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Land Capability and Suitability Mapping in Some Areas of North-Western Coast, Egypt

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ABSTRACT

The objectives of this work are to assess soil suitability and capability for agricultural use in Al-Hwallah region, North-western coast of Egypt by to accomplish the agriculture outgrowth using Land Use Suitability Evaluation Tool (LUSET) and Stori index. The study area is located in the North-western coastal plain in Matrouh Government. It is delimited by longitudes 27° 32' 0" – 27° 35' 0" E and latitudes 31° 7' 0" – 31° 12' 0" N with an area about 13.65 km^2. Fourteen soil profiles were dug and pedo-morphologically described. Thermic and torric are the common temperature and moisture regimes of the investigated area. Based on the field survey, laboratory analysis, and Landsat 8 image interpretation in collaboration with GIS, the physiographic units were extracted. Five main landforms were recognized as follows Piedmont, Foot Slope, Back Slope, Summit and Escarpment. Typic Haplocalcids, Typic Torripasamments and Typic Torriorthents are the dominant soils. According to the land capability assessment by the modified Stori index, the studied soils were categorized in to grade 1, grade 2, grade 3, and grade 4 but grade 3 and 4 are the most common with an area 3.5 km^2 and 5.77 km^2 respectively. According to LUSET suitability results, the most suitable crops in the study area are alfalfa watermelon, barley, wheat, sorghum and olives. The evaluation results indicate that the main limiting factors for agriculture soil suitability in the studied area were soil texture, shallow soil depth, excess of salts and lime.

Keywords: Land Suitability • Land Capability • LUSET •Storie Index • Egypt.

INTRODUCTION

Northwestern coast of Egypt is considered one of the most promising areas of horizontal expansion in the Western desert in land reclamation and utilization owing to its distinguishable place and the water abounding for irrigation. The assessment of agricultural capability in this area requires specific and real assessment of soil and water resources in terms of land capability and suitability for crops farming (Elsheikh *et al.,* 2013). This region vary from other recently reclaimed areas in Egypt, which some of them is located in the calcareous soils got from the marine deposits, while this region is dominated with sandy soil texture and calcareous type of soils (Yousif and Bubenzer, 2012). Land evaluation process is the estimation of land behavior or performance for the specific objective (Anaya-Romero *et al.,* 2015). Land evaluation mapping is a tool that can be utilized to give the information for establishing particular inputs in the sustainable farming planning (George, 2015; UNEP, 2015). Land suitability investigation is a strategy of land evaluation, which identifies the main restricting factors for a specific crop production (Halder, 2013). In the same time it empowers decision makers to improve a crop management method for growing land output (Chen, 2014). The suitability characterizes the grade of the crop needs regarding the present soil/land properties. Suitability is a measure of how well the qualities of a land unit match with the needs of a specific type of land use (FAO, 2007). The main aim of suitability estimation is to decide the capacity of the land to give the optimum ecological needs for a certain use. Land capability estimation characterizes and evaluates land development units from a general viewpoint without taking into consideration the kind of its use (Ande 2011; AbdelRahman *et al.,* 2016). Land suitability estimation has been widely applied in China and other countries, but has also gotten much criticism for its academic and empirical deficiency (Zabihi *et al.,* 2015; Bozdag *et al.,* 2016). LUSET and modified Stori index are very valuable tools in land evaluation of El-Dakhla oasis, Egypt (Sawy, *et al.,* 2013)). Rainfall water harvesting is an important and significant practice in the investigated region which can considerably increase rainwater profitability and increasing environmental protection (Rashash and El-Nahry, 2015). Rainwater harvesting is “the way toward concentrating precipitation through runoff and storing it for useful use” (Frasier, 1994). GIS and remote sensing provide wide coverage of digital elevation models (DEM) that are widely used in soil landscape modeling (Salehi *et al.,* 2003). The utilization of DEM is critical and very important to extract landscape characteristics that are used in land forms description and characterization (Dobos *et al.,* 2000). This work aimed to assess soil crop suitability and land capability to accomplish the agriculture outgrowth using LUSET and Stori index. Meanwhile, this research explores a new reclaimed location in the North-western Coast region with the aim of selecting the suitable agriculture land use whereas the study area is promising for rainwater harvesting.

MATERIALS AND METHODS

Location and typography: The studied area is located in the North-western Coast, Matrouh Government, Egypt. It is delimited by longitudes 27° 32' 0" – 27° 35' 0" E and latitudes 31° 7' 0" – 31° 12' 0" N (Figure 1). The elevation of the study area ranges between 0.1 and 166 m ASL (Figure 2), the slope ranges between 0.0 and 36% (Figure 3) and the main slope diraction is to the north (Figure 4). The total area is 13.65 km^2.

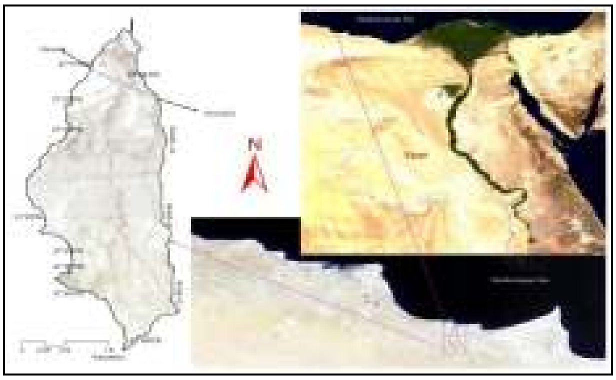

Figure 1. Location map of the research area

Geology: The lithology of the studied area belong to Recent and Halocene (eolian sand and fluvial loams) and the Late Pleistocene marine deposits were recognized by the oolitic limestone disseminated along the Mediterranean shoreline, west of Alexandria (Yousif and Bubenzer, 2012).

