Land Evaluation of East Qattara Depression, Egypt using Remote Sensing and GIS

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Abstract

Availability of sufficient and accurate spatial data concerning land resources is a pillar for sustainable agricultural development. The current work was aimed at using remote sensing (RS) and geostatistical analysis tools within geographic information system (GIS) to map land capability and crop suitability for an area in the Qattara Depressing, Western Desert of Egypt, located east of the Qattara Depression between latitude 30° 10' 4" to 30° 20' 57" N and longitude 28° 32' 26" to 28° 52' 10" E, covering 630 km^2 (63000 ha). Thirty-seven soil profiles were dug to 150 cm. Soil samples were collected from different horizons and analyzed for their main properties. Applied System for Land Evaluation (ASLE) software was used to assess land capability and land suitability. Landforms include sand sheets, sand dunes, depressions, sabkha and water bodies. The 74.69% of the soils are"poor" (C4), 0.47% are"good" (C2), 11.68% are"fair" (C3), 11.12% are"very poor" (C5), and 0.47% are"non-agricultural" (C6). Soil texture, salinity and alkalinity are the main limiting factors. Classes for suitability (considering 22 crops) are highly suitable (S1), suitable (S2), moderately suitable (S3), marginally suitable (S4), currently not-suitable (N1), and potentially not-suitable (N2) for 22 crops. The most recommended crops are date palm and tomatoes. The studied soils require precise management practices to be promising for agricultural expansion.

Keywords: Remote sensing, GIS, Land capability, crop suitability, Qattara Depression

Introduction

The old fertile lands in the Nile Delta region of Egypt undergo various degradation processes that limited their potential exploitation for achieving food security. Therefore, great attention have been paid to the wide deserts that account for nearly 96% of the country total area (Abuzaid and Fadl, 2016). The Western Desert has gained more interest due to its unique nature such as flatness and presence of groundwater derived from the Nubian Sandstone Aquifer (Zahran and Willis, 2009). Qattara Depression is the largest and deepest mega-Depressions of the Western Desert, and one of the world's greatest depressions. It has a total length from NE to SW ranging from 289 to 300 km, width varying from 50 and 150 km, and total surface area of 19605 km^2(Embabi, 2018)

Sustainable use of natural resources is one of the major objectives of the Egypt's Sustainable Agricultural Development Strategy (SADS) 2030 (Soliman, 2017). This requires a preciseevaluation to devote land resources for the optimum use (Mohamed *et al.*, 2019). Land evaluation is the process of determining the fitness of land for a specific use based on its attributes and the ambient environmental conditions (Vasu *et al.*, 2018). This process is an analysis integrating spatial information of various factors, including soil, climate, vegetation, topographic and hydrology, which is an analysis integrating spatial information (Xue, 2011). The results of this process should reach decision makers. Irrational use of land due to lack of proper awareness about land capability leads to destruction of such non-renewable natural resource (Bacic *et al.*, 2013).

Modern technologies; remote sensing (RS) and geographic information system (GIS) have been used increasingly in the field of land resources assessment (Ismail *et al.*, 2013; Abuzaid and Fadl, 2016).Over the conventional methods, such technologies are effective tools in acquiring data for agricultural planning(Reddy, 2018b). This is because studies related to field work and natural resources depend mainly upon on the availability of sufficient and accurate spatial data, i.e. topography, water resources, land use, infrastructure, climate, land cover, geology, and manufacturing infrastructure (Sakai, 2012; Reddy, 2018a). Integrating spatial and non-spatial data of land resources in addition to their combined analysis can be carried out effectively under GIS environment. This enables an accurate inventory, mapping, monitoring and management of natural resources that help decision makers in sustainable agricultural planning (Reddy *et al.*, 2018).

The main objective of the current work was utilizing RS and GIS for mapping land capability and crop suitability of soils located in the Qattara Depression. Such work would help decision makers in drawing a sustainable agricultural planning in this important region in the Western Desert of Egypt.

Materials and methods

Study area

The study area is located in the eastern part of Qattara Depression (Fig. 1) between latitude 30° 10' 4" to 30° 20' 57" N and longitude 28° 32' 26" to 28° 52' 10" E, covering an area of 630 km^2. The minimum temperature is 6.0 °C (in January), while the maximum one is 36.5 °C (in July). Themean annual temperature of 20.94 °C and the total annual rainfall is 13.0 mm. This indicatesa "Thermic" soil temperature regime and "Torric" soil moisture regime.

RS and GIS works

One scene with T35RPP title number and 10 m spatial resolution of Sentinel-2A Multispectral Instrument (MSI) sensor satellite covering the studied area was acquired from the Copernicus Data Hub gateway (https://scihub.copernicus.eu/) on 5/5/2016 (Fig. 2). A digital image processing (radiometric correction, spatial enhancement and classification) was done using ERDAS IMAGINE 2014 software. Topographic map sheets with a scale of 1:50000 **(Egyptian General Survey Authority)** were scanned and georeferenced (UTM projection, Zone 35 and Datum WGS-84) within ArcGIS 10.4 software (ESRI Co, Redlands, USA). Contour lines in every 0.5 m intervals and spot heights were digitized. A digital elevation model (DEM) covering the area was generated using geostatistical analysis. Geological features were imported from scanned and georeferenced geological maps with a scale of 1:50000 **(Egyptian Geological Survey and Mining Authority)**. Based on the classified Sentinel-2A image, DEM and geological map, the geomorphic units of the studied area were extracted according to Zinck and Valenzuela (1990).

