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LAND SUITABILITY ANALYSES FOR CULTIVATING CERTAIN CROPS IN SOME WADIES OF SOUTHWEST SINAI, EGYPT, USING REMOTE SENSING DATA AND GIS TECHNIQUE.

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Key Word: Land suitability, Remote sensing, GIS, Southwest Sinai.

ABSTRACT

Land suitability analysis was done using remote sensing data and GIS technique for an area in Southwest Sinai that includes Wadi Baba, Wadi El-Bidaa, Wadi Naga El-Gada and Elwet Baba. Five physiographic units were delineated as rock land, bajada alluvial terraces, deltaic plain, and wadi. Eighteen soil profiles were described to represent the physiographic units in the study area. Mapping the land suitability based on evaluating soil chemical and physical attributes versus each cropping pattern requirements using the Micro-LEIS Almagra software. The specified crops are: wheat, maize, potato, soybean and sunflower (as annual crops); and alfalfa (as semiannual crops), peach, citrus and olive (as perennial crops). The most limiting factors were soil texture, followed by salinity, sodium saturation, and lime content. The results of this study revealed that southwest Sinai has potentiality for agricultural land use where about 45.72% of the total studied area is highly suitable (S2) to moderately suitable (S3) for the selected crops, while 54.28% of the total studied area is not suitable (S5) for them.

INTRODUCTION

Agricultural land is not only the essential land resource that supplies materials for humans but also a complex system that combines natural ecology and social economy. Rapidly developing economy and growing population accelerate degradation of land and endanger food efficiency **(Wiebe, 2003 and Brouwer, 2004)**. The rapidly growing population in Egypt has a negative impact on its limited natural resources, including water and cultivated area. This requires proper management of such resources. The agricultural expansion outside the Nile Wadi is one of the main objects of the Egyptian national plan **(Darwish *et. al*., 2006)**. Egypt is a net food importer, including far over a half of its wheat needs. The increasing population and limited cultivated land, combined with land degradation and desertification pose significant challenges for production **(World Food Programme, 2013)**. The development and survival or disappearance of civilizations has been based on the performance of land to provide food, fiber, and further essential goods for humans **(Mueller *et. al*., 2010)**. Therefore, assessing the health of agricultural land takes into account the quality and productivity of land as well as the soil environment. Separating human-induced land degradation from that caused by natural processes is a challenging task, but important for developing mitigation strategies **(Le *et al*., 2012)**.

Land suitability is assessed considering rational cropping system, for optimizing the use of a piece of land for a specific use **(FAO, 1976 and Sys *et. al*., 1991)**. The suitability is a function of crop requirements and land characteristics **(FAO 1976)**. Land suitability classification is the process of appraising and grouping specific types of land in terms of their absolute or relative suitability for a specific kind of use. MicroLEIS has been used to determine the main limiting factors that hinder or reduce soil productivity **(Yehia, 1998)**. Suitability analysis can answer the question, what is to grow where?. In order to define the suitability of an area for a specific practice, several criteria need to be evaluated **(Belka, 2005)**. The suitability defines the level of crop requirements with respect to the present soil characteristics. The suitability is a measure of how well the qualities of a land unit match with the requirements of a particular form of land use **(FAO, 2003)**. Interpreting soil qualities and site information for the agricultural use and management practices is integrated using GIS **(FAO, 1991, 2007)**. Land evaluation is considered as a set of methodological guidelines rather than a land classification system, such as land capability and land suitability for Irrigation. Land evaluation systems are traditional or modern system that focus on qualitative aspects **(FAO, 1976 and Van Lanen *et. al*., 1992)**. The specific evaluation expresses the suitability of a given ecosystem or crop and depends on landsite characteristics, rationalization of land use and cropping pattern and farming technologies **(Várallyay, 2011)**. Land suitability using MicroLEIS was applied to predict the effect of water table and salinity on the productivity of wheat **(Bahnassy *et. al*. 2001)**.

The land suitability of Siwa Oasis revealed that the most suitable crops were; clover, wheat, beans, sugar beet, onions, maize, sunflower, tomato, potato, groundnut, pea, lentil, barley, sesame and carrots **(Abdel Kawy and El Nahry 2009)**. **Liambila and Kibret (2016)** applying the Almagra (agricultural soil suitability) model, which is built in MicroLEIS system for agricultural land evaluation and some crops selected for evaluation were sorghum, maize, wheat, sweet potato and soybeans.