Climate: As illustrated in Figure 5, the mean annual temperature ranged between 29.7 C^{o} in August and 12.8 C^{o} in January. The annual precipitation was 137.6 mm with maximum rainfall in January (33.2 mm). Evapotranspiration ranged between 5.90 mm day^{-1} in June and 2.70 mm day^{-1} in January. The relative humidity ranges between 61 and 73 %. According to Soil Survey Staff (2014) the soil temperature regime of the research area is thermic, while moisture regime is torric.

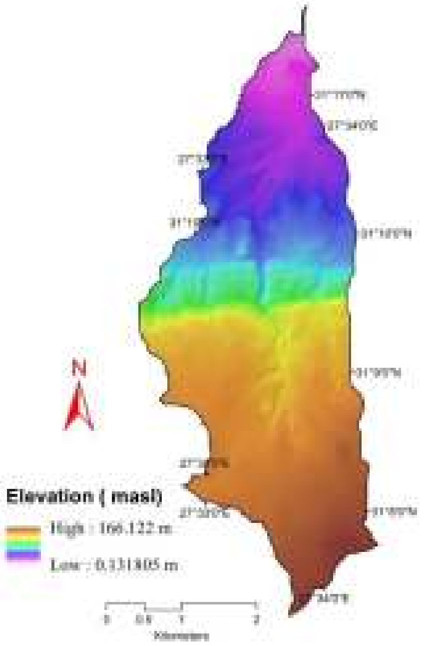

Figure 2. DEM map.

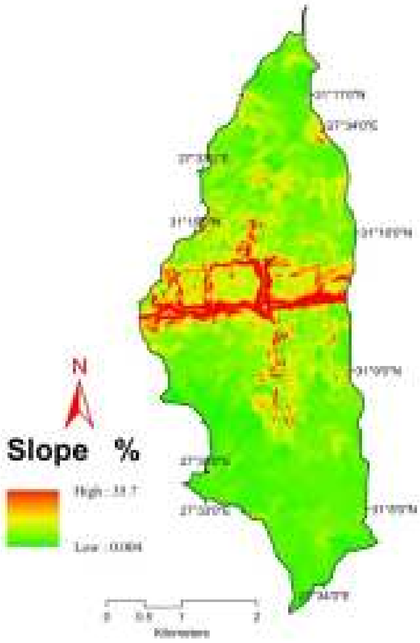

Figure 3. Slope gradient map.

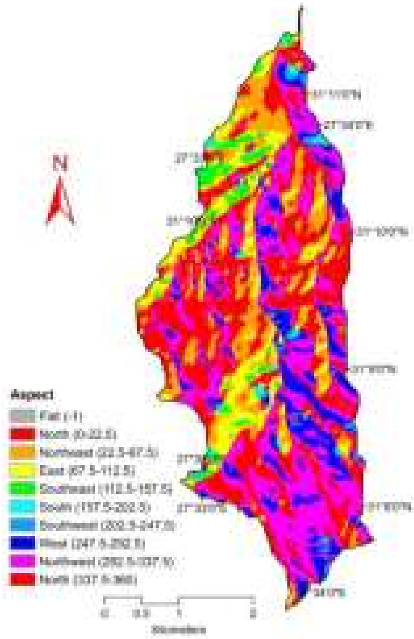

Figure 4. Aspect map.

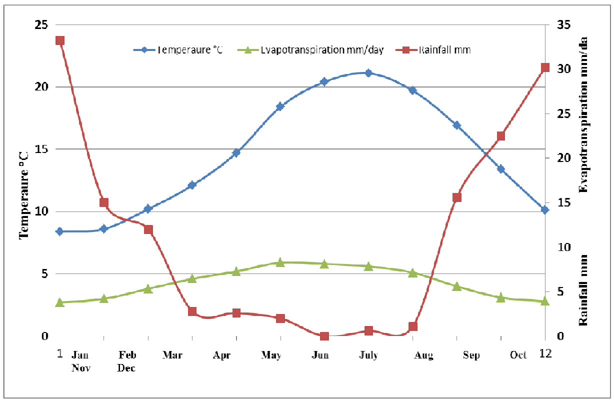

Figure 5. Climate diagram of Matrouh metrological station (average data of Matrouh station, 1985-2015)

Data sets: Digital image processing of Landsat 8 image (path 179, row 38) acquired on 20-09-2017 performed using ENVI 5.2© software (ITT, 2014) for classifying the geomorphologic units. DEM analyses and hydrological analysis were prepared on ASTER GDEM data to extract parametric information, including slope, aspect, hillshade, flow direction, flow accumulation, stream networks, drainage density and watersheds (El Bastwesy *et al.,* 2012) using ArcMap 10.5.1 (ESRI, 2017). The stream drainage network was derived and categorized according to Strahler (1957). Figure 6 explains the methodology framework achived in the study.

