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SITUATION STUDY OF SOILS OF SHUBRA EL-KHIMA DISTRICT, EL-QALUBIYA GOVERNORATE, EGYPT

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ABSTRACT

Shubra El-Khima district is a boundary to Cairo, which belong to the alluvial plain, lie in thermic temperature regime and Torric moisture regime, has not any diagnostic horizon and classify according to USDA, 2014 as follows:

"Typic Haplotorrerts, fine, smectitic, thermic, very deep"

Land suitability according to Sys and Verheye, 1978 are achieved on the soil characteristics and the soils under consideration appear a moderate limitation (S2) which is affected by the clay texture through all the studied area and along of the studied profiles.

The urban area in 1965 was 382.61 feddan and the highly fertile cultivated soils were loss 3225.87 and 31239.95 feddan are recorded in 1984 and 2013, respectively. This deterioration may be due to the increasing of population and the income of real estate investment is higher than the agricultural investment.

INTRODUCTION

Said (1981) reported that the Nile Delta and its classic fan shape have been evolving since upper Miocene time. Said (1993) recorded that the studied area belongs to the late Pleistocene which represented by the deposits of the neonile broke into Egypt some time in the earlier part and also by the deposits which accumulates during recessional phases of this river.

Zahra (2007 and 2011) recognized 8 geomorphic units in the south of Qalubiya Governorate as follows (1) decantation basins; (2) overflow basin; (3) recent river terraces; (4) levee; (5) swale; (6) hummocky areas; (7) hilly area and (8) turtle, which cover about 48.05%, 43.85%, 6.56%, 0.63%, 0.87%, 0.03%, 0.004% and 0.001% of the total area, respectively.

The climatological data of Bahteem station from 2006 to 2011 indicate that total mean annual rainfall 4.3 mm, maximum mean temperature is 35.7 ^{o}C in June while minimum mean temperature 8.6 ^{o}C is recorded in January. The mean annual temperature is 21.8 ^{o}C. So, the soil temperature regime is thermic and soil moisture regime is aridic or torric according to USDA, 2014.

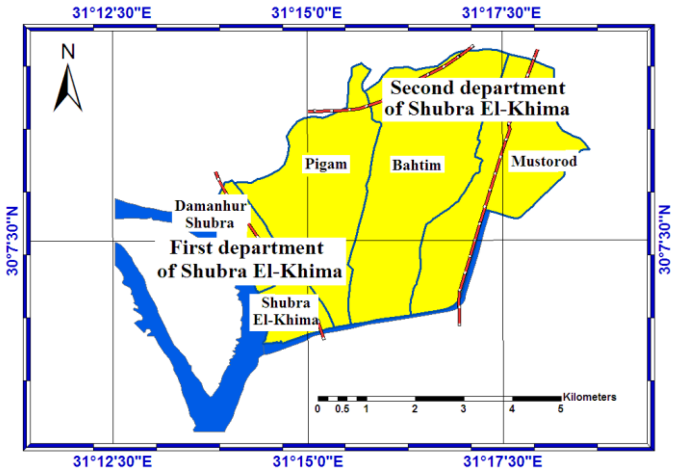
The study under consideration aimed to recognition the main pedological characteristics and corrosion of agricultural soils by urbanization encroachment of Shubra El-Khima district, through, follow up an urbanization growth.

MATERIALS AND METHODS

Used and product data by GIS:

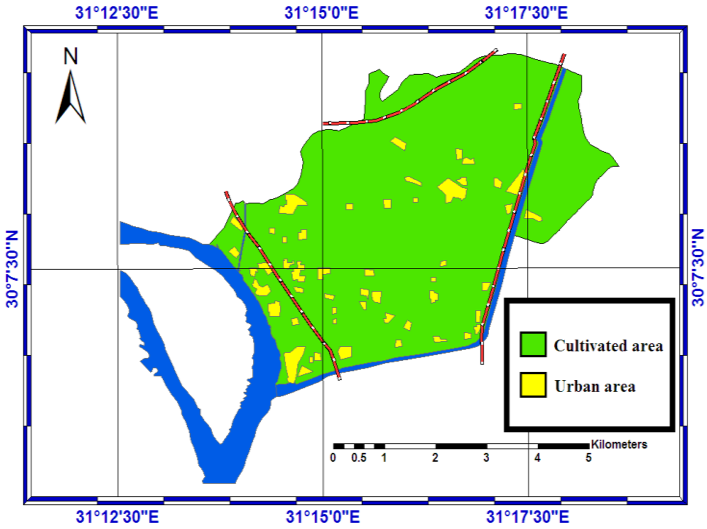
Topo map and satellite imagery are corrected by Egyptian Transverse Mercator (ETM):