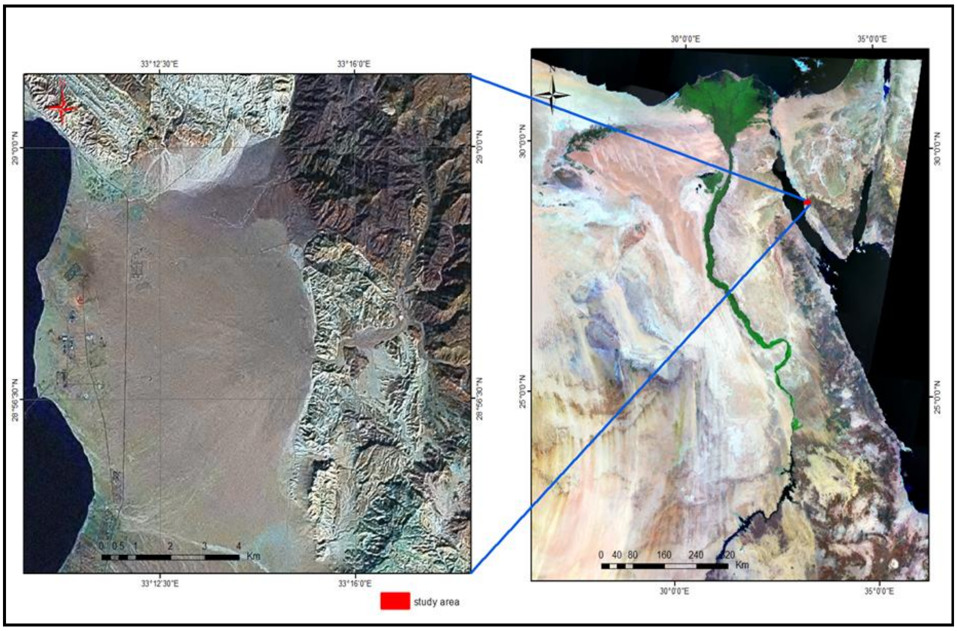
Remote Sensing technology provides a viable alternative to traditional fieldwork due to its large area coverage, multiple spectra information and nearly constant observation. Some of the important applications of remote sensing technology are agriculture, geology and hydrology. Satellite and aerial remote sensing constitute key technologies for improving the availability of vegetation data, and consequently the preconditions for scientific analysis and monitoring **(Karlson and Ostwald, 2016)**. Remote sensing products play an integral role in numerous applications, for example: carbon emission monitoring, forest monitoring, medical science and epidemiology studies, land change detection, natural hazard assessment, agriculture and water/ wetland monitoring, climate dynamics and biodiversity studies **(Khatami *et. al.*, 2016)**. Data layers in multi-criteria evaluation are handled in order to arrive at the suitability, which can be conveniently achieved using GIS. Remote sensing and GIS were used in many studies in Egypt for land resources mapping and management **(Mohamed *et al*., 2014; Saleh and Belal, 2014)**. The process of land suitability classification is the evaluation and grouping of specific areas of land in terms of their suitability for a defined land use. **Ismail et al. (2005)** demonstrated usefulness of GIS for terrain parameter analysis and the effectiveness of GIS and remote sensing integration for monitoring mapping soil characteristics and potential soil units for land reclamation.

This study aims at determining the common land characteristics in Southwest Sinai and evaluating the land suitability for growing some crops using the MicroLEIS Land Evaluation System.

MATERIALS AND METHODS

Selection of the study area

The study area, that includes Wadi Baba, Wadi El-Bidaa, Wadi Naga El-Gada and Elwet Baba, is located in Southwest Sinai Peninsula between longitudes 33º 10' 25'' to 33º 21' 21'' East and latitudes 28º 52' 19'' to 29º 00' 11'' North covering an area of about 25042.66 hectares. (Figure 1)



A **B**

Figure 1 Location map the site (A) and situation (B) of the study area

Digital image specification and processing.

Remote sensing data acquired by Operational Land Imager (OLI) of the satellite TM8. These data were recorded in the year 2017 covering the study area within the path 175 and row 40. The selected image data consists of three spectral bands (green, red and near infra-red) with a spatial resolution of 30 meters pixel size. These multispectral bands were merged with high spatial resolution panchromatic band of 15 m pixel size. The cartographic software **ERDAS (2010)** was used for manipulating these remote sensing data as GIS layer for the processes of band combination geometric correction and image sub setting.

Field work

Eighteen soil profiles that represent the delineated mapping units (Figure 2) were described according to the Guidelines of soil description of **FAO (2006)**. Twenty sites of minipits were used for checking the boundaries among the mapping units. Soil samples of different layers of soil profiles were collected for laboratory analyses.

Laboratory analyses

The collected soil samples were air dried, crushed, sieved through a 2 mm sieve and prepared for laboratory analyses. Laboratory analyses were carried out for particle size distribution using the pipette method

(Piper, 1950), while for calcium carbonate content using Collin's alcimeter **(Black, 1982).** Soil pH in soil past, Electric conductivity and soluble cations (EC) in soil past extract and CEC were determined according to the standard methods outlined by **Page et al (1982)**.

Building up Digital Georeference Database

Mapping units (polygons), roads (lines) and soil profile sites (points) were delineated or vector layers and their georeference database were attributed using Arc GIS 10.3 software.

Land suitability model (MicroLEIS- ALMAGRA model).

Land suitability evaluation modeling was applied following the well-known MicroLEIS suitability model ALMAGRA **De La Rosa *et. al*., (1992&2004)**. ALMAGRA model is a physical soil suitability evaluation model indicates the degree of suitability for a land use, without respect to economic conditions. The land use requirements were matched to the land characteristics of each physiographic unit to determine its suitability, depending on the gradations considered for selected criteria and on the different agricultural uses. The suitability classes for each crop are: soils with optimum suitability (S1), soils with high suitability (S2), soils with moderate suitability (S3), soils with marginal suitability (S4), and soils with no suitability (S5) as shown in Table 1. The main soil limitations are: useful depth (p), texture (t), drainage condition (d), carbonate content (c), salinity (s), sodium saturation (a) and degree of development of the profile (g). For each diagnostic criterion or limiting factor, the land characteristics were selected, and the corresponding levels of generalization were established and related with the suitability classes by means of gradation matrices.

Table 1 Land suitability index and ratings for MicroLEIS program.

Class	Description	Rating (%)
S1	soils with optimum suitability	> 80
S2	soils with high suitability	< 80 > 60
S3	soils with moderate suitability	< 60 > 40
S4	soils with marginal suitability	< 40 > 20
S5	soils with no suitability	< 20 >10

RESULTS AND DISCUSSION

Physiographic units.

