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Determination of soil productivity potentials: a case study in El-Monofeya Governorate of Egypt using remote sensing and GIS techniques.

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Abstract

Soil productivity of El-Monofeya, Governorate Central Delta,(located between the two branches of Rosetta and Damietta -between longitudes 30° 10' & 30° 40' E and latitudes 31° 5' and 31° 25' N,) was done. The area is 254303.01 ha. There were eight major mapping units: overflow basin (OB), decantation basin (DB), high river terrace (RT1), moderate river terrace (RT2), low river terrace (RT3), turtle back (TB), hummocky area (HA), and sand sheet (SS).Requier Land productivity index (RLPI) was done based on the parametric approach and Remote Sensing/GIS techniques.RLPI was used taking into account soil properties and topographic parameters using specific formulas. Of the total area, 54.51 % (106631.58 ha) are excellent and good classes (class I and class II) for agricultural use, 0.91% (2323.38 ha) belong to the 'average class' (class III), 12.77% (32472.00 ha) are 'poor class' (class IV). The remaining of the area 20.09 % (51168.53 ha) are 'extremely poor class' (class V) due to inefficient management practices.

Keywords: El-Menofya Governorate, land productivity, Riquier index.

Introduction

Soils are limited resource and could be renewable and cover most lands of the earth, **(Blum, 2006)**. Cultivated land represents about 40 – 50 % of the earth **(Scherr, 1999 and Davis and Masten, 2003)**, 20% of which are severely degraded **(Scherr, 1999; Adams and Eswaran, 2000 and Davis and Masten, 2003)**. According to **UNDP (2007),** agriculture is the backbone of the economy in many countries, especially the least developed ones; and is one of the world's most important activities supporting mankind. Land resources regeneration is slow with an increased population growth. Potential land use assessment is the prediction of land potential for productive land use **(Fresco et al, 1994 and Mirlotfi and Sargolzehi, 2013).** With a majority of the world population living in rural areas in developing countries, agriculture remains a key activity for providing people the capacity to feed themselves by producing their food **(Costanza et al., 1992; Pearce and Warford, 1993; Andzo-Bika and Kamitewoko, 2004 and Aune 2012)**. Agriculture needs to adapt to climate change including extreme weather events. There are three pathways for agricultural development: conventional agriculture, organic agriculture and conservation agriculture **(Aune 2012).** Egypt is a populous country with a total area of 1 million km^2 and most its population live within the banks of the Nile River, in an area of about 40,000 km^2, where the main arable lands exist **(WB, 2007 and CAPMAS, 2009).** Over 95% of its agricultural production is from irrigated lands. Only 2.5% of Egypt's land area, the Nile delta and the Nile valley, is suitable for intensive agriculture **(Zeydan, 2005)**. The Nile Delta and the Nile Valley are the main contributor to food production, trading activities and national economy, with the Delta constituting 63% of Egypt's arable land **(Abu Al-Izz, 1971 and Shehata, 2014)**.

Soil quality is the capacity of soil to function, within the ecosystem and land-use boundaries, sustaining biological productivity, maintaining environmental quality, and promoting good health for plants, animals and humans (**Doran and Parkin, 1994, Novak et al., 2010 and Dengiz et al, 2010)**. Soil quality has two parts: an intrinsic part covering its inherent capacity for crop growth and a dynamic part influenced by its user or manager **(Doran and Parkin, 1994; Larson and Pierce, 1994; Pierzynski et al., 1994; Acton and Gregorich, 1995; Dumanski and Pieri, 2000; Bouma, 2002; Blum, 2003 and Novak et al., 2010 and Dengiz et al., 2010)**. Soil quality involves its productive and environmental capabilities (**Warkentin 1992; Wander et al. 2002 Bone et al., 2010)** as well as its capacity to resist and recover from degradation **(Blum, 1998).** Inherent soil quality can be assessed using land resource or soil survey inventories **(MacDonald et al., 1995 and Soil Survey Staff, 2000)**. The primary reason for soil surveys is evaluation of soil productivity; **Huddleston (1984).**Databases for soils can be analyzed using the computerized geographic information system (GIS) to develop broad regional assessments of soil quality **(Petersen et al., 1995).** Procedures for land resource assessment and crop production potentials and risks have undergone many changes. Land evaluation involves integration of soil, climate, and land use information through **(FAO, 1976 and Dumanski et al., 1996)**, as well as applications of models **(Burrough, 1993)**, Many land resource assessment studies have not fully capitalized on the opportunities presented by the new techniques in geospatial analysis and information management. Awareness and concerns for problems related to environmental quality are growing at a steady pace: climate change, biodiversity, soil fertility decay and above all food quality and pollution are subjects for debates (**Wu and Sardo, 2010).** Soil quality has interconnections with management practices, productivity and other ecosystem aspects, showing an interdependence controlled by feedback mechanisms. It is also connected with human health practices which directly affect productivity **(Doran, 2002 and Zornoza et al., 2015).**