1. Topo map 1: 100,000 of the studied area published in 1965 by Egyptian General Survey Authority (EGSA, 1965).
2. Landsat satellite imagery TM5 or thematic Mapper of the studied area for 1984.
3. Quick Bird (QB) satellite imagery of the studied area for 2013.
4. Delineate the studied area of Shubra El-Khima district as a polygons, which include first department of Shubra El-Khima (Shubra El-Khima, Damanhur Shubra and Pigam) and second department Shubra El-Khima (Mustorod and Bahtim). It lies essentially on crossing of latitude 30^{o} 6' 20.07" to 30^{o} 9' 38.68" North and longitudes 31^{o} 18' 32.23" to 31^{o} 13' 36.84" East, map 1.

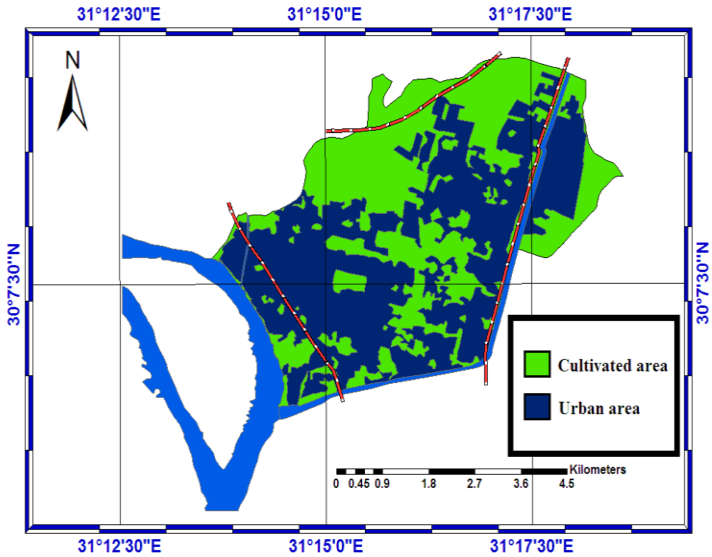


Map (1): The borderland of Shubra El-Khima district.

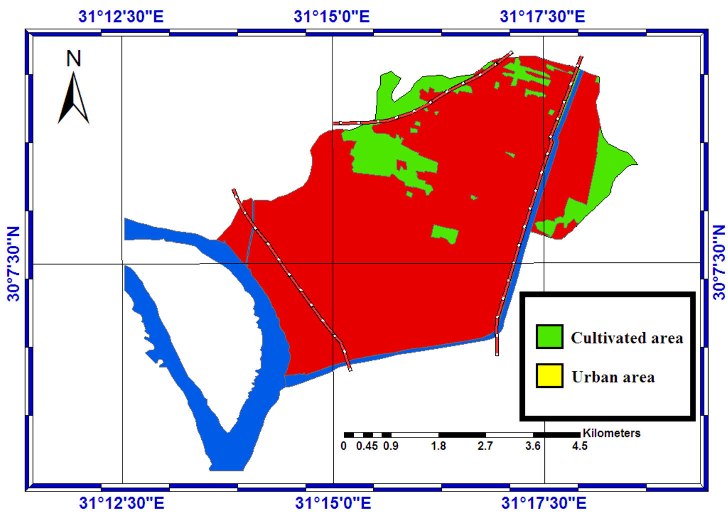
5. Delineate and limit the boundary of urban area and the cultivated land on the corrected map 1965, landsat TM5 1984 and Quick bird 2013 which illustrated on maps 2, 3 and 4.



Map (2): The relationship between cultivated and urban areas in 1965.



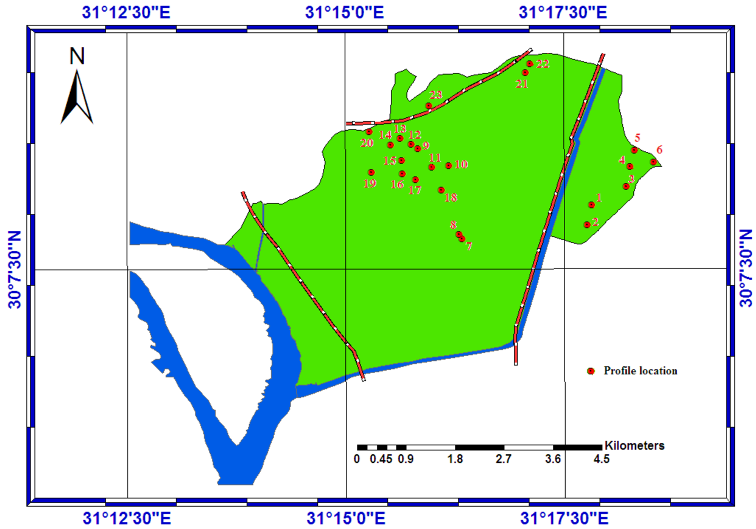
Map (3): The relationship between cultivated and urban areas in 1984.