According to **Afify *et al.* (2010),** using physiographic approach leads to a well understanding of landscape genesis by defining the drainage patterns that link the parent rocks in the highlands and the derived soil parent materials to the relatively lowlands. This approach realizes a reliable relationship between the physiographic features and the detectable soil attributes. Accordingly, physiographic features were categorized for the study area by tracing boundaries that are associated with different geomorphic processes. These features were emphasized by their spectral signature as reflected in remote sensing data. Five physiographic units (Table 2 and Figure 2) are described as follows:

i) **Rock land**

These physiographic unit is mostly delineated in the eastern part of the study area consisting of dissected and rugged sedimentary parent rock.

ii) **Bajada**

According to **Chorley *et al.* (1985),** Bajadas occur most commonly in semiarid and desert region as gently inclined surface extending from the base of mountain ranges out into land basin. They are formed by lateral coalescence series of alluvial fans to produce a depositional belt along the piedmont zone. In the study are, these bajadas are mostly extending along the foot slopes of the relatively high lands.

ii) **Alluvial terraces**

Afify *et al.* (2010) used the physiographic term for specifying the land form of terraces as alluvial terraces being have alluvium that was derived and deposited by water. They are also termed as old or young alluvial terraces when the landscape evolution and the degree of parent material development can be specified. In the study area, the alluvial parent material of these terraces were mainly derived from limestone rocks and moved downwards during the fluvial periods. These terraces are distributed westwards from bajadas to the deltaic plains.

iii) **Deltaic plains.**

Huggett (2007) stated that deltas are formed by deposition when rivers run into the sea. So long as the deposition rate surpasses the erosion rate, a delta will grow. According to **Elazab (2011),** these deltas are distributed along the shoreline with curved fronts having almost flat surfaces, but locally separated from that shoreline by marine sediments. In the study area, these deltaic plains were delineated in the western part of the study area aligning the shoreline of the Gulf of Suez.

iv) **Wadi.**

Wadis were described by **Afify *et al.* (2016)** as confined drainage system within the rock land and bajadas but somewhat opened within the alluvial terraces. They collect a seasonal run off sourced from intermittent rains on the catchment areas having soils of the most recent ones that are still affected by the seasonal flooding agent. In the study area, these wadis have nearly level surface extending eastwards to the Gulf of Suez from the catchment areas that are mostly formed in limestone rocks.

Table 2 Physiographic units and associated artificial features in the study area.

	Area (hectares)	area %
Physiographic unit		
Rock land	13080.27	52.21
Bajada	1253.643	5.00
Alluvial terraces	2543.989	10.16
Wadi	3005.124	12.00
Deltaic plain	4646.417	18.56
Artificial features		
Settlement	506.22	2.02
Roads	7.0	0.05
Total area	25042.66	100.00

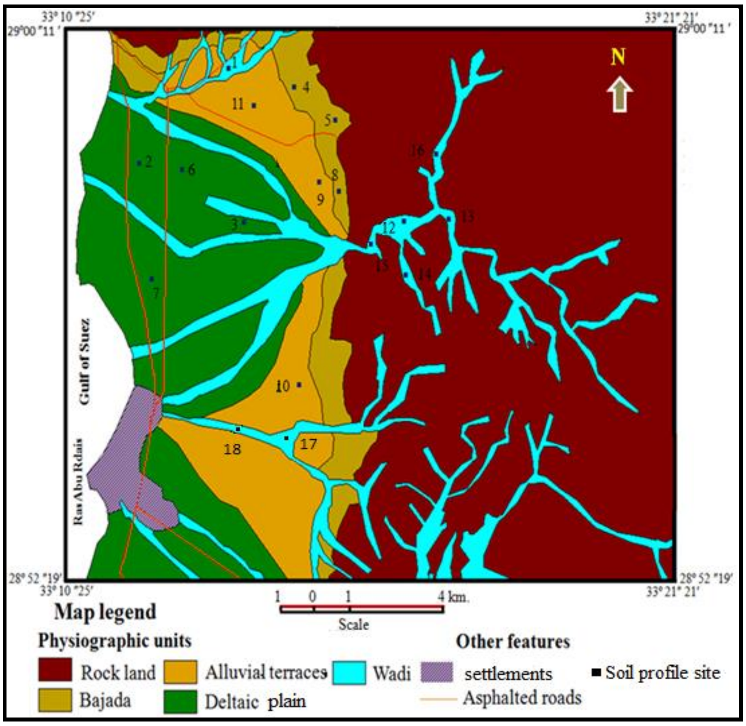


Figure 2 Physiographic map of the study area.

Land evaluation assessment

The overall soil suitability of a soil component (unit) was assessed through the maximum limitation method where suitability is taken from the most limiting factor of soil characteristics in Tables 3 and 4. These tables include the required soil attributes, which were processed for setting up the land suitability classes. Nine cropping patterns were tested for their suitability in the study area, namely, wheat, maize, potato, soybean, sunflower, alfalfa, peach, citrus and olive. The requirements of each kind of utilization are obtained from **Sys *et al*., (1993).**

Table 3 Particle size distribution of the soils in the study area.