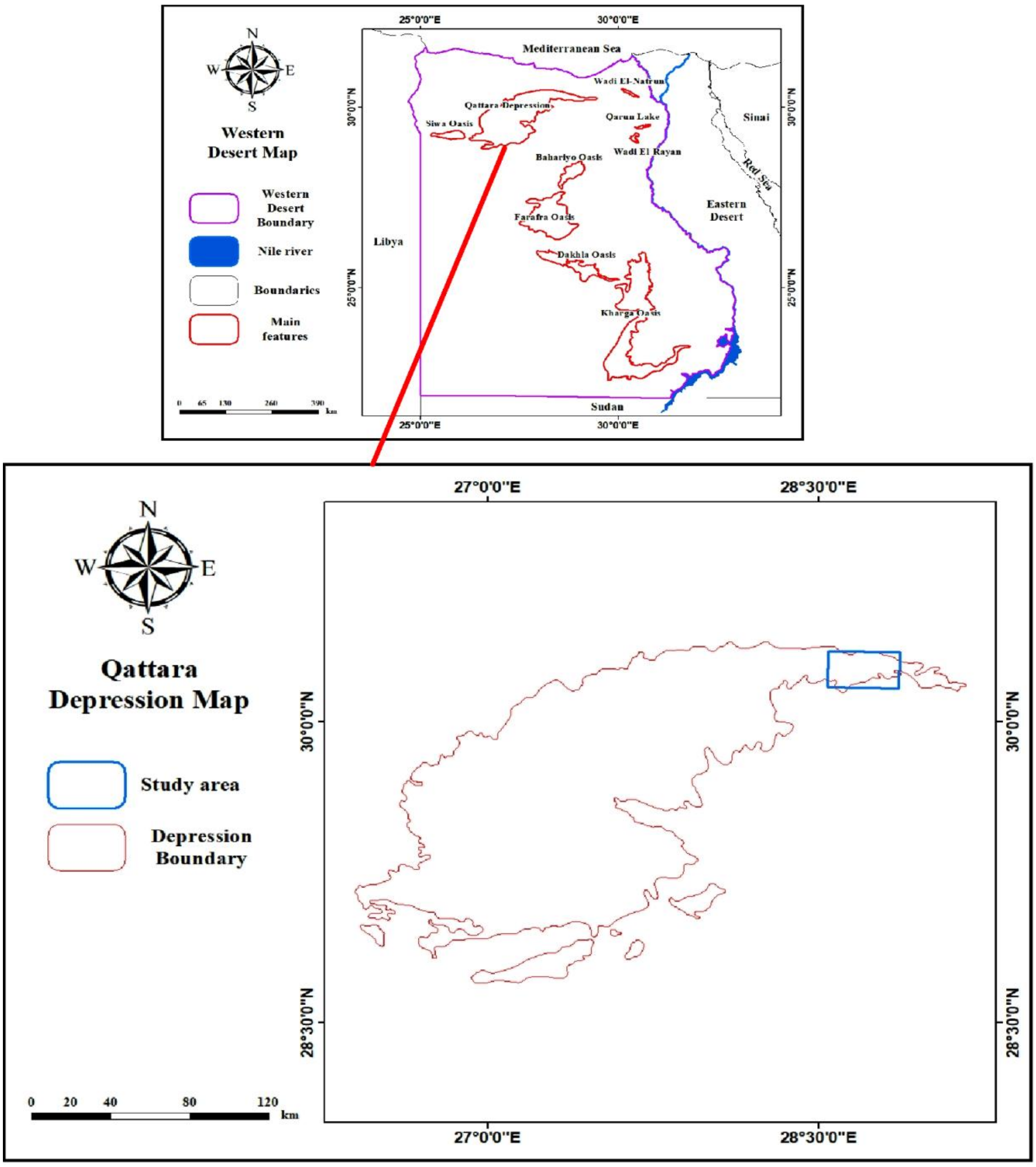


Fig. 1. Location map if the study area

Field work and laboratory analysis

Thirty-seven soil profiles were dug to a 150 cm depth, unless opposed by rock formations or permanent water table. The Global Positioning System (GPS) was used to define the exact locations of soil profiles (Fig. 2). A detailed description of soil profiles were done according to (FAO, 2006). Soil samples (102 samples) were collected from the profiles to represent the subsequence horizons of each profile and kept for different laboratory analysis. Soil samples were air dried, crushed, and passed through a 2-mm sieve. Soil physicochemical analyses were performed according standard procedures (Soil Survey Staff, 2014).

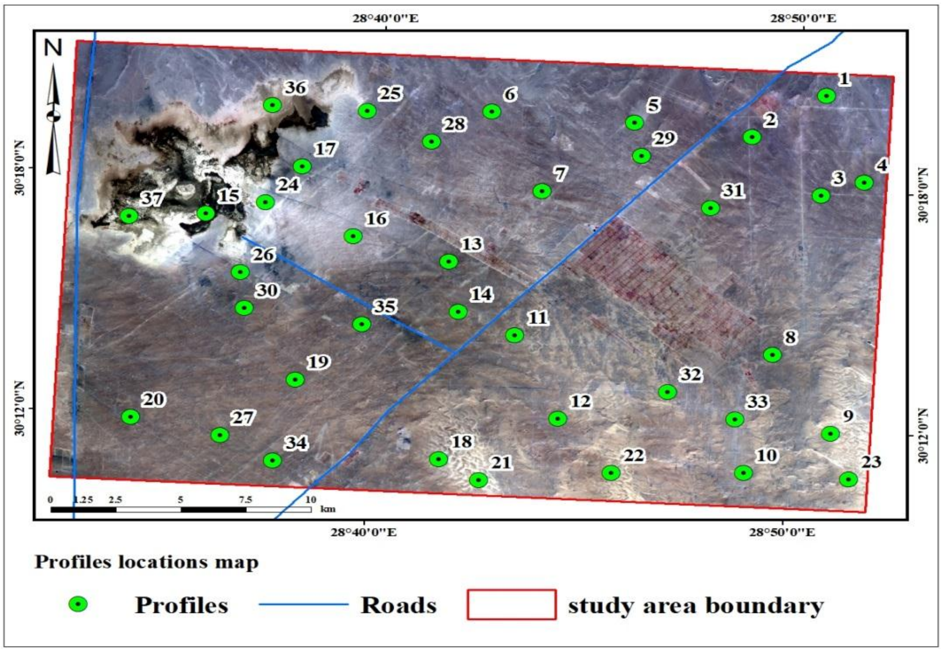


Fig. 1. Sentinel-2A image of the study area and profile locations

Land evaluation

The Applied System for Land Evaluation (ASLE) software (Ismail and Morsy, 2001) was used to predict land capability and crop suitability in the studied area. Land suitability based on matching crop requirements proposed by Sys *et al.* (1993) with soil properties. The factors reverent to the study are clay content, profile depth, land form, level of surface and slope, pH, $CaCO_3$, gypsum, cation exchange capacity (CEC), exchangeable sodium percentage (ESP) and salinity (expressed as EC). Capability and suitability classes are shown in Table 1.