Agricultural productivity relates inputs to outputs of the the agricultural activity **(Shafi, 1984; Singh and Dhillion, 2002 and Dharmasiri, 2009).** The yield per unit was suggested **as** a parameter for agricultural productivity **(Singh and Dhillion, 2000).** Since productivity should consider all factors of production, average return per unit does not represent the real picture and the use of marginal return per unit was suggested (**Tekwa et al., 2011).** Productivity loss by land degradation is a result of mismatch between land use and land quality **(Van Lynden and Kuhlman, 2003 and Tekwa et al., 2011).** Agricultural productivity is associated with the attitude towards work, industriousness and aspirations for a high standard of living, **(Singh and Dhillion, 2000)**. Agricultural productivity is affected by physical, socio-economic and technological factors **(Kirch, 1994)**. Productivity may be raised by input packages consisting of improved seeds, fertilizers, agro-chemicals and labour **(Fladby, 1983).** Human activity is an important factor and may have positive or negative effects on productivity **(John et al., 2006).** World agriculture production should increase by 70% by 2050 in order to keep pace with the population growth **(Aune, 2012).** However, the increase will have to be achieved in a way that preserves the environment. Land degradation leads to a decrease in soil productivity **(Hillel, 2009; Van Lynden and Kuhlman, 2003)**. In Egypt, many soils are degraded due to water logging and salt accumulation **(Darwish and Abdel Kawy, 2008 and Wahab et al., 2010**, **Abd El Gawad, 1983; El Kattib, 1983; Abd El Halim et al., 1996; and Abd El Kawy, 2002)**. Salinization and water logging lead to yield reduction by 17 to 25 % in the Nile valley and delta **(Dregne, 1986 and Mohamedin et al., 2010)**.

The current work aims at assessing soil productivity potentials in El- Monofeya area in view of soil physical and chemical properties as the well as the biodiversity factors in. Land surveying data, laboratory analyses, remote sensing and Geographic Information System (GIS) were the main tools to fulfill this objective.

Materials and Methods

Site description

El-Menofeya is one of the Governorates of Central Delta, Egypt. It lies between the two Nile branches of Rosetta and Damietta. It has a triangular shape with its base towards the north and its top to the south. It is between latitudes 31° 5' and 31° 25' N, and longitudes 30° 10' and 30° 40' E,(Figure 1). It is bounded by El-Giza Governorate to the south, El-Gharbiya to the north, El-Kalubia to the east and El-Behaira to the west. The total area of the Governorate is about 2543 km^2 (254300 ha), It is administratively divided into nine provinces, : (1) Shebin-El-Kom, (2) Berkat-El-Saba, (3) Qowisna, (4) El-Bagour, (5) Ashmone, (6) Menoof, (7) El-Shohada, (8) Talla and (9) El-Sadat. The capital of the Menofya is Shebin-El-Kom City, its elevation around is 12 m above sea level.