Physiographic Unit	Profile No.	Depth (cm)	Gravel %	Sand%	Silt %	Clay%	Textural class
Bajada	4	0-25	35	95.2	1.3	3.5	Sand
		25-100	35	86.8	2.5	10.7	Loamy sand
		100-150	35	92.7	1.5	5.8	Sand
	5	0-30	35	90.8	3.9	5.3	Sand
		30-70	40	88.3	2.5	9.2	Loamy sand
		70-150	35	94.3	1.2	4.5	Sand
	8	0-25	60	92.45	0	7.55	sand
		25-100	50	83	2.5	14.5	Sandy loam
		100-150	40	93.9	1.8	4.3	Sand
Alluvial terraces	9	0-25	40	80.4	13.5	6.1	loamy Sand
		25-120	35	72.5	7.5	20	Sandy clay loam
		120-150	30	87	7.5	5.5	loamy Sand
	10	0-25	35	79.2	15	5.8	loamy Sand
		25-125	30	70.3	9	20.7	Sandy clay loam
		125-150	30	80.9	6.1	13	Sandy loam
	11	0-35	15	93.5	2.5	4	Sand
		35-75	10	85.8	1.4	12.8	Sandy loam
		75-150	10	90.7	2.5	6.8	Sand
Deltaic plain	2	0-30	25	92.5	2.5	5	Sand
		30-70	20	83.3	1.7	15	Sandy loam
		70-150	20	92	1.5	6.5	Sand
	3	0-30	35	93.2	4.5	2.3	Sand
		30-70	35	90.3	1.9	7.8	Sand
		70-150	30	94.8	2.3	2.9	Sand
	6	0-50	30	81.95	9.5	8.55	Loamy sand
		50-100	25	75.9	12.5	11.6	sandy Loam
		100-150	25	93.9	1.3	4.8	Sand
	7	0-60	25	89.8	7.7	2.5	sand
		60-90	20	83.2	6.5	10.3	Loamy sand
Wadi	1	0-25	30	80.6	9.7	9.7	Loamy sand
		25-60	35	64.8	15.1	20.1	Sandy clay loam
		60-150	30	79.3	7	13.7	Sandy loam
	12	0-50	40	84.2	10	5.8	loamy Sand
		50-100	35	79.8	5.2	15	Sandy loam
		100-150	30	85.4	2.5	12.1	loamy Sand
	13	0-60	45	91	2.5	6.5	Sand
		60-90	45	86	4.5	9.5	loamy Sand
		90-150	40	90.4	1.4	8.2	Sand
	14	0-50	25	91.4	2.5	6.1	Sand
		50-100	25	77.6	10	12.4	sandy Loam
		100-150	15	91.2	2.5	6.3	Sand
	15	0-50	15	70.6	13.8	15.6	Sandy loam
		50-100	20	71.1	15.5	13.4	Sandy loam
		100-150	10	76	12	12	Sandy loam
	16	0-100	15	85.2	7.2	7.6	Loamy sand
		100-125	25	72.5	7.5	20	Sandy clay loam
		125-150	10	92.1	2.5	5.4	Sand
	17	0-70	20	78.5	9.8	11.7	sandy Loam
		70-110	15	86.8	2.5	10.7	Loamy sand
		110-150	10	83	2.5	14.5	Sandy loam
	18	0-60	15	93.2	4.5	2.3	Sand
		60-120	10	91	3.5	5.5	Sand
		120-150	10	91.1	2.5	6.4	Sand

Table 4 Required soil chemical analyses of the soils in the study area.