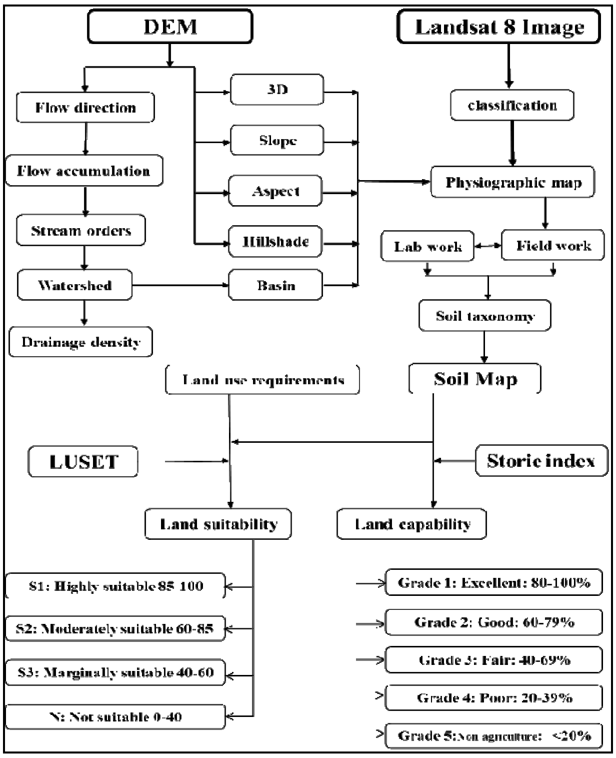

Figure 6. Methodology framework followed in the study

Field and lab work: Fourteen soil profiles were dug and described according the FAO (2006). Forty five soil samples were collected from the different layers for analyses. Soil samples were air dried and prepared to make soil physical and chemical analysis according to USDA (2014). Soil Survey Staff (2014) was used to classify each soil profiles in order to recognize the major soil sets. DEM was used for creating 3D presentation of the studied area using Arc GIS 10.5.1. Based on the digital and visual interpretation of Landsat image as well geological map, 3D map, field observations, and the previous works, the landform map was distinguished to different units.

Land evaluation: Based on the soil analysis and crop requirement Land suitability was achieved using land use suitability evaluation tool (LUSET), a computer- based program (Yen *et al.,* 2006). Based on the soil analysis the land capability was carried out using Modified Storie Index (UCDAVIS, 2008). The calculation was run and coding using VisualBasic for application under Microsoft Excel. Storie index rating =

[(FactorA/10)*(FactorB/100)*(FactorC/100)*(FactorX/100)]*100

Where; **A: soil depth (cm), B: Surface Texture, C: Slope, and X: includes; Drainage, Microrelief, Fertility, Alkalinity.**

RESULTS AND DISCUSSION

The DEM map reveals that the elevation varies from 0.1 to 166.1 ASL as presented in Figure 2. The slope analysis (Figure 3) reveals that, 12.22 % of the area is flat to nearly level (0–1%), 81.46 % is very gently slope to sloping (1–10%), 6.28 % is strongly sloping to moderately steep (10–30%), and 0.1.04 % is steep (>30%). The aspect analysis (Figure 4) shows that, the directions of the slopes are north (30.46%), northeast (16.03%), east (9.64%), southeast (3.63%), south (10.01%), southwest (1.67%), west (11.13%), and northwest (26.44%). The maximum stream order of drainage network is four.

Mapping units: The results reveal that study area included five landforms (mapping units) are namely Piedmont, Foot Slope, Back Slope, Summit and Escarpment as displayed in Figure 7. Table 1 shows some chemical and physical properties of the investigated soils.

Summit: It occupies the southern portion of the research area and it has clear boundaries with the Escarpment. This unit has an almost flat and gently undulating topography. This mapping unit is shallow to deep, soil depth ranges between 40 and 150 cm. Texture extends between sandy and loamy sand, slightly saline, and with few gravel. It occupies about 6.09 km^2 (44.60 %). The soil pH values range between 7.87 and 8.56. The electrical conductivity (EC) ranges between 0.25 and 5.43 dSm^{-1}. Calcium carbonate ($CaCO_3$) ranges between 12.1 and 54.2 %. Cation exchange capacity (CEC) ranges between 1.07 and 11.40 Cmol+ kg^{-1} soil. Organic matter ranges between 0.21 and 1.29 %. Field capacity ranges between 4.90 and 18.8 %. As displayed in Table 2, Typic Torripasamments represent 83.40 % (profiles No.9, 10, 11, 12, 13) and Typic Haplocalcids represent 16.60 % (profile 14) of the unit. This unit comprises 44.60 % of the investigated area.

Back slope: This mapping unit is moderate to deep, soil depth extends between 75 and 150 cm. Texture ranges between sandy and loamy sand, slightly to moderately saline, and with very few to many gravels. It occupies about 1.47 km^2 (10.78 %). This unit has gently undulating to undulating topography. Soil pH ranges between 7.70 and 8.70. EC ranges between 0.9 and 10.2 dSm^{-1}. $CaCO_3$ ranges between 16.2 and 44.7 %. CEC ranges between 1.34 and 5.98 Cmol kg^{-1} soil. OM ranges between 0.19 and 0.81 %. Field capacity ranges between 7.10 and 13 %. As shown in Table 2, Typic Torripasamments represent 33.33 % (profiles No.7) and Typic Haplocalcids represent 66.67 % (profile 6, 8) of mapping unit. This unit comprises 10.78 % of the investigated area.