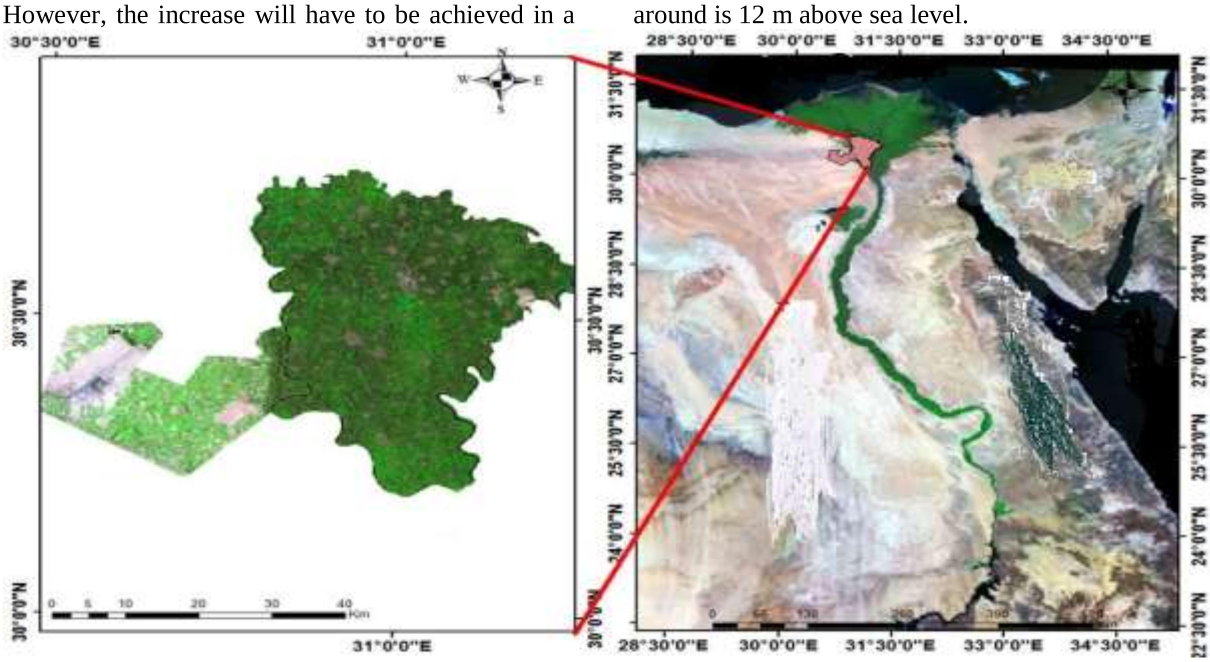
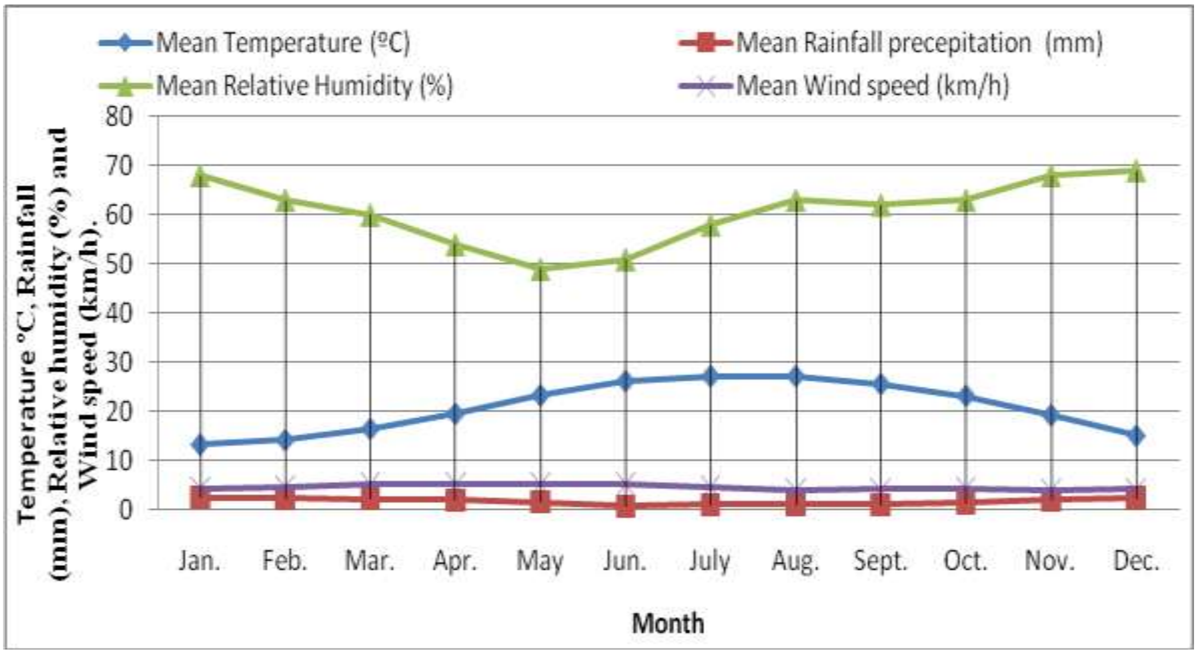


Fig. 1: Location of El-Menofeya Governorate.

Climate

The climate is a Mediterranean one with hot arid summer and little rain in winter, with average temperature of 15.0 to 27.2 °C. The highest is 33.6 °C in July and August, while the lowest is 5.6 °C in January. The dray months are June, July, August, and September. The wet months are January and February. Average monthly relative humidity ranges from 49.0 % in May to 69.0 % in December Figure. 2 shows the of El-Menofya climate diagrams.



Source: EMA(1996).

Fig. 2: Climate of El- Menofeya Governorate.

Geology and Geomorphology

Land of the Monofeya belongs to the late Pleistocene represented by deposits of the Neonile **(Said, 1993)**. There are three major geomorphologic units in the middle of the Delta, namely: young deltaic plain, old deltaic plain, young aeolian plain **(El-Fayoumy, 1968)**.

Satellite Data:

Digital image processing of Landsat 8.0 ETM$^+$ (enhanced thematic mapper$^+$) satellite images in 2016 was executed using ENVI 5.1 software **(ITT, 2009)**. The digital image processing included bad lines manipulation by filling gaps module designed using IDL language, data calibration to radiance according to **Lillesand and Kiefer (2007).**

Soil Taxonomy

According to **EMA (1996) and USDA (1975)**, the soil temperature regime is thermic and the soil moisture regime as torric and the soil order is Entisols.

Soil survey and field work

A semi detailed survey was prepared for the soil patterns, land forms and the landscape characteristics. One profile pit was dug to represent each of the major soil types,. Ten soil profiles were examined for their morphological features according to the **FAO (2006)**. Soil samples were taken from the horizons or layers of the profiles for laboratory analysis.

Soil laboratory analyses

Particle size distribution was determined according to **USDA (2004)**. Electric conductivity (EC) of soil paste extract, soluble cations and anions, organic matter, pH, exchangeable sodium percent, as well as available N,P and K nutrients and cation exchange capacity (CEC) were determined according to **Bandyopadhyay (2007)**.

Soil productivity index

Productivity potential of the soil profiles were assessed by applying the mathematical model proposed by **Riquier et al. (1970)**. The system suggested calculation of a productivity index considering eight factors as determining land productivity factors. They are moisture availability (H), drainage (D), effective depth (P), texture/structure (T), soluble salts (S) organic matter (O), CEC (A), and mineral reserves (M). Each of the land characteristics with associated attributes was digitally encoded in a GIS database to generate eight thematic layers. The diagnostic factors of each thematic layer were assigned values, for factor rating (Tables 1, to 4).