Physiographic Unit	Profile No.	Depth (cm.)	pH	E.C (dSm^{-1})	Cation ($mmolcL^{-1}$)			$CaCO_3$ (gkg^{-1})	CEC ($cmolc\ kg^{-1}$)
					Ca^{++}	Mg^{++}	Na^{+}		
		0-25	7.30	2.40	22.35	1.37	1.95	56.3	2.64
	4	25-100	6.30	2.27	19.90	4.63	1.03	65.1	3.62
		100-150	6.50	1.88	11.22	8.78	0.05	52.0	4.04
		0-30	6.90	1.00	3.73	2.82	2.72	68.1	3.08
Bajada	5	30-70	7.00	0.89	4.39	2.88	1.95	102.0	5.34
		70-150	6.50	0.50	2.76	1.02	1.24	121.0	2.48
		0-25	7.00	3.50	27.84	02.52	05.16	22.5	4.74
	8	25-100	6.70	2.63	18.37	7.10	3.00	19.1	6.36
		100-150	7.50	1.05	3.27	4.66	3.00	52.0	3.04
		0-25	7.40	3.40	30.20	03.26	03.05	23.1	9.74
	9	25-120	6.70	4.60	28.67	10.01	10.44	64.0	14.46
		120-150	6.50	5.49	32.86	7.90	16.09	53.9	5.44
		0-25	6.50	3.30	30.00	1.27	03.40	21.6	7.66
Alluvial terraces	10	25-125	7.60	3.08	20.41	9.78	3.35	87.0	14.18
		125-150	6.80	3.09	21.43	7.82	4.00	52.0	7.32
		0-35	8.60	0.97	00.20	00.80	07.00	13.1	3.04
	11	35-75	7.00	1.31	7.96	3.74	3.00	121.3	4.06
		75-150	6.70	0.56	1.94	1.93	2.16	62.6	3.04
		0-30	7.60	0.80	2.94	1.06	2.93	4.5	3.64
	2	30-70	6.40	0.75	3.47	2.29	1.45	41.0	11.48
		70-150	7.10	0.77	3.37	2.67	1.74	69.0	2.2
		0-30	7.40	0.85	2.84	4.61	0.61	1.80	1.8
	3	30-70	7.00	0.29	2.14	0.88	0.12	24.0	4.68
		70-150	6.20	0.15	0.82	0.88	0.05	78.0	2.2
Deltaic plain		0-50	6.60	14.50	80.20	19.26	33.04	10.8	4.5
	6	50-100	7.70	08.50	42.16	03.66	28.26	13.5	6.34
		100-150	6.30	6.70	45.41	15.91	12.19	130.0	3.04
		0-60	7.00	17.00	56.67	23.52	68.00	015.7	2.34
	7	60-90	6.10	7.62	40.51	17.98	19.13	120.0	4.18
		90-150	6.70	6.53	18.67	14.35	26.52	73.0	4.74
		0-25	7.40	6.80	37.06	3.94	27.91	14.4	4.38
	1	25-60	6.90	2.91	21.43	6.68	3.57	70.40	15.3
		60-150	6.65	3.24	22.45	5.19	5.74	67.80	4.18
		0-50	7.20	0.47	1.27	1.00	1.66	0.5	7.1
	12	50-100	6.90	2.13	1.73	6.00	11.14	02.0	13.60
		100-150	6.10	11.79	37.04	21.36	45.00	121.0	6.28
		0-60	7.40	1.90	14.40	02.48	02.58	27.9	4.46
	13	60-90	6.70	1.36	7.65	5.74	1.10	19.1	4.18
		90-150	6.60	1.53	11.22	3.96	1.10	2.0	4.18
		0-50	7.50	2.40	03.73	03.37	14.66	4.0	3.9
	14	50-100	5.80	2.34	3.78	9.43	12.19	9.0	3.9
		100-150	7.20	3.85	19.49	8.06	12.90	9.0	3.04
Wadi		0-50	6.70	2.70	25.88	03.21	00.82	46.3	13.07
	15	50-100	6.30	4.94	27.55	14.90	9.73	113.0	9.4
		100-150	6.80	29.00	68.06	28.92	170.00	47.00	10.26
		0-100	6.40	3.46	08.33	07.94	15.59	9.0	3.32
	16	100-125	6.80	5.05	21.43	21.02	13.25	32.0	4.32
		125-150	6.70	4.03	28.57	6.33	9.03	104.0	4.32
		0-70	6.8	0.8	3.47	2.66	1.40	112.0	4.02
	17	70-110	6.8	0.89	4.39	2.89	1.95	53.0	3.12
		110-150	6.7	1.36	7.66	5.74	1.11	9.0	3.50
		0-60	6.2	0.76	3.36	2.66	1.73	51.0	3.14
	18	60-120	6.5	1.88	11.22	8.78	0.05	106.0	4.01
		120-150	6.1	0.57	1.94	1.93	2.16	89.0	3.89

A land evaluation modeling for cropping pattern was applied following the MicroLEIS model Almagra **(figure 3) (De La Rosa *et. al*., 1992; De la Rosa *et. al*., 2004)**. The MicroLEIS with an Almagra model (Agricultural Soil Suitability) has been used to assess the suitability of the different soils in the study area.

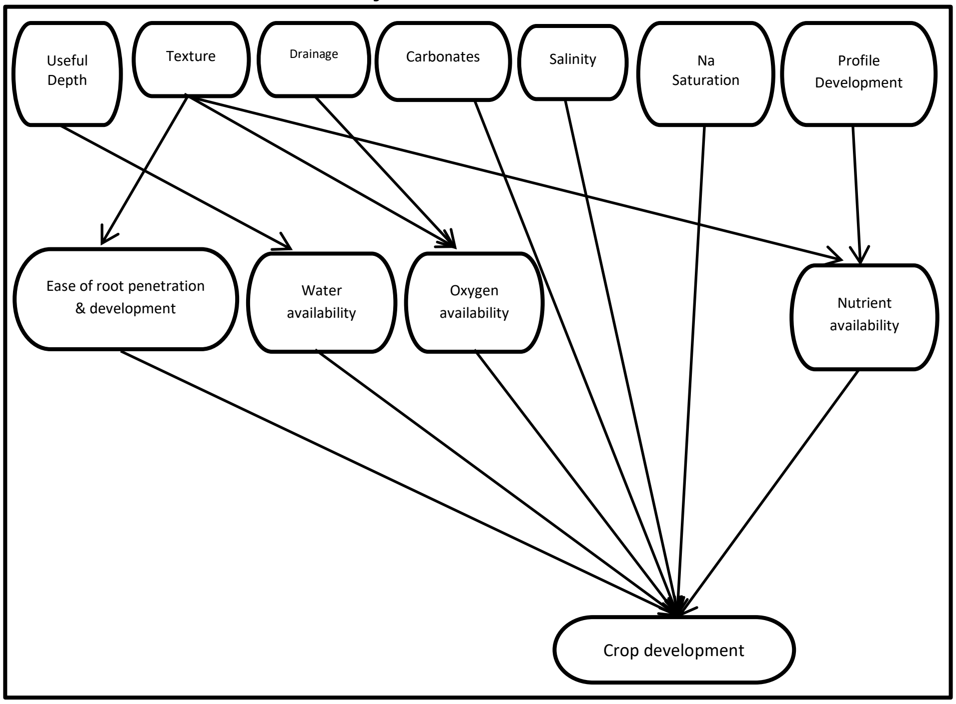


Figure 3 Scheme of Almagra model (flow effects of selected characteristics on crop production)