Foot slope: This mapping unit is shallow to deep, soil depth extends between 40 and 130 cm. Texture ranges between sandy and loamy sand, slightly saline, and with very few to abundant gravels. It occupies about 2.07 km^2 (15.16 %). This unit has an almost flat to gently undulating topography. Soil pH ranges between 8.16 and 8.38. EC ranges between 0.6 and 4.3 dSm^{-1}. $CaCO_3$ ranges between 27.5 and 62.3 %. CEC ranges between 3.05 and 10.95 Cmol kg^{-1} soil. OM ranges between 0.43 and 0.82 %. Field capacity ranges between 6.40 and 18.80 %. As illustrated in Table 2, Typic Haplocalcids represent 33.33 % (profile 5), Typic Torripasamments represent 33.33 % (profiles 4) and Typic Haplocalcids represent 33.33 % (profile 3) of mapping unit. This unit comprises 15.16 % of the investigated area.

Piedmont: This mapping unit is deep, soil depth ranges between 100 and 130 cm. Texture extends between sandy and loamy sand, slightly saline, and with very few gravels. It occupies about 0.97 km^2 (7.13 %). This unit has an almost flat to very gently undulating topography. Soil pH ranges between 7.8 and 8.44. EC ranges between 0.29 and 0.65 dSm^{-1}. $CaCO_3$ ranges between 35.6 and 90.3 %. CEC ranges between 0.45 and 6.79 Cmol kg^{-1} soil. OM ranges between 0.43 and 1.08 %. Field capacity ranges between 5.50 and 13.90 %. As illustrated in Table 2, Typic Haplocalcids represent 33.33 % (profile 5), Typic Torripasamments represent 50 % (profile 1) and Typic Haplocalcids represent 50 % (profile 2) of mapping unit. This unit comprises 7.13 % of the studied area.

Escarpment: This mapping unit is rocky severely to weakly dissected rock land, denuded, smoothened relief. This unit is strongly sloping to moderately steep topography. It occupies about 3.05 km^2 and comprises 7.13 % of the investigated area.

Land capability: The purpose of land capability is to investigate and register all data in order to select the most intensive and appropriate agriculture use of the land without undue danger of soil degradation. The best known one of this system is modified Storie index adopted by UCDAVIS (2008). Modified Storie index predicts the general land capability. Through applying Storie index equation, the soils of studied area are classified in to grade 1, grade 2, grade 3, and grade 4 as shown in Table 3 and Figure 8. Grade 1 occupies 0.77 km^2 (7.3 %) and exists in the summit mapping unit. Grade 2 occupies 0.57 km^2 (5.4 %) and locates in the Piedmont mapping unit. Grade 3 occupies 3.5 km^2 (33 %) and exists in all mapping unit. Grade 4 occupies 5.77 km^2 (54.3 %) and locates in summit, foot Slope, and back slope mapping unit.

Table 1 . Some physical and chemical properties of the studied soils.