Table 1. Definitions of soil moisture and organic matter as soil productivity factors (Riquier et al., 1970).

	Soil moisture content (H)		Organic matter in A1 horizon (O)
H1	Rooting zone below wilting point all the year round	**O1**	Very little organic matter, less than 10 g/kg
H2	Rooting zone below wilting point for 9 to 11 months of the year H2a: 11, H2b: 10, H2c: 9 months,	**O2**	Little organic matter, 10-20 g/kg
H3	Rooting zone below wilting point for 6 to 8 months of the year H3a:8, H3b: 7, H3c: 6 months,	**O3**	Average organic matter content, 20-50 g/kg
H4	Rooting zone below wilting point for 3 to 5 months of the year H4a:5, H4b: 4, H4c: 3 months,	**O4**	High organic matter content, over 50 g/kg
H5	Rooting zone above wilting point and below field capacity for most of the year	**O5**	Very high content but C/N ratio is over 25

Table 2. Definitions of soil drainage and reserves weatherable mineral as soil productivity factors (Riquier et al., 1970).

	Drainage (D)		Reserves of weatherable mineral in B horizon (M)
D1a	Marked waterlogging, water table almost reaches the surface all year round	**M1**	Reserves very low to nil
D1b	Soil flooded for 2 to 4 months of year	**M2**	Reserves fair
D2a	Moderate waterlogging, water table being sufficiently close to the surface to harm deep rooting plants	**M2a**	Minerals derived from sands, sandy material or ironstone
D2b	Total waterlogging of profile for 8 days to 2 months	**M2b**	Minerals derived from acid rock
D3a	Good drainage, water table sufficiently low not to impede crop growing	**M2c**	Minerals derived from basic or calcareous rocks
D3b	Waterlogging for brief period (flooding), less than 8 days each time.	**M3**	Reserves large
D4	Well drained soil, deep water table; no waterlogging of soil profile	**M3a**	Sands, sandy materials or ironstone
		M3b	Acid rock
		M3c	Basic or calcareous rocks

Table 3. Definitions of soil texture and structure of root zone, soil depth, soluble salt content and cation exchange capacity as soil productivity factors (Riquier et al., 1970).

	Texture and structure of root zone (T)		Soil depth (P)
T1	Pebbly, stony or gravelly soil	**P1**	Rock outcrops with no soil cover or very shallow cover
T1a	Pebbly, stony or gravelly > 60 % by weight	**P2**	Very shallow soil, < 30 cm
T1b	Pebbly, stony or gravelly from 40 to 60 %	**P3**	Shallow soil, 30-60 cm
T1c	Pebbly, stony from 20 to 40 %	**P4**	Fairly deep soil, 60-90 cm
T2	Extremely coarse textured soil	**P5**	Deep soil 90-120 cm
T2a	Pure sand, of particle structure	**P6**	Very deep soil > 120 cm
T2b	Extremely coarse textured soil (> 45% coarse sand)		**Soluble salt content (S)**
T2c	Soil with non-decomposed raw humus (> 30% organic matter) and fibrous structure	**S1**	< 0.2 %
T3	Dispersed clay of unstable structure (ESP > 15%)	**S2**	0.2-0.4 %
T4	Light textured soil, fS, LS, SL, cS and Si	**S3**	0.4- 0.6 %
T4a	Unstable structure	**S4**	0.6- 0.8 %
T4b	Stable structure	**S5**	0.8- 1.0 %
T5	Heavy-textured soil: C or SiC	**S6**	> 1.0 %.

T5a	Massive to large prismatic structure	**S7**	Total soluble salts (including Na_2CO_3) 0.1-0.3%
T5b	Angular to crumb structure or massive but highly porous	**S8**	0.3-0.6%
T6	Medium-heavy soil: heavy SL, SC, CL, SiCL, Si	**S9**	> 0.6%
T6a	Massive to large prismatic structure		**CEC (A)**
T6b	Angular to crumb structure (massive but porous	**A0**	Exchange capacity of clay < 5 cmolc/kg
		A1	CEC of clay < 20 cmolc/kg (probably kaolinite and sesquioxides)
T7	Soil of average, balanced texture: L, SiL and SCL	**A2**	CEC of clay from 20 to 40 cmolc/kg
		A3	CEC of clay >40 cmolc/kg

Note: fS: fine sand, LS: loamy sand, SL: sandy loam, S: Sand, C: Clay, Si: Silt, SiC: Silty Clay, CS: Course sand.

Table 4. Ratings of different soil and land characteristics as soil productivity factors (Riquier et al., 1970).