Generating capability and suitability maps

The geostatistical analysis using the inverse distance weighting (IDW) technique was used for this purpose. The IDW predicts unknown values; (v) for any geographic point (x) using a number (n) and weight (w) of measured surrounding sample points (m). The equation is as as follows:

$$v(x) = \sum_{i=1}^{n} w_i m_i / \sum_{i=1}^{n} w_i$$

The weight is calculated using the distance (d) between the point x and the neighbor point m and the power parameter (p), which determines the significance of sample points upon the interpolated value as follows:

$$w_i = 1/{d_i}^p$$

Table 1. Land capability and suitability indices and classes of the ASLE

Capability index (CI)	Class	Description	Suitability index (SI)	Class	Description
> 80	C1	Excellent	> 80	S1	Highly suitable
80 - 60	C2	Good	80 - 60	S2	Suitable
60 - 40	C3	Fair	60 - 40	S3	Moderately suitable
40 - 20	C4	Poor	40 - 20	S4	Marginally suitable
20 - 10	C5	Very poor	20 - 10	Ns1	Currently not suitable
< 10	C6	Non-agriculture	< 10	Ns2	Permanently not suitable

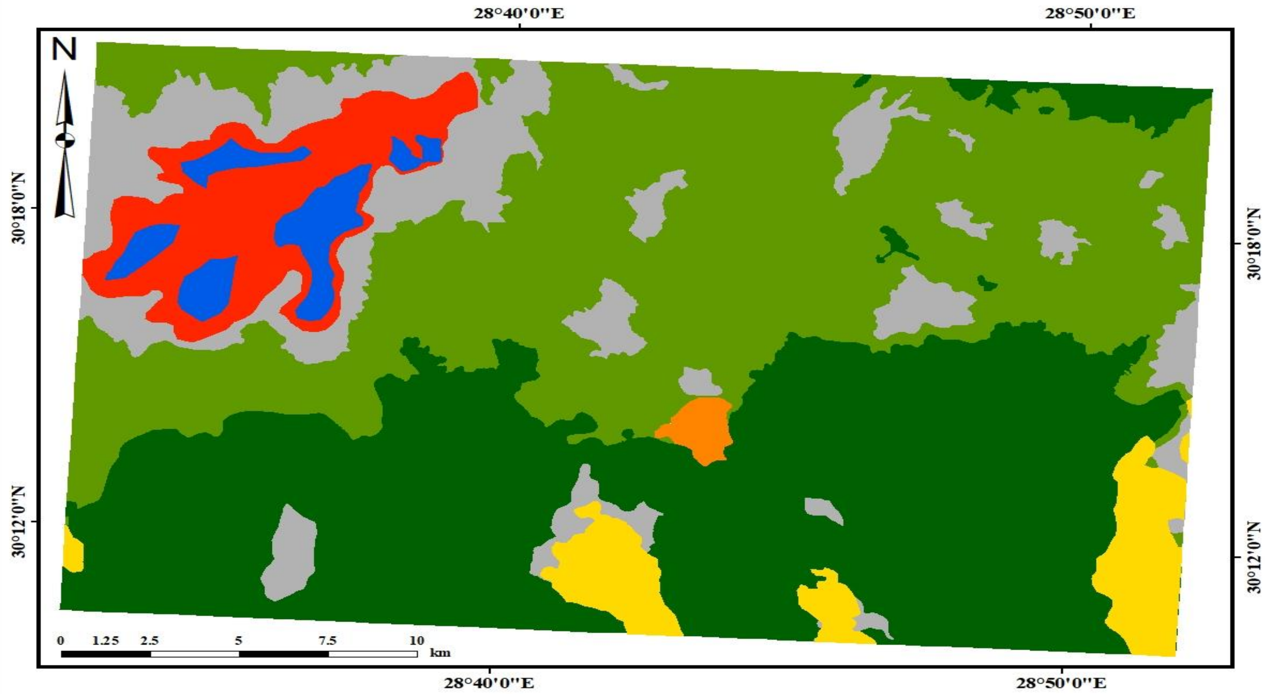
Results and discussion

Geomorphology

The studied area includes five landforms; sand sheets (relatively high and relatively low), sand dunes (longitudinal and pyramid), depressions, sabkha and water bodies (Fig. 3). The sand sheets cover over three-quarters of the area (74.96%; 472.22 km^2) and include two units; relatively high (238.42 km^2) and relatively low (233.80 km^2). The sand dunes are located in the southern parts covering an area of 30.57 km^2 (4.85% of the total area). Two types of sand dunes are presented; longitudinal sand dunes with an area of 27.34 km^{2}and pyramid sand dunes with an area of 3.32 km^2. Depressionsoccurin the form of small scattered areas covering 76.89 km^2 (12.20%of the total area). The sabkha is located in the northwestern part with an area of 36.09 km^2, representing 5.73% of the total area.Water bodies, in the form of shallow water lakes surrounding sabkha deposits, occupy 14.23 km^2, i.e. 2.26% of the total area.

Soil properties

Soil depth varies from 120 to 150 cm, indicating deep to very deep soils (Table 2). According to Soil Science Division Staff (2017), the soils are moderately to strongly alkaline with a pH range of 7.35 to 8.69, and none-saline to strongly saline with an EC ranging from 0.40 to 118.80 dS m^{-1}. Soil organic matter content is very low (Hazelton and Murphy, 2016) with a range of 0.01 to 3.10 g kg^{-1}. Soils gypsum content is<100 g kg^{-1}, thus it considered low (FAO, 1990). The soils $CaCO_3$ranges from 2.60 to 309.30 g kg^{-1}. The CEC ranges from low to very high (Hazelton and Murphy, 2016) with a range of 6.78 to 49.19 comlc kg^{-1}. The ESP ranges from 3.48 to 60.66, which indicates none to very high sodicity (alkalinity) hazards(FAO, 1988). The sand fraction dominates soil particles averaging 85.61% followed by silt (9.55%) and clay (4.86%). Soil texture varies from sand to clay with sand being the most dominant textural class.



Physiographic Units

Physiographic unit	area km^2	area %
Relatively High Sand Sheet	238.42	37.84
Relatively Low Sand Sheet	233.8	37.11
Depression	76.89	12.21
Longitudinal sand dunes	27.34	4.34
Pyrimed sand dunes	3.23	0.51
Sabkha	36.09	5.73
Water Bodies	14.23	2.26

Fig. 3. Geomorphic map of the studied area

Land capability classification

The spatial distribution of land capability classes (Fig. 4) demonstrates that 74.96% of the studies soils are poor (C4), while the remaining area is occupied by good (C2), fair (C3), very poor (C5) and non-agricultural soils (C6). These classes represent 0.47, 11.68, 11.12 and 1.77% of the total soils, respectively. The main limiting factors are soil texture, salinity and sodicity (alkalinity). Sandy soils have inherent poor fertility status and low water-holding capacity(Bassouny and Abuzaid, 2017). High clay content results in unfavorable physical conditions that cause adverse effects on plant growth and development. Unfavorable conditions include low infiltration rate, poor drainage, and poor aeration (Hazelton and Murphy, 2016). Salinity and alkalinity are two processes dominating arid and semi-arid soils and induce a major abiotic stress that limits plant productivity(Jafari *et al.*, 2018).