The mean weighted value of each determined soil property (V) was calculated according to **Ismail et al. (2005)** by using the following equations:

$$v = \left[\frac{\sum_{i=1}^{n}(vi \times ti)}{T}\right]$$

Where (vi) is the parameter value of each horizon, (ti) is the horizon thickness and (T) is total profile depth. After the final data preparation, the physical and chemical properties were applied to Almagra Model of **MicroLEIS web-Based Program, (2009)** to run the land suitability evaluation for the selected crops: wheat (W), maize (M), potato (P), and soybean (Sb), sunflower(Sf) as annual crops; alfalfa (A) as semiannual crop and peach (Pe), citrus fruit (C) as well as olive (O) as perennial crops (Figures 4 - 9). The spatial analysis function in ArcGIS 10.3 was used to create thematic layers of the most constrained factors. In the suitability model, the evaluation results are presented in the form of a matrix of two dimensional array with rows including the soil characteristics and columns consisting of the soil units for which the evaluation was computed. The intersection of the two arrays (i.e. the cells of the matrix) is considered as the result. The overall soil suitability of a soil component (unit) was assessed through the maximum limitation method where the suitability is taken from the most limiting factor of soil characteristics. The definitions of soil suitability classes, soil factors and limitation are listed in Table 5, while soil suitability classes for the selected crops are included in Table 6.

Table 5 Soil factors and limitations versus soil suitability classes

Soil factor		Limitation		Soil suitability class	
Symbol	Definition	Symbol	Definition	Symbol	Definition
A	Sodium saturation	1	None	S1	Highly suitable
C	Carbonate	2	Slight	S2	Suitable
D	Drainage	3	Moderate	S3	Moderately suitable
G	Profile development	4	Severe	S4	Marginally suitable
P	Useful depth	5	Very severe	S5	Not suitable
S	Salinity				
T	Texture				

Table 6 Land suitability classes and limiting factors for the different physiographic unit of the study area.

Geographic unit	Annual crops					Semiannual crops	Perennial crops			Area (%)
	Wheat (W)	Maize (M)	Potato (P)	Soybean (Sb)	Sunflower (Sf)	Alfalfa (A)	Peach (Pe)	Citrus (C)	Olive (O)	
Rock land	S5	S5	S5	S5	S5	S5	S5	S5	S5	52.26
Bajada	S2tca	S3c	S3c	S2tcs	S2tca	S2tca	S3c	S3c	S2ca	5.00
Alluvial terraces	S2tca	S3c	S3c	S2tcs	S2tcs	S2tcs	S3c	S3c	S3s	10.16
Deltaic plain	S2tca	S3c	S3c	S2tcs	S2tcs	S2tcs	S3cs	S3cs	S3c	18.56
Wadi	S2ca	S3c	S3c	S2csa	S2csa	S2csa	S3c	S3c	S2csa	12.00

Note: S2 (suitable), S3 (moderately suitable), S5 (not suitable), t (texture), c (carbonate), s (salinity), and a (sodium saturation).

The overall land suitability classes of the study area did not significantly differed among each other. In general, the soils of the study area varied from suitable and moderately suitable. (45.72% of the total area) to not suitable (54.28% of the total area) for all selected crops. The unsuitable class resulted from the existence of one or more soil limitations such as soil texture, carbonate content, salinity, or sodium saturation. The results of the current study indicate that the most limiting factors were soil texture, followed by salinity, sodium saturation, and lime content.