Factors	**Crop Growing**	**Pasture**	**Tree Crop**	**Factors**	**Crop Growing**			**Pasture**	**Tree Crop**
		H		**D**	**H4, H5**	**H2,H3**			
H1	5	5	5	D1	10	40		60	5
H2a*	10	20	10	D2	40	80		100	10
H2b	20	20	10	D3	80	90		90	40
H2c	40	30	10	D4	100	100		80	100
H3a	50	30	10	P					
H3b	60	40	20	P1	5			20	5
H3c	70	60	40	P2	20			60	5
H4a	80	70	70	P3	50			80	20
H4b	90	80	90	P4	80			90	60
H4c	100	90	100	P5	100			100	80
H5	100	100	100	P6	100			100	100
				T					
				T1a	10			30	50
				T1b	30			50	80
				T1c	60			90	100
					H4,5,6	**H3**	**H1,2**		
				T2a	10	10	10		
				T2b	30	20	10		
O	**H1H2H3 D3D4**	**H4H5D1D2**		T2c	30	30	30	The same rating as for pasture	The same rating as for tree crops
O1	85	70		T3	30	20	10		
O2	90	80		T4a	40	30	30		
O3	100	90		T4b	50	50	60		
O4	100	100		T5a	50	60	20		
O5	70	70		T5b	80	80	60		
		A		T6a	80	80	60		
A0		85		T6b	90	90	90		
A1		90		T7	100	100	100		
A2		95		**S**	**T1,2,4**	**T5,6,7**			
A3		100		S1	100	100			
M	**H1H2H3**	**H4 H5**		S2	70	90			
M1	85	85		S3	50	80			
M2a	85	90		S4	25	40			
M2b	90	95		S5	15	25			
M2c	95	100		S6	5	15			
M3a	90	95		S7	60	90			
M3b	95	100		S8	15	60			
M3c	100	100		S9	5	15			

Results and Discussion

Geomorphologic features.

Landforms of the area can be divided into two mapping units (Figure 3): flood plains (overflow basins, decantation basins, river terraces and turtle backs) and aeolian plains (hummock areas and sand sheets). Data in Table 5 show the areas of landforms.

Table 5. Landforms and mapping units and their areas total study area.

Landform	Mapping unit (landform code)	Profile No.	Area (ha)	Area %
Overflow basins	**OB**	5 and 6	33931.82	13.34
Decantation basins	**DB**	7	47851.95	18.82
High River terraces	**RT1**	2, 4 and 8	22918.27	9.01
Moderate River terraces	**RT2**	1 and 3	2323.38	0.91
Low River terraces	**RT3**	9	1929.54	0.76
Turtle backs	**TB**	Ne	32685.35	12.85
Hummock areas	**HA**	Ne	18483.18	7.27
Sand sheets	**SS**	10	32472.00	12.77
Levees	**LV**	Ne	20104.51	7.91
Nile River	**NR**	Ne	41603.00	16.36
Total area (ha)			254303.01	100.00

Note: Ne: non-existent

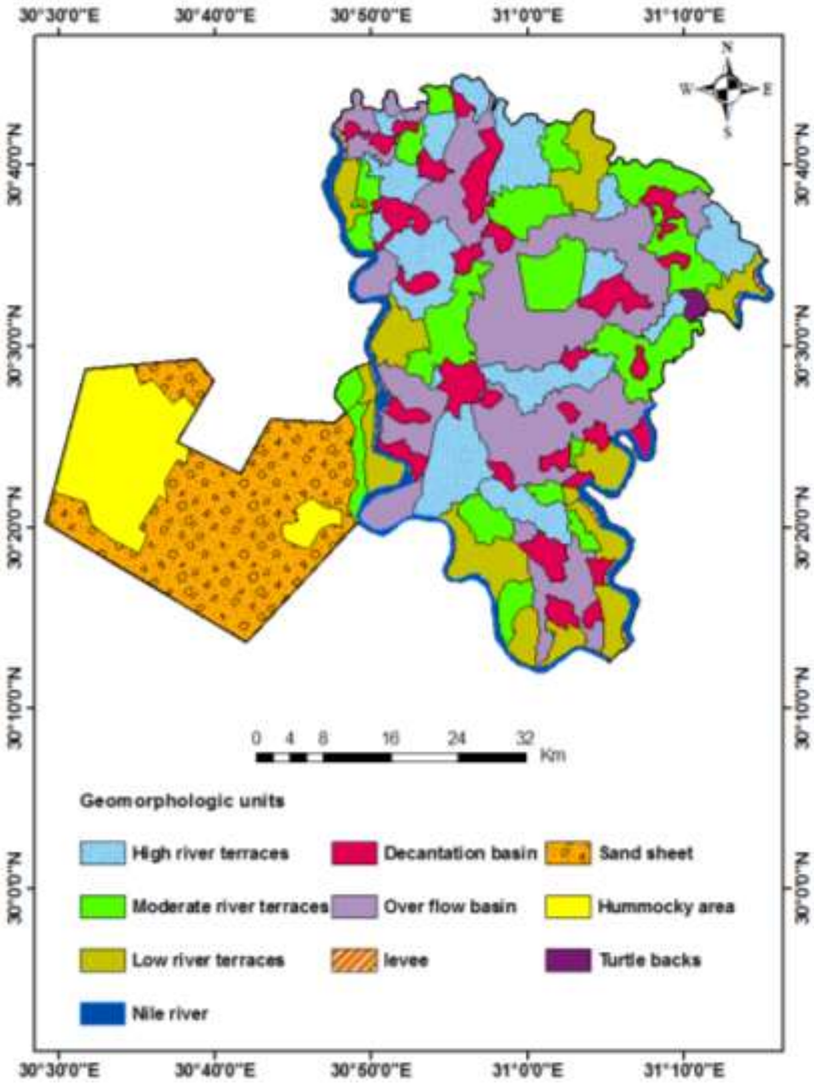


Fig. 3: Geomorphologic map of the study area.