Table 2. Soil physicochemical properties of the studied area

Unit	Profile No.	Depth, cm	pH*	EC, ** dS m^{-1}	OM, g kg^{-1}	$CaCO_3$, g kg^{-1}	Gypsum, g kg^{-1}	CEC, cmolc kg^{-1}	ESP	Soil texture
Relatively high sand sheets	1	0-35	8.31	0.79	2.20	117.00	9.50	7.60	4.70	Loamy sand
		35-70	8.24	3.24	0.80	69.00	0.40	7.65	7.73	Loamy sand
		70-150	8.21	13.76	2.10	20.00	4.90	8.18	11.95	Sand
	8	0-30	7.78	0.96	1.50	23.00	4.30	7.64	4.80	Loamy sand
		30-70	7.73	0.64	1.30	11.10	0.10	8.18	5.38	Sand
		70-150	7.79	1.56	1.00	10.20	2.40	8.64	6.51	Sand
	10	0-30	8.08	1.44	0.90	5.90	3.90	8.18	5.85	Sand
		30-80	7.92	6.56	0.40	5.90	12.00	8.09	8.52	Sand
		80-150	7.95	7.60	1.90	5.70	2.80	8.64	8.93	Sand
	12	0-20	8.06	2.30	1.40	31.50	5.90	7.36	6.71	Loamy sand
		20-50	8.16	1.60	2.00	10.80	1.40	8.30	10.13	Sand
		50-150	8.11	19.00	1.80	11.50	1.90	8.41	9.48	Sand
	19	0-30	8.19	1.33	0.40	50.80	5.10	8.30	4.32	Sand
		30-60	8.25	1.02	2.00	31.50	13.10	8.29	4.98	Sand
		60-150	7.55	8.92	0.70	23.10	13.20	8.37	12.47	Sand
	20	0-30	7.70	4.33	0.40	30.80	3.20	8.63	18.22	Sand
		30-70	7.90	24.30	2.30	11.50	12.40	8.64	36.10	Sand
		70-150	7.54	19.45	1.00	10.00	3.90	8.64	16.03	Sand
	32	0-30	8.10	0.58	1.40	10.70	21.50	8.56	5.20	Sand
		30-65	7.93	0.87	0.20	11.60	29.90	8.55	5.66	Sand
		65-125	8.03	0.55	2.40	14.30	28.30	8.63	4.84	Sand
	33	0-25	7.66	1.28	2.70	13.70	31.60	7.10	9.84	Loamy sand
		25-65	7.72	1.06	0.40	12.30	38.20	8.56	10.79	Sand
		65-130	7.67	1.23	0.70	17.80	26.90	8.68	9.83	Sand
	34	0-35	7.76	1.29	1.50	6.90	15.90	6.88	5.73	Loamy sand
		35-65	7.70	0.98	1.00	10.30	53.80	8.81	6.39	Sand
		65-130	7.71	1.19	1.30	14.40	33.50	8.81	4.26	Sand
	35	0-35	7.99	0.73	0.90	9.90	36.90	8.40	4.59	Sand

Relatively low sand sheets		35-75	8.01	0.44	1.40	10.80	28.90	8.73	3.84	Sand
		75-140	8.03	0.49	2.10	17.90	51.50	8.55	4.36	Sand
	2	0-30	7.95	8.44	1.00	89.00	7.90	7.80	9.86	Loamy sand
		30-60	7.97	12.40	2.20	53.00	0.50	7.61	11.55	Loamy sand
		60-150	7.91	16.46	0.40	21.00	6.20	7.70	15.75	Loamy sand
	3	0-30	8.38	1.36	0.90	40.00	5.60	7.61	5.41	Loamy sand
		30-80	8.38	3.20	0.60	22.10	14.20	7.89	7.70	Loamy sand
		80-150	8.22	3.70	1.90	19.60	13.90	7.92	7.25	Loamy sand
	6	0-20	8.05	2.24	0.80	60.00	8.30	7.70	6.63	Loamy sand
		20-80	7.98	14.70	0.60	33.00	1.10	7.70	11.03	Loamy sand
		80-150	7.92	5.40	0.70	6.00	6.40	8.56	7.91	Sand
	7	0-20	7.84	13.12	1.80	30.60	3.40	7.99	11.88	Loamy sand
		20-80	7.94	0.96	0.10	22.10	11.80	8.56	5.87	Sand
		80-150	7.99	0.76	1.20	11.10	12.20	8.46	4.41	Sand
	14	0-30	7.71	0.92	0.30	28.90	7.00	8.56	5.58	Sand
		30-60	7.83	2.40	1.90	11.10	12.30	9.03	6.18	Sand
		60-150	7.81	4.20	1.20	8.50	11.10	9.13	7.94	Sand
	16	0-40	7.53	1.36	1.50	28.10	14.30	7.75	5.65	Loamy sand
		40-80	7.68	9.60	0.10	11.10	10.70	7.94	9.94	Loamy sand
		80-150	7.65	7.65	1.00	4.30	10.70	8.56	9.07	Sand
	28	0-25	7.39	3.21	0.20	18.50	16.30	8.74	4.98	Sand
		25-65	7.35	1.39	0.50	12.30	39.10	8.93	4.61	Sand
		65-135	7.66	0.55	1.10	11.70	16.00	9.03	4.44	Sand
	29	0-45	7.98	1.16	2.40	24.30	28.10	7.82	5.64	Loamy sand
		45-85	8.05	0.40	0.20	24.30	39.90	7.77	3.48	Loamy sand
		85-140	8.25	0.47	2.30	26.90	33.10	7.77	4.19	Loamy sand
	30	0-30	7.80	1.06	1.40	9.40	21.30	8.69	4.84	Sand
		30-75	7.80	1.06	0.20	9.90	47.00	8.83	4.84	Sand
		75-125	7.77	0.51	2.50	9.10	31.20	8.89	4.54	Sand
	31	0-25	8.61	2.04	0.70	21.40	18.70	8.78	4.37	Sand
		25-60	8.66	0.64	2.60	32.10	43.80	8.64	7.24	Sand
		60-130	8.69	0.93	1.00	21.40	43.40	8.63	10.22	Sand

EC, electrical conductivity; * 1:2.5 soil : water suspension; ** soil paste extract; OM, organic matter; CEC, cation exchange capacity; ESP, exchangeable sodium percentage

Table 2. Cont.