Unit	NO	Depth (cm)	Gravels %	Texture Sand %	Silt %	Clay %	class	F.C %	W.P %	A.W %	S.P %	EC dSm^{-1}	pH -log [H+]	$CaCO_3$ %	OM %	CEC Cmol kg^{-1}
Piedmont	1	0-24	1.3	92	2.5	5.5	S	7.60	2.80	4.80	35.98	0.648	7.88	78.7	0.92	4.83
		24-60	0	97	2.5	0.5	S	5.50	0.30	5.20	23.33	0.278	7.96	83.9	0.60	0.93
		60-100	0	97	2.5	0.5	S	5.50	0.30	5.20	23.33	0.292	8.33	90.3	0.43	0.45
	2	0-20	0	84.5	10	5.5	LS	13.90	7.90	6.00	36.52	0.544	8.07	35.6	1.08	5.27
		20-55	0	84.5	10	5.5	LS	13.90	7.90	6.00	36.52	0.544	8.07	35.6	0.89	4.74
		55-90	0	84.5	5	10.5	LS	11.90	6.00	5.90	40.01	0.458	8.28	40.4	0.55	6.79
		90-110	0	87	7.5	5.5	LS	8.70	2.90	5.80	36.34	0.555	8.38	46.6	0.43	3.45
		110-130+	0	82	10	8	LS	10.80	4.20	6.60	38.78	0.444	8.44	40.0	0.43	4.95
Foot Slope	3	0-20	2.9	89.5	7.5	3	S	6.40	0.90	5.50	32.80	2.69	8.16	62.3	0.43	1.95
		20-60	2.7	72	10	18	SL	18.80	10.60	8.20	44.00	4.18	8.20	55.3	0.43	10.95
		60-100	0	72	10	18	SL	18.80	10.60	8.20	44.00	3.22	8.34	40.8	0.43	10.95
		100-130	0	79.5	12.5	8	LS	11.30	4.30	7.00	38.96	4.32	8.37	27.5	0.43	4.95
	4	0-30	2.7	84.5	5	10.5	LS	11.90	6.00	5.90	40.01	0.864	8.21	60.3	0.49	6.62
		30-40								Partially weathered Limestone						
		+ 40								Bedrock						
	5	0-27	4.4	89.5	7.5	3	S	6.40	46.70	5.50	32.80	0.676	8.30	49.3	0.82	3.05
		27-55	55.6	84.5	7.5	8	LS	10.20	4.20	6.00	38.60	2.00	8.38	60.7	0.60	5.43
		55-60								Partially weathered Limestone						
		+ 60								Bedrock						
Back Slope	6	0-30	1.6	79.5	12.5	8	LS	11.30	4.30	7.00	38.96	0.927	8.70	27.3	0.48	5.09
		30-60	1.8	82	10	8	LS	10.80	4.20	6.60	38.78	9.48	7.78	17.6	0.25	4.45
		60-90	3.0	84.5	10	5.5	LS	9.10	2.90	6.20	36.52	10.22	7.80	19.9	0.19	2.78
		90-120	0	84.5	10	5.5	LS	9.10	2.90	6.20	36.52	8.35	7.66	22.1	0.19	2.78
		120-150	0	87	10	3	S	7.10	1.00	6.10	32.98	6.52	7.80	16.2	0.21	1.34
	7	0-35	2.3	89.5	7.5	3	S	6.40	0.90	5.50	32.80	3.5	8.3	29.2	0.81	3.02
		35-75	14.7	82	15	3	SL	8.10	1.10	7.00	33.34	5.7	8.02	25.1	0.81	3.02
		+ 75								Bedrock						
	8	0-10	19.4	84.5	10	5.5	LS	9.10	2.90	6.20	36.52	5.48	8.05	36.4	0.77	4.41
		10-45	9.0	87	7.5	5.5	LS	8.70	2.90	5.80	36.34	8.12	8.16	44.7	0.77	4.41
		45-70	0	79.5	10	10.5	SL	13.00	6.10	6.90	40.20	6.73	8.17	38.1	0.26	5.98
		70-80								Partially weathered Limestone						
		+ 80								Bedrock						
Summit	9	0-20	0	87	10	3	S	7.10	1.00	6.10	32.98	0.920	8.18	21.1	0.69	2.68
		20-35	0	82	7.5	10.5	LS	12.50	6.10	6.40	40.29	1.32	8.41	41.6	0.47	6.57
		35-80	0	82	10	8	LS	10.80	4.20	6.60	38.78	1.73	8.38	54.2	0.21	4.34
		+ 80								Bedrock						
	10	0-18	0	94.5	5	0.5	S	4.90	0.20	4.70	22.51	0.42	8.20	26.3	1.12	2.39
		18-50	0	97	2.5	0.5	S	4.90	0.20	4.70	22.32	0.28	8.24	22.2	0.87	1.69
		50-80	0	92	7.5	0.5	S	5.50	0.30	5.20	22.69	0.25	8.28	21.7	0.65	1.07
		80-120	7.4	87	7.5	5.5	LS	8.70	2.90	5.80	36.34	0.58	8.45	21.9	0.69	4.18
		120-150	0	82	10	8	LS	10.80	4.20	6.60	38.78	1.41	7.87	32.7	0.52	5.21
	11	0-18	0	89.5	5	5.5	S	8.10	2.80	5.30	36.16	4.47	8.20	52.2	1.02	5.11
		18-55	0	74.5	7.5	18	SL	18.50	10.50	8.00	43.82	5.43	8.34	45.6	0.77	11.91
		+ 55								Bedrock						
	12	0-30	6.7	74.5	12.5	13	SL	15.20	46.70	7.70	42.01	0.474	8.20	24.0	1.29	10.36
		30-60	4.2	72	10	18	SL	18.80	10.60	8.20	44.00	1.08	8.28	25.9	0.59	11.40
		60-100	4.2	69.5	15	15.5	SL	18.00	9.40	8.60	43.45	1.30	8.48	25.5	0.41	9.40
		100-150	0	72	12.5	15.5	SL	17.60	9.30	8.30	43.18	1.13	8.53	23.2	0.40	9.37
	13	0 - 22	0	73	13	14	SL	15.2	46.7	7.7	42.01	0.27	8.15	28.80	0.70	2.96
		22 - 40	0	70	12	18	SL	18.8	10.6	8.2	44	0.35	8.56	49.36	0.50	3.65
		+ 40								Bedrock						
	14	0-15	0.0	94.5	5	0.5	S	4.90	0.20	4.70	22.51	0.425	7.91	20.7	0.85	1.63
		15-45	0.0	97	2.5	0.5	S	4.90	0.20	4.70	22.33	0.183	8.19	21.5	0.85	1.63
		45-95	6.3	84.5	10	5.5	LS	9.10	2.90	6.20	36.52	0.187	8.26	18.0	0.71	4.24
		95-125+	6.3	89.5	7.5	3	S	6.40	0.90	5.50	32.80	0.201	8.24	12.1	0.26	1.48