Land productivity evaluation.

The fundamental principle of land evaluation is to estimate the potential of the soil for different productive uses, such as farming, livestock production and forestry. Productivity is the capacity of soil in to produce a specific plant or sequence of plants under specific systems of management inputs. **Riquier et al. (1970)** described productivity as the initial soil capacity to produce a certain amount of crop per hectare per annum. Soil potential productivity on the other hand is the productivity of soil when all possible improvements are made. It is thus, the future potentiality of soil taking into account its physical and chemical properties which can be modified by conservation practices or improvements and also properties which are not modifiable by present day technology **(Riquier et al., 1970)**.

Land productivity classification.

The model of Riquier Land Productivity Index (RLPI) works interactively, comparing the values of the properties of the land unit with the generalization levels designated for each productivity class. The Riquier soil productivity model is based on analysis of the soil factors which affect the productivity. The following steps explain the mechanism of the RLPI model:

1-The soil factors including effective moisture availability (H), drainage (D), effective depth (P), texture/structure (T), soluble salt (S), organic matter (O), cation exchange capacity (A) and mineral reserve in B horizon (M) all of which are used as diagnostic criteria (Figure 4).

2-Calculated mean weighted mean value for each determined soil property (V) is used to evaluate the soil based on multiplying the parameter value (Vi) of each horizon by the horizon thickness (ti) divided by the total profile depth (T) according to the following equation:

3- After preparation, of final data of physical and chemical properties the RLPI was colculaled The spatial analysis function in ArcGIS 10.1 was used to create thematic layers of the most constraining factors. The diagnostic factors of each thematic layer were assigned values of factor rating identified in Tables 1 to 4.

4- The RLPI was calculated for the different mapping units according to the following equation:

RLPI = (H/100) x (D/100) x (P/100) x (T/100) x (S/100) x (O/100) x (A/100) x (M/100) x 100

5- Each factor was rated on a scale of 0 to 100, the actual percentages being calculated multiplied by each other. The resultant is the index of productivity (between 0 and 100). The rating of the productivity and potentiality of the soils was done according to the grading system in Table 6.

Table 6. Class and rating limit of actual soil productivity (P) and potential soil productivity (P/) indices

Class	Class	Rating	Class name
1	I	65-100	Excellent
2	II	35-64	Good
3	III	20-34	Average
4	IV	8-19	Poor
5	V	0-7	Extremely Poor to Nil

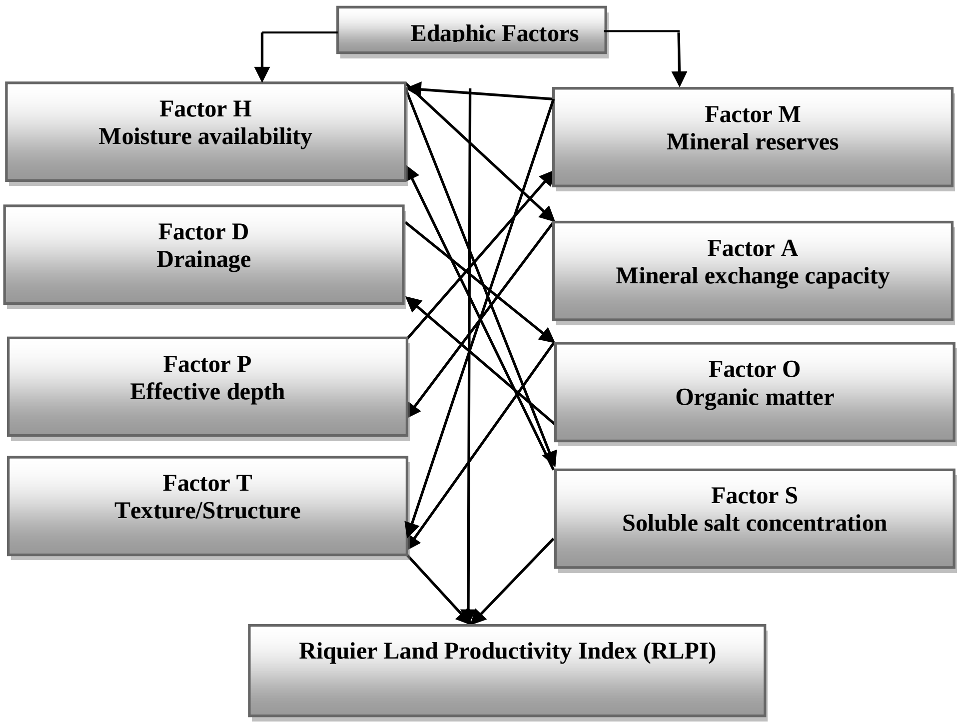


Fig. 4: Model of the Riquier Land Productivity Index (RLPI).