Unit	Profile No.	Depth, cm	pH	EC, dS m^{-1}	OM, g kg^{-1}	$CaCO_3$, g kg^{-1}	Gypsum, g kg^{-1}	CEC, cmolc kg^{-1}	ESP	Soil texture
Longitudinal sand dunes	9	0-40	8.01	2.06	1.20	18.70	10.70	9.67	5.98	Sand
		40-150	8.18	1.36	2.40	11.10	8.70	9.77	5.41	Sand
	18	0-50	8.06	0.48	1.90	11.90	4.00	9.46	3.96	Sand
		50-150	8.06	3.04	0.10	5.10	1.00	9.98	7.55	Sand
	21	0-40	7.91	2.20	2.18	10.70	11.90	9.80	10.24	Sand
		40-120	7.82	2.57	2.81	17.80	2.90	9.60	14.29	Sand
	22	0-45	8.00	0.62	0.20	3.70	3.50	9.46	4.25	Sand
		45-150	8.07	2.15	2.60	3.70	12.90	9.67	6.89	Sand
	23	0-50	7.39	3.00	2.00	14.40	4.30	10.03	13.05	Sand
		50-150	7.44	2.24	0.80	14.40	6.00	10.38	9.05	Sand
Pyramid	11	0-30	8.30	1.20	0.50	45.00	12.30	9.98	5.39	Sand
		30-150	8.15	1.56	0.40	25.00	3.50	9.46	6.51	Sand
Depression	4	0-40	8.12	4.72	0.01	2.60	0.50	7.72	8.96	Sandy loam
		40-80	8.16	3.88	1.50	14.50	12.70	9.82	8.38	Sand
		80-150	8.04	1.40	0.20	4.70	14.00	9.87	5.63	Sand
	5	0-30	7.74	17.44	0.40	56.00	13.70	9.77	12.93	Sand
		30-80	7.79	13.76	0.70	61.00	12.50	9.77	11.95	Sand
		80-150	7.82	31.20	0.10	30.00	4.00	9.77	15.76	Sand
	13	0-30	7.58	3.20	0.40	19.60	5.10	6.78	7.59	Sandy loam
		30-80	7.69	2.52	2.10	11.10	6.00	9.98	6.67	Sand
		80-150	7.73	0.96	0.40	4.30	13.50	10.09	5.87	Sand
	17	0-30	7.91	19.24	0.70	59.50	4.40	9.82	14.08	Sand
		30-80	7.95	51.52	1.40	57.70	1.40	9.66	20.78	Sand
		80-150	7.96	48.94	2.20	22.00	5.90	9.55	19.74	Sand
	24	0-30	7.90	1.09	1.50	51.50	14.60	9.77	5.15	Sand
		30-70	7.88	4.08	0.80	53.60	18.20	7.70	8.30	Sandy loam
		70-125	7.81	17.58	0.50	53.60	13.70	7.65	14.21	Sandy loam
	25	0-30	7.87	0.76	0.30	35.90	10.00	10.03	4.86	Sand
		30-65	7.89	13.10	0.60	26.90	39.10	10.33	11.99	Sand
		65-130	7.95	13.92	0.20	33.90	50.10	9.91	12.28	Sand
	26	0-30	7.66	1.59	1.90	12.30	10.90	10.50	5.12	Sand
		30-60	7.63	2.55	1.00	9.60	10.50	10.39	14.04	Sand
		60-120	7.43	4.60	0.70	9.60	7.80	10.61	13.51	Sand
	27	0-25	7.87	0.88	0.30	17.20	14.60	10.58	4.30	Sand
		25-70	7.44	4.20	0.70	9.60	40.00	10.72	16.17	Sand
		70-120	7.55	4.62	0.50	10.30	41.90	10.69	27.91	Sand
Sabkha	15	0-35	8.30	97.74	2.10	69.00	21.80	17.88	57.96	Silt loam
		35-150	8.50	118.80	1.50	256.50	62.70	44.00	60.66	Clay
	36	0-40	8.30	87.58	1.30	44.40	18.20	20.79	54.96	Silt loam
		40-120	8.50	106.44	0.90	178.50	87.40	49.19	57.52	Clay
	37	0-25	8.30	80.73	3.10	67.60	32.50	19.52	52.85	Silt loam
		25-120	8.50	98.13	1.10	309.30	56.70	47.27	55.31	Clay