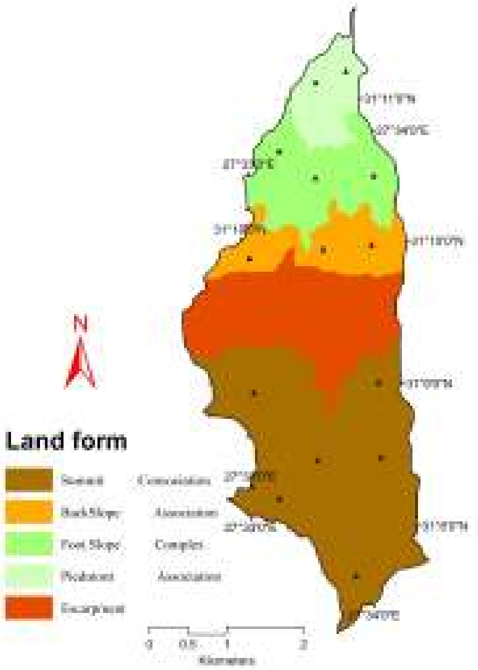

Figure 7. Physiographic soil map

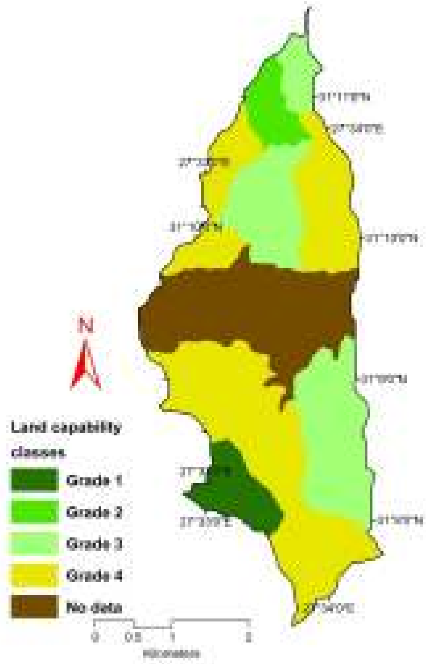

Figure 8. Land capability map

Table 2. Legend of the physiographic soil map of the study area.

Landform	Area km^2	%	Main Soils	% of Mapping unit	Represented profiles	Kind of Mapping Unit
Piedmont	0.97	7.13	Typic Torripasamments	50	1	Association
			Typic Haplocalcids	50	2	
Foot Slope	2.07	15.16	Typic Haplocalcids	33.33	3	Complex
			Typic Torripasamments	33.33	4	
			Typic Torriorthents	33.33	5	
Back Slope	1.47	10.78	Typic Haplocalcids	66.67	6, 8	Association
			Typic Torripasamments	33.33	7	
Summit	6.09	44.60	Typic Torripasamments	83.40	9, 10, 11, 12, 13	Consociation
			Typic Haplocalcids	16.60	14	
Escarpment	3.05	22.33	Rocky	--	--	--
Total	13.65	100 %				

The major limiting parameter for land capability in studied area is soil texture. Soil texture is very effective factor in soil and crop management. The dominant texture class in the investigated soils is Sand, Loamy sand and Sandy loam texture. According to Sys (1993) soil texture consider as severe limiting factor in all the studied area. The soil depth is rated as a severe limiting factor in small area (profile 4 and 13) and as moderate limiting factor in some other areas. High lime concentration may not only severely prevent water movement but also may prevent root penetration. Based on the evaluation rate suggested by Sys (1993), the lime content that is either less than 10 % or greater than 25% covers most of the area or this is considered as a moderate limiting factor for land capability.

Land suitability classification: The current study used land use suitability evaluation Tools (LUSET), to assess the soil suitability for specific types of crops. These crops are categorized into three groups; field crops (barley, groundnuts, sesame, alfalfa, sorghum, maize, onion, wheat, soya and sunflower), fruit crops (olives, plum, mango, peach and citrus), and vegetable crops (cowpea, beans, watermelon and potato). The process and calculations of LUSET program were coded by using Visual Basic for application. There are four methods for calculating the overall suitability (maximum, minimum, average, or exponent). The requirements of the most commonly grown crops provided by Sys *et al,* 1993 are recorded in this program. LUSET was used to evaluate land suitability of the investigated area using the exponent equation for all the selected crops.

Table 3. Area in km² of land capability classes for the investigated soils

Capability	Summit	Piedmont	Foot Slope	Back slope	Total
Grade 1	0.77	--	-	--	0.77
Grade 2	--	0.57	--	-	0.57
Grade 3	1.80	0.41	0.85	0.44	3.5
Grade 4	3.51	--	1.22	1.04	5.77
Total	6.08	0.98	2.07	1.48	10.61

Suitability maps for all the selected crops and distribution of them among different mapping units are shown in Tables 4 and 5 and Figure 9. In general speaking, the investigated soils can be categorized into three suitability classes (S1, Highly suitable; S2, Moderately suitable; S3, Marginally suitable). The suitability class S1 represents very small area and is mostly related to barley, wheat and sorghum (Table 4 and 5). Meanwhile, the suitability classes S2 and S3 are the common classes in the studied area. In summit mapping unit all crops have S2 and S3 classes expect Wheat, barley and Sorghum. S2 and S3 are the most common classes in piedmont unit for all crops. In foot slope unit, S3 is the common class for most crops. This is due to the soil depth is very shallow in the foot slope unit. In back slope mapping unit all crops have S2 and S3 classes expect barley and sorghum. The dominant limiting parameters affecting land suitability are soil texture, soil depth in some areas, high lime concentration and salinity in some areas.