Map (4): The relationship between cultivated and urban areas in 2013.

Pedological study:

Field morphological description is carried out on twenty three soil profiles cover the pilot area (map 5) according to guidelines of FAO, 1990. Soil samples were collected, air dried, crushed, sieved through a 2 mm sieve and subjected to different physical and chemical analysis. Gravel content was determined as percent by volume.



Map (5): Location of the studied profiles.

- Particle size distribution is carried out according to Black (1965) using hexametaphosphate as dispersing agent.
- pH values were measured in the saturated soil paste according to (Richared, 1954).
- Total salinity (ECe) and soluble cations and anions were determined in saturated soil paste extract (Jackson, 1975).
- Sulphate; calculated by subtracting total anions from total cations.
- Organic matter was determined according to the modified procedure in Jackson (1958).
- Gypsum content was determined by precipitation with acetone (Richard, 1954).
- Calcium carbonate content was determined volumetrically using Collin's Calcimeter (Richard, 1954).

RESULTS AND DISCUSSION

Pedological study:

The studied area is distinguished as an alluvial plain, which is a plain produced by deposition of alluvium; e.g. a delta plain according to Robert and Julia (1984). Whereas, the studied area is scattered through the urban encroachment, twenty three soil profiles are executed. These profiles from the morphological characteristics are similar and the following description are the representative one (profile No. 8).

District: Shubra El-Khima **Governorate:** El-Qalubiya
Location/ coordinate: 30^o 07' 50.34" N, 31^o 16' 18.20" E
Topography: Flat **Slope:** level
Land use: Annual field cropping **Crops:** clover
Parent material: Alluvial deposits **Physiographic unit:** Alluvial plain
Surface feature: Medium cracks width and moderately widely spaced
Drainage class: well drained **Water table:** very deep, not observed

The morphological description

Depth (cm)	Description
0 – 30	Very dark grayish brown (10YR 3/2, moist) clay, medium subangular blocky; weak grade, firm (moist), very sticky and very plastic (wet), common medium voids, few fine and medium roots, moderate effervescence, clear smooth boundary.
30 – 80	Dark brown (10YR 3/3, moist) clay, fine angular blocky; moderate grade, firm (moist), very sticky and very plastic (wet), common distinct slickensides, few fine voids, few fine and medium roots, few soft lime segregation, moderate effervescence, clear smooth boundary.
80 – 150	Dark grayish brown (10YR 4/2, moist) clay, medium angular blocky; weak grade, very firm (moist), very sticky and very plastic (wet), common very fine voids, few soft and hard lime, weak effervescence.

Data of physical and chemical properties are illustrated in Tables 1 and 2, which are summarized as follows in the subsequent pages.

Soil of physical properties in Table 1 show "clay texture class" in different layers of all studied profiles, whereas, the clay contents vary from 41.70 to 77.16%, the silt contents change between 10.44 and 32.20%. While the contents of sand oscillate from 2.70 to 31.30%. On the other hand the components of total carbonate, gypsum and organic matter contents are 3.0 – 6.2%, 0.06 – 0.24% and 0.19 – 0.93%, respectively.

Data of Table (2) show the chemical properties. The soil reaction (pH) ranges from 7.08 to 8.08, which tend to be neutral to slightly alkali. Soil salinity appears non-saline to slightly saline levels, the record values are from 0.65 to 3.94 dS/m. Values of sodium adsorption ratios (SAR) change between 1.16 and 7.53 which emphasize the pH values. Distribution of soluble cations show Na^{+} > Ca^{2+} > Mg^{2+} > K^{+} and its values 2.06 – 22.00, 2.01 – 14.86, 0.07 – 9.32 and 0.10 – 0.77 me/L, respectively, while, the distribution of soluble anions appear SO_4^{2-} > Cl^{-} > HCO_3^{-} which appear values 2.12 – 22.2, 2.00 – 20.08 and 0.77 – 4.00 me/L, respectively. The previous discussion shows that the soils under consideration have clay texture class through soil profiles, soil cracks and slickensids, on the other hand, there are no any diagnostic horizon, so, according to USDA, 2014, the soil of the studied area classify as:

"Typic Haplotorrerts, fine, smectitic, thermic, very deep"

Table (1); Soil physical properties of the studied area.