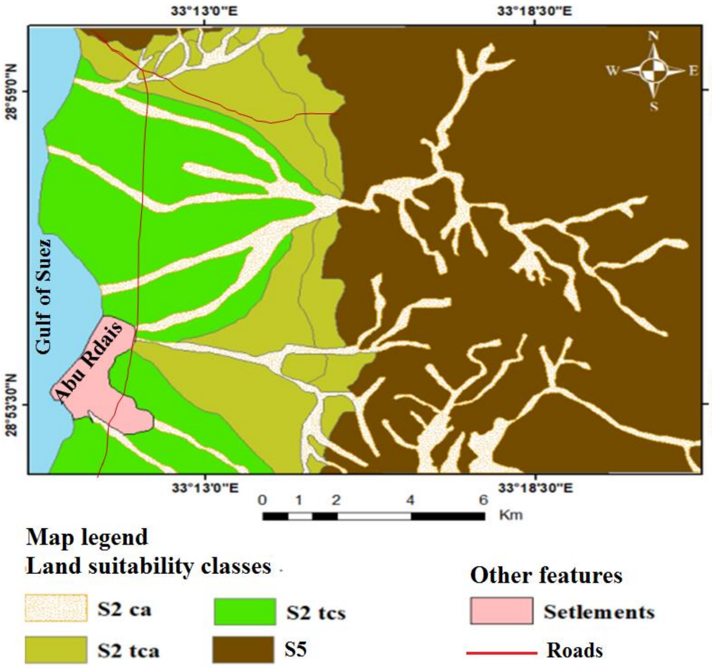


Figure 4 Land suitability map for wheat

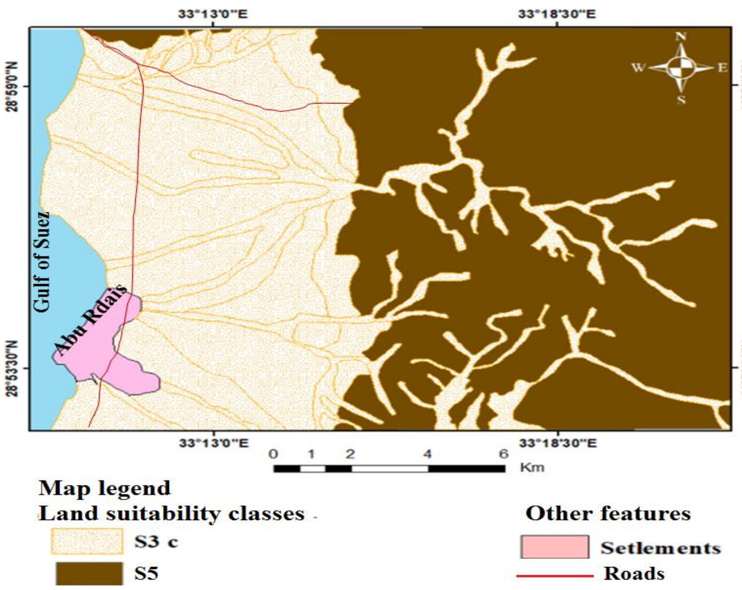


Figure 5 Land suitability map for maiz and potato

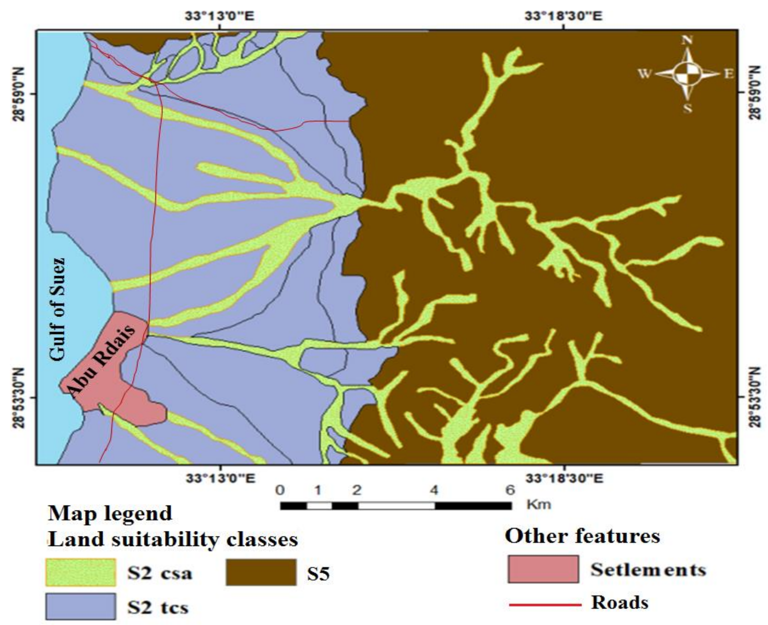


Figure. 6 Land suitability map for soybean

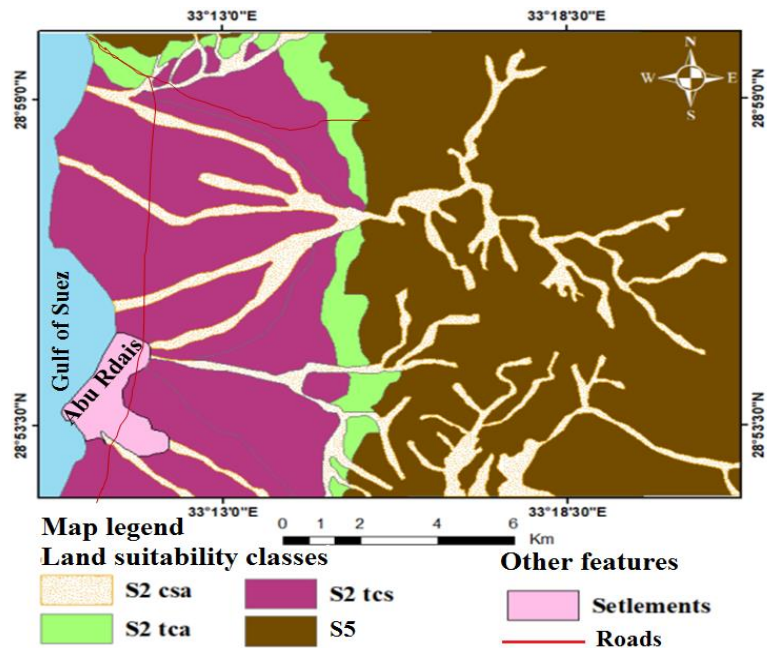


Figure 7 Land suitability map for sunflower and alfalfa

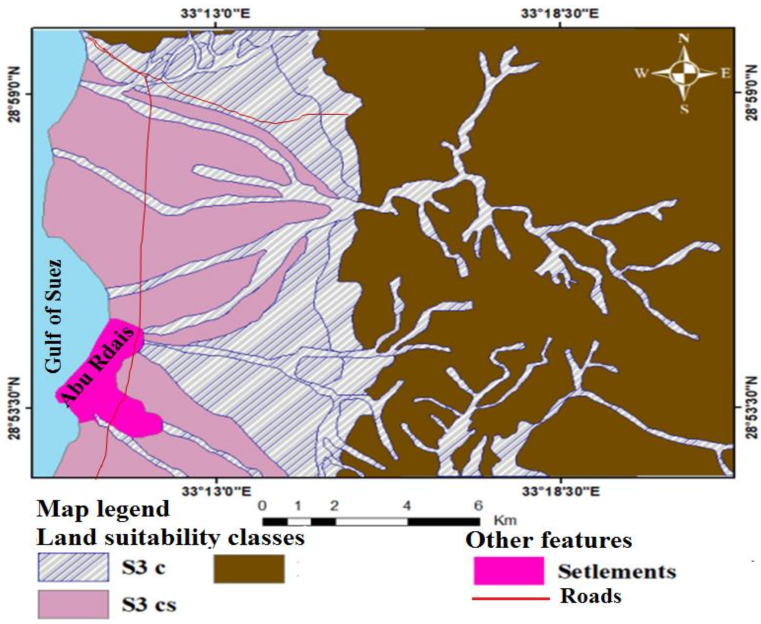


Figure 8 Land suitability map for peach and citrus

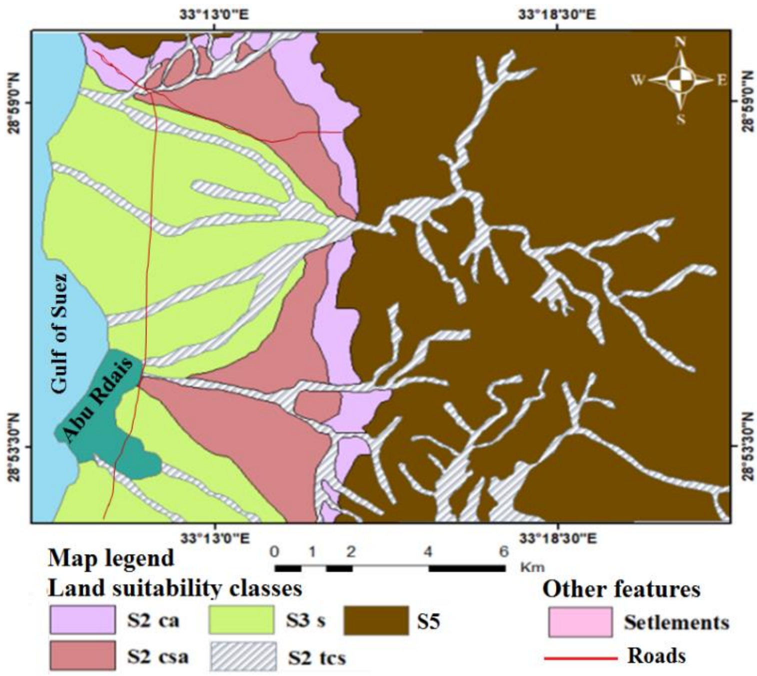


Figure 9 Land suitability map for olive

CONCLUSION

Remote sensing data and GIS application are very helpful tools to store, manipulate and quantitative evaluate of soil suitability. The results of the study revealed that about 45.72% % of the study area is high to moderately high of land suitability for selected crops. The main suitability limitations were soil texture, carbonate content, salinity, or sodium saturation. Also, the suitability analyses showed that the study area is suitable for cropping wheat, maize, potato, and soybean, sunflower, alfalfa, peach, citrus and olive. The study area is of moderate potentiality for horizontal agricultural expansion. This area is promising for the agricultural development considering the advantage of the natural resources without threatening their quality.

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تحليل مدى ملائمة التربة لمحاصيل مختلفة في بعض أودية منطقة جنوب غرب سيناء-مصر، باستخدام معلومات الاستشعار عن بعد وتقنية نظم المعلومات الجغرافية.