Table 4. **Land suitability classification for 20 crops generated by LUSET.**

Crop	Piedmont		Foot Slope			Back Slope				Summit				
Profile	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Potato	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3
Tomato	S2	S3	S3	S3	S3	S2	S3	S3	S3	S2	S3	S2	S3	S3
Beans	S2	S3	S3	S3	S3	S2	S3	S3	S3	S2	S2	S2	S3	S2
Cowpea	S2	S3	S3	S3	S3	S2	S2	S3	S3	S2	S2	S2	S3	S2
Soya	S3	S2	S3	S3	S3	S2	S2	S3	S3	S2	S2	S2	S3	S3
Watermelon	S2	S2	S2	S3	S3	S2	S2	S3	S2	S2	S2	S2	S3	S2
Onion	S3	S3	S3	S3	S3	S3	S3	S3	S3	S2	S3	S3	S3	S2
Sunflower	S3	S3	S3	S3	S3	S2	S2	S3	S3	S2	S3	S2	S3	S2
Sesame	S2	S3	S2	S3	S3	S3	S2	S3	S3	S2	S2	S3	S3	S2
Groundnuts	S2	S2	S3	S3	S3	S2	S2	S2	S3	S2	S2	S2	S2	S3
Barley	S2	S2	S2	S2	S2	S1	S2	S2	S2	S2	S2	S2	S2	S2
Alfalfa	S3	S3	S3	S3	S3	S2	S2	S3	S3	S2	S3	S3	S3	S2
Maize	S3	S2	S3	S3	S3	S2	S3	S3	S3	S2	S2	S2	S3	S2
Wheat	S2	S2	S2	S2	S2	S2	S2	S3	S2	S1	S2	S2	S2	S2
Sorghum	S2	S2	S2	S2	S2	S1	S1	S2	S2	S1	S2	S2	S2	S1
Peach	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3	S3
Plum	S3	S3	S3	S3	S3	S3	S2	S3	S3	S3	S3	S3	S3	S3
Olives	S2	S2	S2	S2	S2	S2	S2	S2	S2	S2	S2	S2	S2	S2
Citrus	S3	S3	S3	S3	S3	S3	S3	S3	S3	S2	S3	S3	S3	S3
Mango	S3	S3	S3	S3	S3	S3	S3	S3	S3	S2	S3	S2	S3	S3

Table 5. Area in km² of land suitability classes in the studied area.

Crop	Piedmont		Foot Slope		Back Slope			Summit		
	S2	S3	S2	S3	S1	S2	S3	S1	S2	S3
Potato	--	0.97	--	2.07	--	--	1.47	--	--	6.09
Tomato	0.41	0.57	--	2.07	--	0.44	1.04	--	1.90	4.18
Beans	0.41	0.57	--	2.07	--	0.44	1.04	--	3.57	2.51
Cowpea	0.41	0.57	--	2.07	--	0.90	0.57	--	3.57	2.51
Soya	0.57	0.41	--	2.07	--	0.90	0.57	--	2.90	3.18
Watermelon	0.97	--	0.85	1.22	--	0.90	0.57	--	4.92	1.17
Onion	--	0.97	--	2.07	--	--	1.47	--	1.80	4.28
Sunflower	--	0.97	--	2.07	--	0.90	0.57	--	2.58	3.51
Sesame	0.41	0.57	0.85	1.22	--	0.46	1.01	--	2.80	3.29
Groundnuts	0.97	--	--	2.07	--	1.47	--	--	4.07	2.01
Barley	0.97	--	2.07	--	0.44	1.04	--	--	6.09	--
Alfalfa	--	0.97	--	2.07	--	0.90	0.57	--	1.80	4.28
Maize	0.57	0.41	--	2.07	--	0.44	1.04	--	3.57	2.51
Wheat	0.97	--	2.07	--	--	0.90	0.57	1.13	4.96	--
Sorghum	0.97	--	2.07	--	0.90	0.57	--	1.80	4.28	--
Peach	--	0.97	--	2.07	--	--	1.47	--	--	6.09
Plum	--	0.97	--	2.07	-	0.46	1.01	--	--	6.09
Olives	0.97	--	2.07	--	--	1.47	--	--	6.09	--
Citrus	--	0.97	--	2.07	--	--	1.47	--	1.13	4.96
Mango	--	0.97	--	2.07	--	--	1.47	--	1.90	4.18

