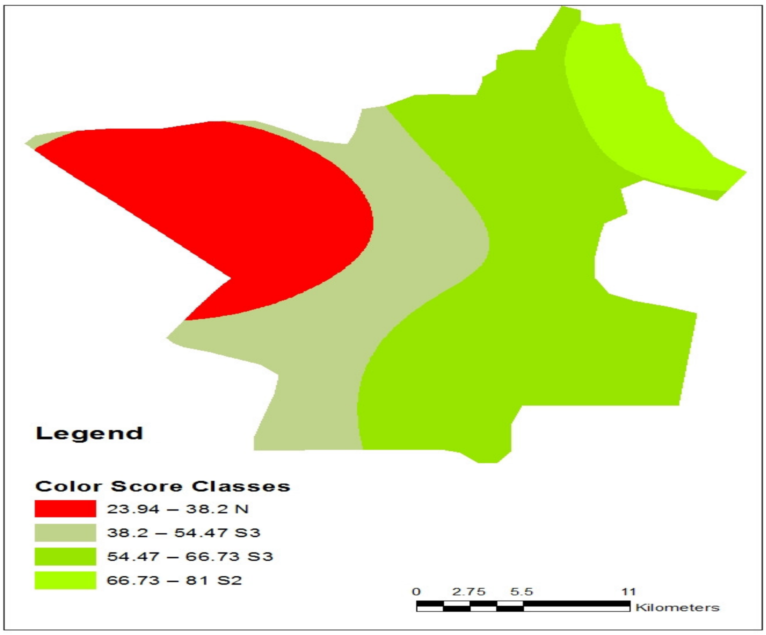

Fig. 4 : Spatial distribution of land suitability for pasture crops

Table 7 : Productivity capability and land suitability class for pasture crops

Productivity capability %	suitability	Land class	Area %	Area ha	series
81	suitable	S2	23.76	18567.36	DM97
53.86	Moderately suitability	S3	6.03	4714.11	MM11
23.94	Non suitable	N	21.14	16524.27	MM9
56.85	Moderately suitability	S3	32.48	25387.92	DM95

Conclusions

Possibility of using geographic information systems and remote sensing technologies in land assessment and using Sys (1980) equation for cereal and pasture crops, on the basis of which DM97 soil series was identified that are very suitable for cereal crops and suitable for pasture crops and soils series MM11 and DM95 are suitable for cereal and pasture crops.

Recommendations

1. Approval of the maps prepared by using GIS before starting the cultivation of lands.
2. Possibility of converting medium, appropriate and inappropriate varieties using soil management programs and suitable plants.

References

AL-Ani, H.A.A. (2002). A comparison of methods for evaluating lands with a diverse gypsum content for irrigated agriculture in Salah al-Din Governorate. Master Thesis College of Agriculture, Univ. of Baghdad.

AL-Rubaie, R.J.M.K. (1987). A study of the criteria for classification of lands in the marginal area of the island. Master Thesis - College of Agriculture – Univ. of Baghdad

FAO, (1976). A frame work for land evaluation. FAO. Soil Bullten No-23, Rome, Italy, 72 pp.

Black, C.A.; Evans, D.D.; White, L.L.; Ensminger, L.E. and Clark, F.E. (1965). Method of soil analysis. Part 1. In Agronomy Series (9). Am. Soc. Agron.

Heywood, I.; Cornelius, S. and Carver, S. (2002). An Introduction to Geographical Information Systems, Prentice Hall, Harlow England.

Khiddir, S.M. (1986). Statistical approach in the use of parametric sys–teems applied of the FAO fame work for land evaluation .Ph.D. Thesis Univ. of Ghent, Belgium.

Jackson, M.L. (1958). Soil Chemical analysis. Prentice Hall, Inc. Englewood Cliffs, N. J.

Page, A.L.; Miller, R.H. and Kenncy, D.R. (1982). Method of soil analysis. Part 2 Agronomy 9.

Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils . USDA , Handbook No. 60.

Soil Survey Division Staff. (1993). Soil survey manual. USDA Handbook No. 18.U. S. Gov. Prit office, Washington, DC.

Sys, C. (1972). Land Evaluation. Part I, International Training Center for post Graduate soil Scientist, Ghent, Belgium.

Sys, C. (1980). Land Evaluation. Parts I, II and III, Courses ITC, Chent. Belgium.