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تم تحليل مدى ملائمة التربة لزراعة محاصيل معينة باستخدام الاستشعار عن بعد ونظم المعلومات الجغرافية ،وذلك في منطقة تقع في جنوب غرب سيناء تضم وادى بعبع، وادى البيضاء، وادى نجع الغضا وعلوة بعبع. تم انتاج خريطة فيزيوجرافية تشتمل على خمس وحدات فيزيوجرافية أساسية هي: الأراضي الصخرية (Rock Land), المروحيات المجمعة (Bajada) , المصاطب الرسوبية (Alluvial terraces) , السهل الدلتاوى (Deltaic plain) والوادي (Wadi)

تم حفر ووصف ثمانية عشر قطاعا للتربة ممثلة للوحدات الفيزيوجرافية لمنطقة الدراسة، وتم عمل التحاليل الكيميائية والطبيعية اللازمة لتقييم اختلافات التربة ومدى ملائمتها لمختلف المحاصيل، ثم استخدمت نتائج هذه التحاليل مع نتائج بيانات الاستشعار عن بعد ونظم المعلومات الجغرافية في إنتاج خرائط لمدى ملائمة التربة المدروسة لبعض المحاصيل، واستخدم في ذلك برنامج Micro-LIES-Almagara model لإنتاج خرائط الملائمة للمحاصيل المختلفة وتحديد المحددات في كل وحدة خرائطية وباستخدام هذا البرنامج تم التوصل لمعرفة افضل المحاصيل نموا في منطقة الدراسة، وهى كالتالي: من المحاصيل الحولية (القمح، الذرة، البطاطس، فول الصويا، وعباد الشمس) والمحاصيل النصف حولية (البرسيم

الحجازى) والمحاصيل المعمرة (الخوخ، الموالح، والزيتون). حيث أشارت النتائج الشائعة لمنطقة الدراسة إلى أن معظم العوامل المحددة لمدى ملائمة التربة بمنطقة الدراسة هي القوام، الملوحة، التشبع بالصوديوم، ومحتوى التربة من الجير. كما أظهرت نتائج الدراسة إلى إمكانية زراعة هذه الأرض حيث وجد أن حوالى 45.72 % من إجمالي المساحة المدروسة ذات درجة ملاءمة متوسطة إلى عالية، وأن حوالى54.28 % من إجمالي المساحة تحت الدراسة غير صالحة.