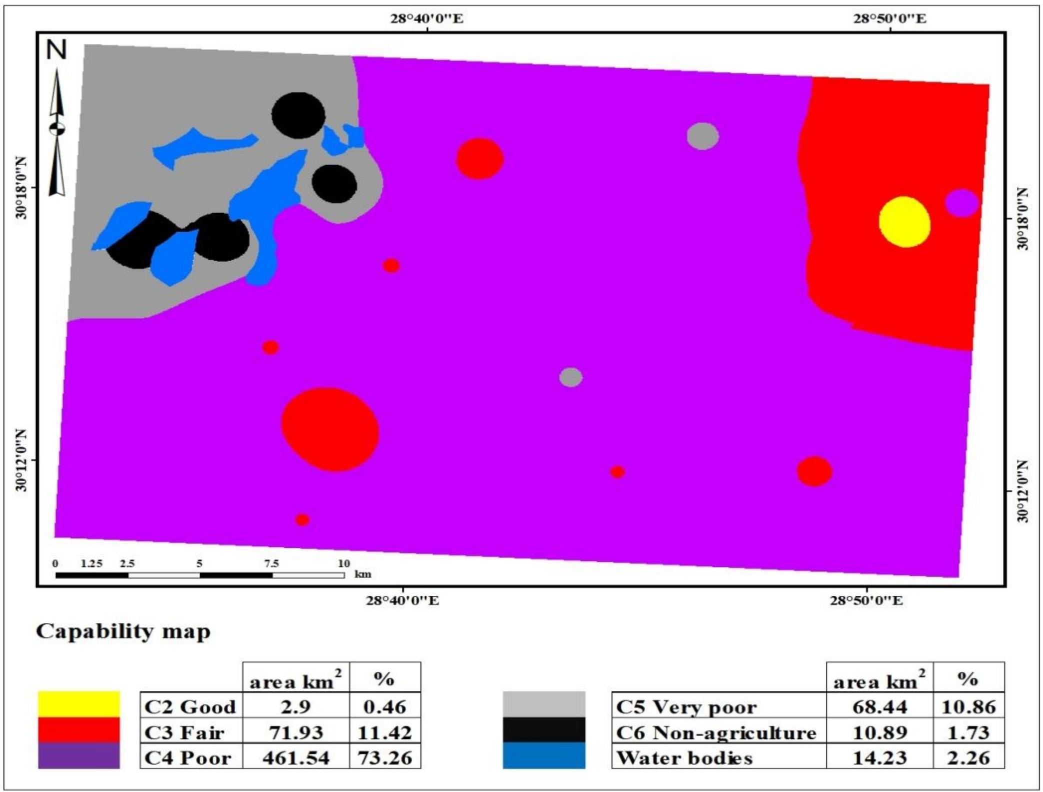


Fig. 4. Land capability map of the studied area

Land suitability classification

The spatial distribution of suitability classes in the studied area (Table 3 and Fig. 5) indicates that the soils are highly suitable (S1), suitable (S2), moderately suitable (S3), marginally suitable (S4), currently not-suitable (N1) and permanently not-suitable (N2) for the selected crops. Generally, soils belong to the order suitable (S1, S2, S3 and S4) cover more than 90% of the studied area for all the selected crops, except for faba bean, pea and citrus. For these crops, the soils of the order "suitable" occupy 80.99, 81.01 and 88.01% of the total area, respectively.

Conclusion

Land resources assessment plays a crucial role in land use planning and helps decision makers in sustainable agricultural planning. Such a procedure would be more effective and accurate when integrating modern technologies; RS and GIS with ASLE software. A total area of 630 km^2 located in the eastern part of Qattara Depression is classified into 5 capability classes; good (C2), fair (C3), poor (C4), very poor (C5) and non-agricultural (C6). Poor soils occupy the majority of the area (74.96%), while the remaining area is classified as"good"(0.47%), "fair" (11.68%), "very poor" (11.12%) and "non-agricultural"(1.77%). The main limiting factors are soil texture, salinity and alkalinity. The soils are highly suitable (S1), suitable (S2), moderately suitable (S3), marginally suitable (S4), currently not-suitable (N1) and permanently not-suitable (N2) for the selected 22 crops. The most recommended crops are date palm and tomato.

Table 3. Land suitability classification of the studied area

Crop	High suitable (S1)		Suitable (S2)		Moderately suitable (S3)		Marginally suitable (S4)		Currently not suitable (N1)		Permanently not suitable (N2)	
	Area, km^2	Area, %	Area, km^2	Area, %	Area, km^2	Area, %	Area, km^2	Area, %	Area, km^2	Area, %	Area, km^2	Area, %
Alfalfa	0.76	0.12	89.42	14.52	398.56	64.73	88.04	14.30	31.80	5.16	7.12	1.16
Barley	0.93	0.15	119.79	19.46	407.53	66.19	59.43	9.65	22.16	3.60	5.87	0.95
Faba bean	0.10	0.02	26.87	4.36	323.28	52.51	148.40	24.10	100.23	16.28	16.82	2.73

Maize	0.79	0.13	55.87	9.07	391.55	63.59	118.13	19.19	39.18	6.36	10.19	1.66
Peanut	8.04	1.31	265.54	43.13	148.75	24.16	129.82	21.08	53.19	8.64	10.36	1.68
Sorghum	1.15	0.19	100.21	16.28	371.24	60.30	101.02	16.41	32.55	5.29	9.53	1.55
Soybean	0.10	0.02	26.87	4.36	323.29	52.51	148.49	24.12	100.18	16.27	16.78	2.73
Sugar beet	4.16	0.68	236.17	38.36	292.06	47.44	59.58	9.68	18.53	3.01	5.19	0.84
Sunflower	4.16	0.68	236.17	38.36	292.06	47.44	59.58	9.68	18.53	3.01	5.19	0.84
Wheat	0.88	0.14	111.31	18.08	414.98	67.40	60.09	9.76	22.53	3.66	5.90	0.96
Cabbage	2.62	0.43	170.01	27.61	308.98	50.18	98.60	16.01	29.23	4.75	6.26	1.02
Onion	0.92	0.15	99.00	16.08	313.44	50.91	136.17	22.12	57.59	9.35	8.58	1.39
Pea	0.79	0.13	75.21	12.22	287.72	46.73	157.57	25.59	83.98	13.64	10.45	1.70
Pepper	13.90	2.26	290.07	47.11	142.51	23.15	123.75	20.10	39.21	6.37	6.27	1.02
Potato	6.36	1.03	268.00	43.53	200.46	32.56	105.08	17.07	27.77	4.51	8.03	1.30
Tomato	39.68	6.44	360.05	58.48	105.60	17.15	87.15	14.15	18.86	3.06	4.38	0.71
Water melon	9.71	1.58	269.62	43.79	198.20	32.19	104.35	16.95	26.14	4.25	7.67	1.25
Citrus	1.60	0.26	74.86	12.16	337.02	54.74	128.42	20.86	63.01	10.23	10.80	1.75
Date palm	52.63	8.55	427.25	69.39	59.21	9.62	59.71	9.70	12.73	2.07	4.17	0.68
Fig	24.05	3.91	372.78	60.55	106.91	17.36	85.86	13.95	20.81	3.38	5.29	0.86
Grape	13.99	2.27	297.00	48.24	180.88	29.38	91.94	14.93	24.28	3.94	7.60	1.23
Olive	24.05	3.91	372.78	60.55	106.91	17.36	85.86	13.95	20.81	3.38	5.29	0.86