Determination of Riquier Land Productivity index (RLPI)

Most of the study area 54.51 % (106631.58 ha) consists of class I and class II in terms of agricultural use: **OB, DB, RT1 and RT3** mapping units. A portion of 0.91 % (2323.38 ha) of the an average class (class III): **RT2** mapping unit, and 12.77% (32472.00 ha) has class **SS** mapping unit. The remaining 20.09 % (51168.53 ha) has class V. **TB and HA** mapping units. This study demonstrates that more than half of El-Menofya area is productive lands. Table shows values of index range from "excellent" to "extremely poor" due to different limiting factors. Some of these limiting factors are not correctable such as soil depth and soil texture, while salinity and CEC can be corrected. The parametric evaluation system of the index is given in Tables 7 to 10, and their map is shown in Figure 5 using GIS.

Table 7. Values of the factors of Riquier Land Productivity Index of the studied soils of Monofeya area.

Mapping unit	Moisture availability	Drainage	Effective depth (cm)	Texture / structure	Soluble salt concentration (dS/m)	Organic matter content (g/kg)	Cation exchange capacity ($cmol_c$/kg)	Mineral reserve in B horizon
OB	Rooting zone below wilting point for 3 months of the year	Good drained	110	Clay	1.33	28.55	40.98	Basic or calcareous rocks
DB	Rooting zone below wilting point for 3 months of the year	Good drained	110	Clay	0.58	25.20	46.46	Minerals derived from basic or calcareous rocks
RT1	Rooting zone below wilting point for 3 months of the year	Good drained	113	Clay	0.69	20.70	37.48	Basic or calcareous rocks
RT2	Rooting zone below wilting point for 3 months of the year	Moderate drained	93	Clay loam	0.85	17.35	39.41	Minerals derived from basic or calcareous rocks
RT3	Rooting zone below wilting point for 3 months of the year	Well drained	120	Clay	0.44	23.90	40.12	Minerals derived from basic or calcareous rocks
SS	Rooting zone below wilting point for 9 months of the year	Well drained	140	Sand	1.33	5.80	12.36	Minerals derived from sands, sandy material or ironstone

Table 8. Soil characteristics of the investigated area**.**

Mapping unit	Moisture availability (H)	Drainage (D)	Effective depth (P)	Texture / structure (T)	Soluble salt concentration (S)	Organic matter content (O)	Cation exchange capacity (A)	Mineral reserve in B horizon (M)
OB	H4c	D3a	P5	T5b	S1	O3	A3	M3c
DB	H4c	D3a	P5	T5b	S1	O3	A3	M2c
RT1	H4c	D3a	P5	T5b	S1	O3	A2	M3c
RT2	H4c	D2a	P5	T6b	S1	O2	A2	M2c
RT3	H4c	D4	P5	T5b	S1	O3	A3	M2c
SS	H2c	D4	P6	T4b	S1	O1	A1	M2a

Table 9. Assessment of Requier Land Productivity Index of the study area.

Mapping unit	Moisture availability (H)	Drainage (D)	Effective depth (P)	Texture / structure (T)	Soluble salt concentration (S)	Organic matter content (O)	Cation exchange capacity (A)	Mineral reserve in B horizon (M)	Riquire Productivity Index (RPI)	Class
OB	100	80	100	80	100	90	100	100	57.60	**II**
DB	100	80	100	80	100	90	100	95	54.72	**II**
RT1	100	80	100	80	100	90	95	100	54.72	**II**
RT2	100	40	100	90	100	80	95	95	26.02	**III**
RT3	100	100	100	80	100	90	100	95	68.40	**I**
SS	40	100	100	60	100	85	90	85	15.61	**IV**

Table 10. Distribution of Requier Land Productivity Index of the study area

Riquier Land Productivity Index RLPI (%)	Grade	Class	Mapping unit	Area (ha)	Area %
65 – 100	**I**	Excellent	**RT3**	1929.54	13.34
35 – 64	**II**	Good	**OB, DB and** RT1	104702.04	41.17
20 – 34	**III**	Average	**RT2**	2323.38	0.91
8 – 19	**IV**	Poor	**SS**	32472.00	12.77
0 – 7	**V**	Extremely poor to nil	**TB and HA**	51168.53	20.09