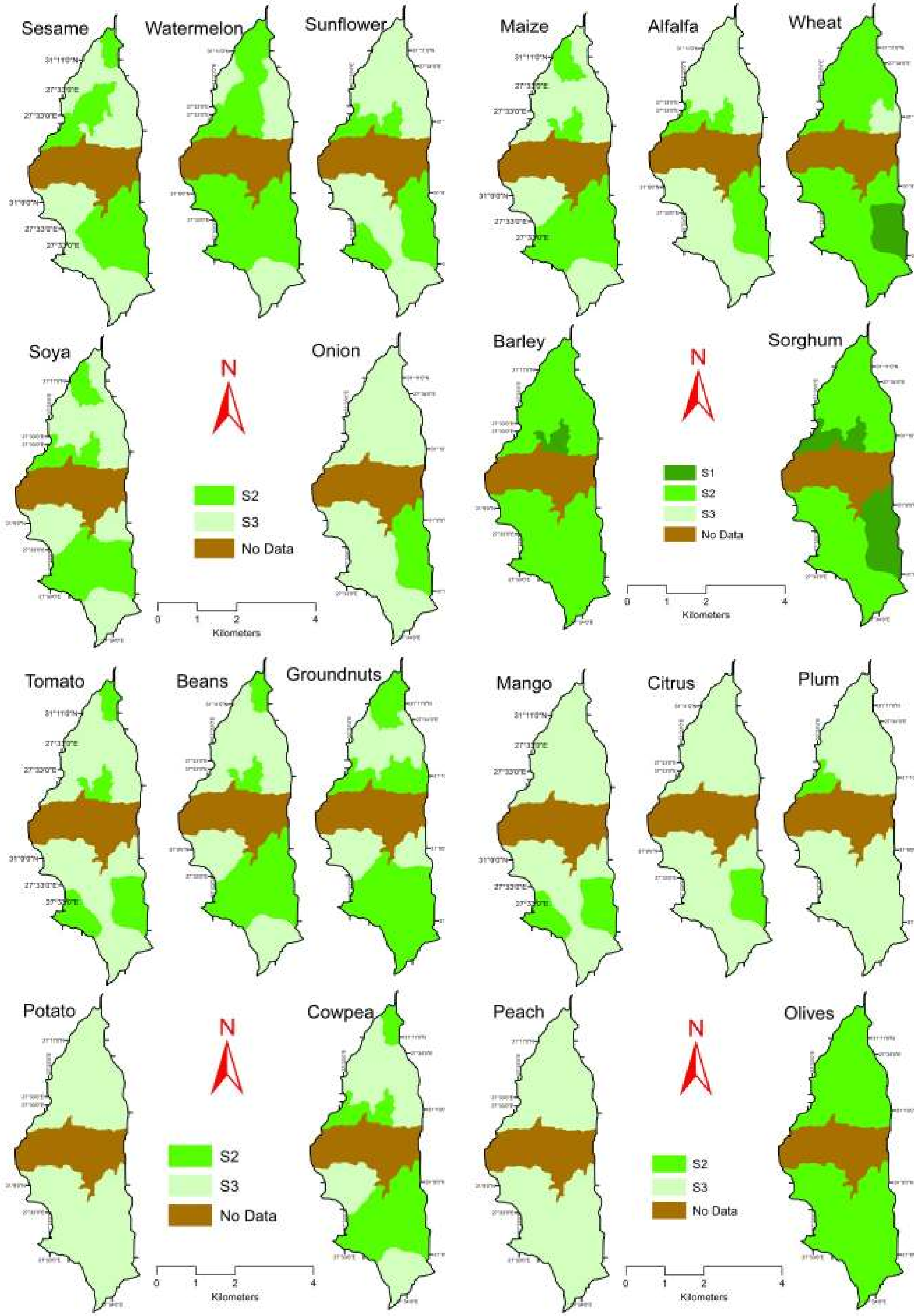

Figure 9. Land suitability map for the selected crops

CONCLUSION

The objectives of our work mainly aimed at evaluate soils for agricultural suitability and capability to accomplish the agriculture outgrowth. However during this study, LUSET and Stori index were used and results found that, the most suitable crops in this area were barley, wheat and sorghum. On the contrary, fruit crops are the least suitable crops in the investigated area

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خرائط القدرة الانتاجية وصلاحية الاراضى لبعض مناطق الساحل الشمالى الغربى - مصر

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يهدف هذا العمل إلى دراسة خصائص الأراضي بمنطقة الحوالة، الساحل الشمالي الغربي لمصر لتقييم القدرة الانتاجية للاراضى و مدى صلاحيتها للاستخدام وذلك باستخدام أداة تقييم صلاحية استخدام الأراضي (LUSET) ومؤشر ستوري. تقع منطقة الدراسة بالساحل الشمالي الغربي بين خطى طول ٣٢' ٢٧° - ٣٥' ٢٧° شرقاً و دائرتى عرض ١٧' ٣١° - ١٢'٣١° شمالاً بمساحة ١٣,٦٥ كم٢. تم حفر أربعة عشر قطاعاً أرضياً ووصفهم وصفاً مورفولوجياً.النطاق الرطوبى السائد بالتربة هو النطاق الجاف Torric بينما النطاق الحرارى السائد هو الحرارى Thirmic . تم تحديد الوحدات الفيزيوجرافية للمنطقة باستخدام نظم المعلومات الجغرافية من خلال دمج صورة القمر الصناعى لاندسات ٨ مع نموذج الارتفاعات الرقمية DEM و نتائج العمل الحقلى. تم التعرف على خمس وحدات فيزيوجرافية بالمنطقة وهى Piedmont ، Summit ، Escarpment ، Foot Slope و Back Slope. اوضحت النتائج وقوع اراضى منطقة الدراسة في تحت المجموعات العظمي التالية Typic Haplocalcids ، Typic Torripasamments ، Typic Torriorthents . اوضحت نتائج القدرة الانتاجية ان الاراضى المدروسة تقع ضمن أراضى الدرجة الاولى والثانية والثالثة والرابعة ولكن الدرجة الثالثة والرابعة هى السائدة بالمنطقة بمساحة ٣,٥ كم ٢ و ٥,٧٧ كم ٢ على التوالى. اوضحت نتائج تقييم صلاحية الارض للاستخدام ان المحاصيل الاكثر ملاءمة في منطقة الدراسة هى البرسيم ، الشعير ، القمح ، الذرة الرفيعة ، البطيخ والزيتون. واظهرت النتائج أن اهم محددات استخدام الاراضى بالمنطقة هى قوام التربة ، عمق التربة الضحل، ارتفاع الملوحة وزيادة نسبة كربونات الكالسيوم.