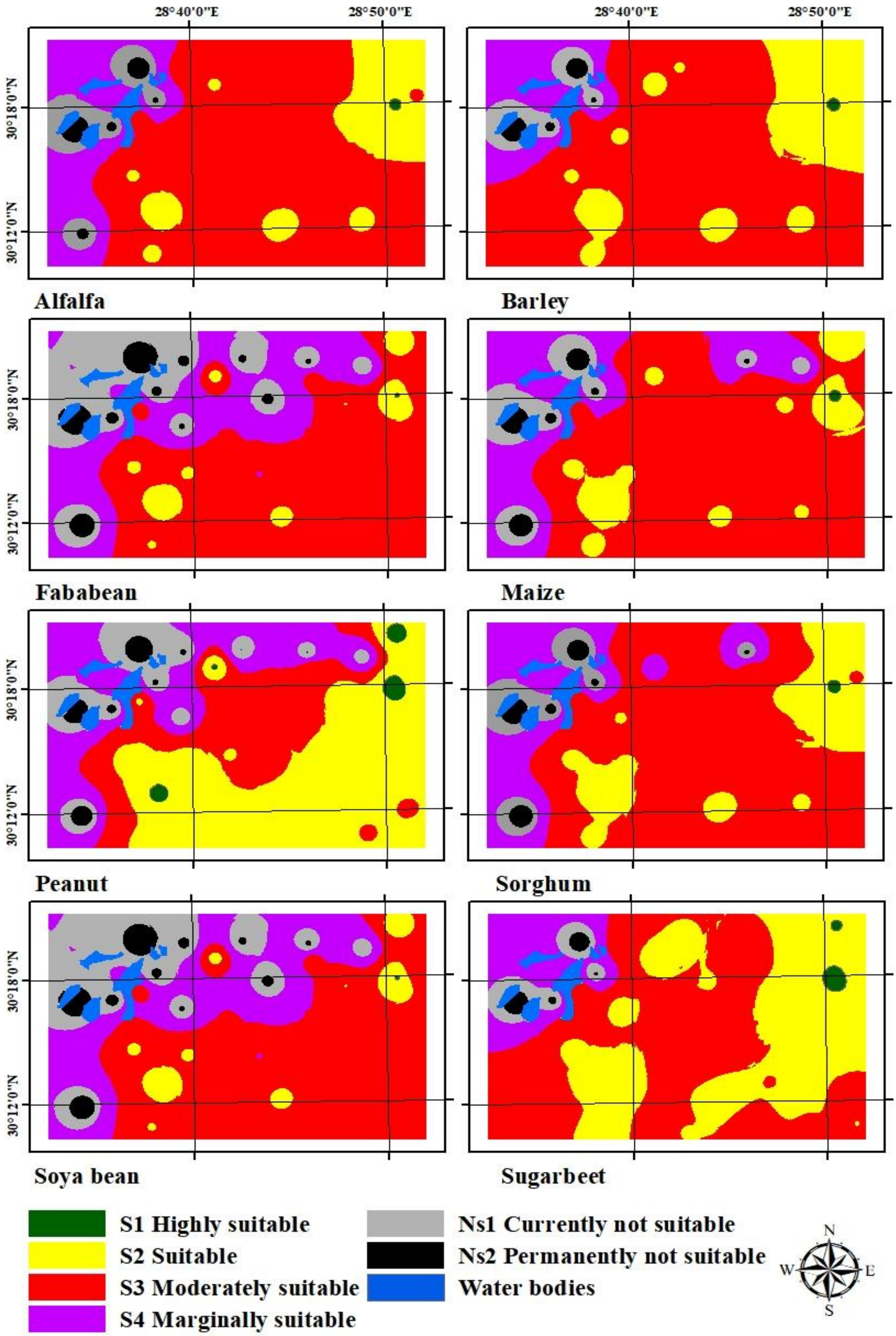


Fig. 5. Land suitably map of the studied area

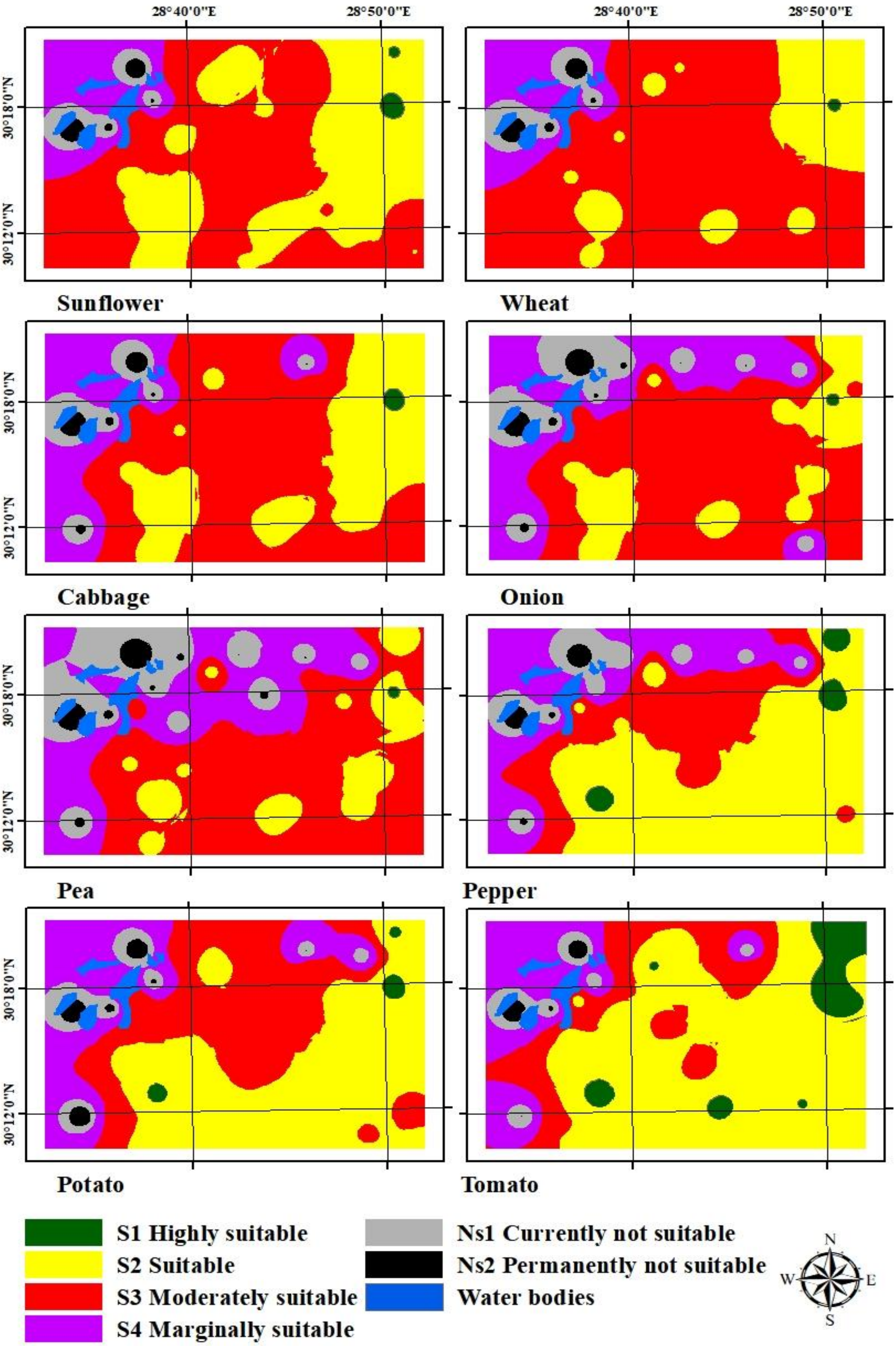

28°40'0"E
28°50'0"E
30°18'0"N
30°12'0"N
Sunflower
Wheat
Cabbage
Onion
Pea
Pepper
Potato
Tomato
S1 Highly suitable
S2 Suitable
S3 Moderately suitable
S4 Marginally suitable
Ns1 Currently not suitable
Ns2 Permanently not suitable
Water bodies
N
W
E
S

Fig. 5 Cont.