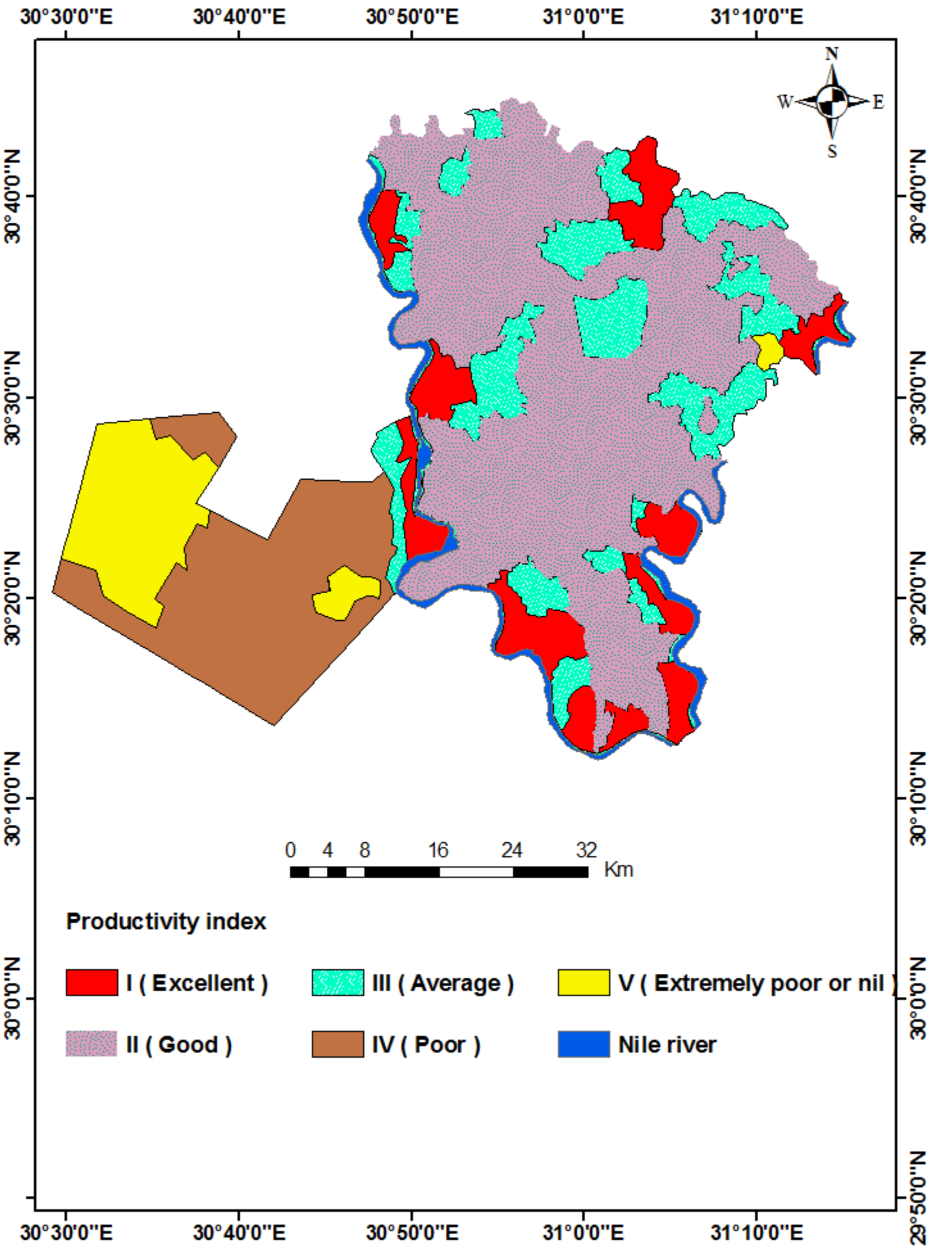


Fig 5: Riquier Productivity Index map.

Conclusion

The Nile Delta is one of the oldest intensely cultivated areas on earth. It is very heavily populated, with population densities up to 1700 inhabitants per square kilometer. The low lying, fertile floodplains are surrounded by deserts. The agricultural productivity is influenced by a number of physico-socio-economic, institutional and organization factors among them drought and climatic conditions land productivity of the different categories, each of which corresponding to a certain level of details. At each level study area of Monofeya Governorate.

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تحديد قدرات الأرض الإنتاجية: حالة الدراسة فى محافظة المنوفية – مصر باستخدام تقنيات الاستشعار من بعد ونظم المعلومات الجغرافية.

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انتاجية اراضى محافظة المنوفية ، الجزء الاوسط من دلتا النيل . المحافظة تقع في وسط الدلتا ، وتقع بين فرعي دمياط ورشيد (بين خطى طول 30° 10' & 4030 °' شرقا وخطى عرض 2531 °31 & 5' °' شمالا) وتغطى مساحة قدرها 254303.01 هكتار وتتضمن المنطقة ثمانية وحدات خرائطية: أحواض فيضية (OB)– أحواض تجميعية (DB) – شرفات نهرية عالية (RT1) – شرفات نهرية متوسطة (RT2)– شرفات نهرية منخفضة (RT3)– ظهور السلاحف(TB) – مناطق الآكام (HA)– الفرشات الرملية (SS). دليل إنتاجية التربة (LPI) يكون محسوب على أساس مقترحات حدودية بأستخدام تقنيات الاستشعار من بعد و نظم المعلومات الجغرافية. RLPI يكون مستخدم مع الاخذ في الاعتبار خصائص التربة وطبوغرافيتها بإستخدام صيغ خاصة وعمل تصنيف لإنتاجية التربة لكل وحدة خرائطية. واظهرت البيانات والنتائج المتحصل عليها54.51% من المساحة الكلية (106631.58 هكتار) هي من الاقسام الممتازة والجيدة ويتبع القسم الاول والثاني(I and II) وتكون صالحة تماما للإستخدام الزراعى. 0.91% من المساحة الكلية (2323.38 هكتار) يتبع القسم الثالث(III)، بينما 12.77% من المساحة الكلية (32472.00 هكتار) تتبع القسم الرابع الفقير الإنتاجية (IV). (القسم الخامس V) باقى المساحة (20.09%) يظهر قيم منخفضة للإنتاجية وهذا ناشئ عن ممارسات إدارة التربة التى لا تواجة متتطلبات الإنتاجية.