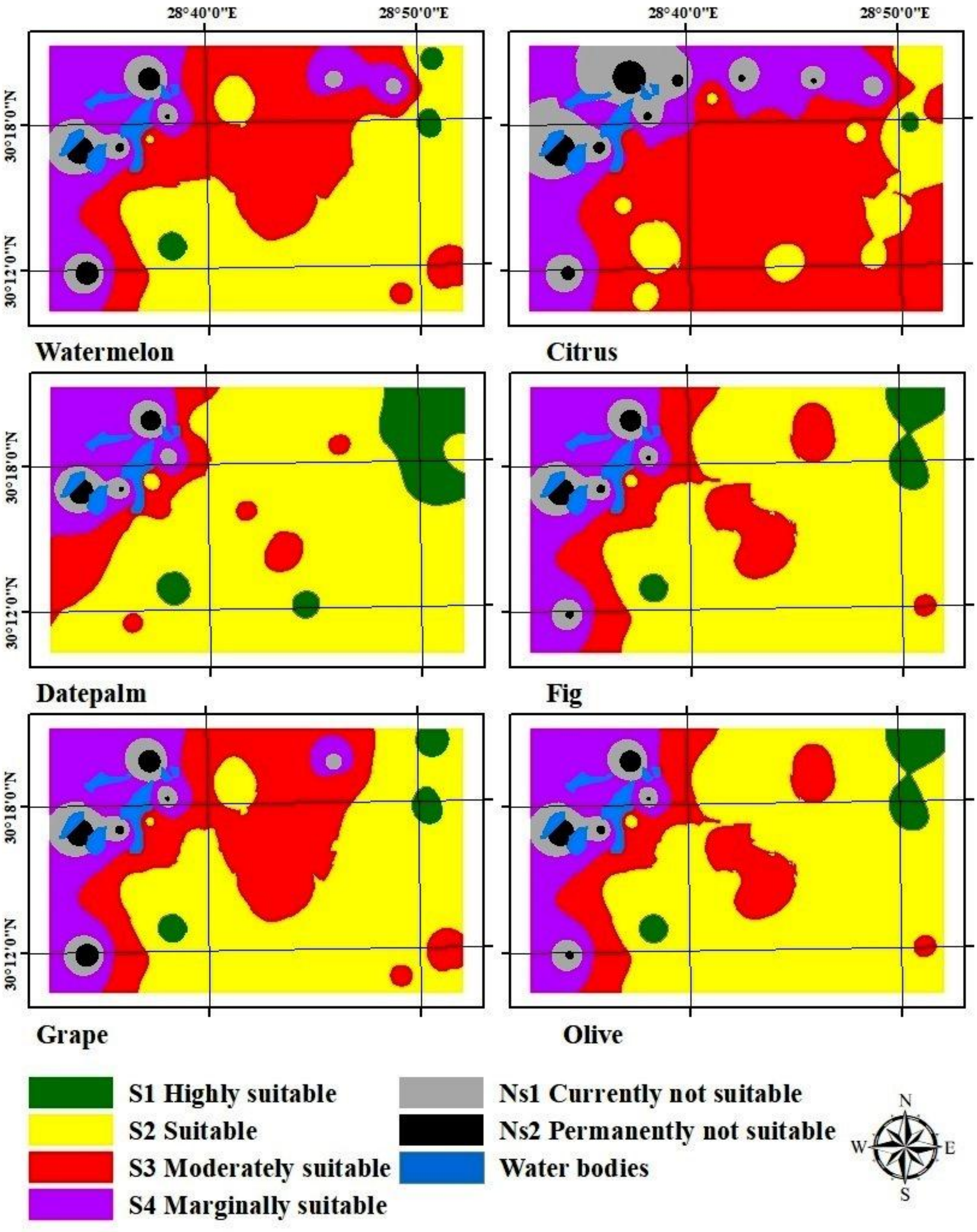

28°40'0"E
28°50'0"E
30°18'0"N
30°12'0"N
Watermelon
Citrus
Datepalm
Fig
Grape
Olive
S1 Highly suitable
S2 Suitable
S3 Moderately suitable
S4 Marginally suitable
Ns1 Currently not suitable
Ns2 Permanently not suitable
Water bodies
N
E
S
W

Fig. 5 Cont.

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تقييم الأراضي بشرق منخفض القطارة – مصر بإستخدام الإستشعار عن بعد ونظم المعلومات الجغرافية

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**وحدة الإستشعار عن بعد ونظم المعلومات الجغرافية – معهد بحوث الأراضي والمياه – مركز البحوث الزراعية – مصر

تم إستخدام بيانات القمر الصناعي Sntinel-2Aونظام التحليل الإحصائي المكاني خلال منظومة المعلومات الجغرافية لإنتاج خرائط قدرة التربة وملاءمتها للزراعة ببعض المحاصيل في مساحة قدرها 630 كم2 (63000 هكتار) من الأراضي الواقعة بشرق منخفض القطارة مصر. تم تمثيل منطقة الدراسة بعدد 37 قطاع أراضي جمعت منها عينات التربة تبعاً لترتيب الأفاق، وتم تحليها للتعرف على خواصها الكيميائية والفيزيائية. أوضحت النتائج ان المنطقة تحتوي على 5 أشكال أرضيةهي الفرشات الرملية – الكثبان الرملية – المنخفضات – السبخات – الأجسام المائية. بإستخدام نظام التقييم الإلكتروني ASLE وجد أن غالبية الأراضي المدروسة (74.69%) ضعيفة القدرة (C4)، بينما باقي المساحة تشغلها الأراضي الجيدة (C2) (0.47%)، المتوسطة (C3) (11.68%)، الضعيفة جداً (C5) (11.12%)، والغير صالحة للزراعة (C6) (1.77%). تم تقييم صلاحية التربة لزراعة 22 محصول ووجد أن الأراضي عالية الصلاحية (S1)، صالحة (S2)، متوسطة الصلاحية (S3)، هامشية الصلاحية (S4)، غير صالحة حالياً (N1)، وغير صالحة مستقبلاً (N2) للمحاصيل المختارة. وجد أن أفضل المحاصيل الموصى بزراعتها هي نخيل البلح والطماطم.