Prof. No.	Coordinate	Depth (cm)	Clay %	Silt %	Sand %	Texture class	Total $CaCO_3$ (%)	Gypsum (%)	O.M %
1	30° 08' 07.93" N 31° 17' 49.23" E	0 - 30	73.40	22.35	4.25	*Clay*	6.10	0.09	0.83
		30 - 80	65.10	32.20	2.70	*Clay*	5.20	0.11	0.71
		80-150	68.18	26.82	5.00	*Clay*	5.80	0.07	0.50
2	30° 07' 56.01" N 31° 17' 46.13" E	0 - 25	67.27	26.33	6.40	*Clay*	4.60	0.06	0.78
		25 - 80	64.13	30.17	5.70	*Clay*	4.20	0.08	0.63
		80-150	65.30	31.30	3.40	*Clay*	5.30	0.06	0.55
3	30° 08' 19.00" N 31° 18' 13.26" E	0 - 20	57.93	27.33	14.74	*Clay*	4.70	0.07	0.75
		20 - 80	51.64	28.05	20.31	*Clay*	3.90	0.08	0.53
		80-150	70.31	18.98	10.71	*Clay*	5.35	0.07	0.33
4	30° 08' 30.86" N 31° 18' 15.74" E	0 - 25	56.26	24.23	19.51	*Clay*	6.10	0.12	0.34
		25 - 75	50.80	30.63	18.57	*Clay*	5.40	0.08	0.22
		75-150	51.90	30.02	18.08	*Clay*	5.70	0.09	0.19
5	30° 08' 40.58" N 31° 18' 18.69" E	0 - 20	41.70	27.00	31.30	*Clay*	4.60	0.17	0.72
		20 - 60	57.93	27.33	14.74	*Clay*	5.30	0.13	0.63
		60-150	51.64	28.05	20.31	*Clay*	5.10	0.13	0.61
6	30° 08' 33.48" N 31° 18' 31.85" E	0 - 20	50.50	30.50	19.00	*Clay*	3.60	0.15	0.71
		20 - 70	50.24	25.87	23.89	*Clay*	4.40	0.18	0.54
		70-150	51.64	28.05	20.31	*Clay*	3.80	0.12	0.42
7	30° 07' 47.87" N 31° 16' 20.49" E	0 - 25	65.30	31.30	3.40	*Clay*	5.60	0.14	0.86
		25 - 70	64.30	30.00	5.70	*Clay*	4.80	0.12	0.71
		70-150	67.27	26.33	6.40	*Clay*	3.00	0.09	0.62
8	30° 07' 50.34" N 31° 16' 18.20" E	0 - 30	59.61	31.76	8.63	*Clay*	5.20	0.15	0.43
		30 - 80	66.94	20.46	12.60	*Clay*	5.40	0.14	0.39
		80-150	58.10	23.78	18.12	*Clay*	3.60	0.14	0.25
9	30° 08' 41.39" N 31° 15' 50.31" E	0 - 20	57.50	30.20	12.30	*Clay*	4.90	0.18	0.85
		20 - 70	55.60	28.80	15.60	*Clay*	4.20	0.19	0.79
		70-150	53.50	30.70	15.80	*Clay*	4.60	0.13	0.64
10	30° 08' 31.51" N 31° 16' 11.27" E	0 - 20	61.47	22.73	15.80	*Clay*	5.70	0.24	0.83
		20 - 80	50.80	30.63	18.57	*Clay*	4.40	0.15	0.59
		80-150	61.64	28.05	10.31	*Clay*	3.90	0.08	0.35
11	30° 08' 30.40" N 31° 15' 59.70" E	0 - 25	64.62	25.17	10.21	*Clay*	5.10	0.09	0.93
		25 - 75	60.80	30.63	8.57	*Clay*	5.90	0.08	0.85
		75 - 150	61.64	23.05	15.31	*Clay*	4.30	0.06	0.29
12	30° 08' 44.33" N 31° 15' 45.70" E	0 - 25	59.50	22.30	18.20	*Clay*	5.80	0.24	0.64
		25 - 80	56.40	21.10	22.50	*Clay*	5.20	0.18	0.55
		80 - 150	53.50	29.70	16.80	*Clay*	4.40	0.15	0.34
13	30° 08' 47.59" N 31° 15' 37.89" E	0 - 30	61.90	20.02	18.08	*Clay*	5.20	0.22	0.65
		30 - 80	62.04	23.05	14.91	*Clay*	5.60	0.19	0.54
		80-150	62.35	29.67	7.98	*Clay*	3.80	0.12	0.41
14	30° 08' 43.59" N 31° 15' 31.13" E	0 - 25	62.65	25.84	11.51	*Clay*	5.70	0.18	0.81
		25 - 75	62.93	22.33	14.74	*Clay*	4.90	0.14	0.79
		75 - 150	67.21	22.31	10.48	*Clay*	5.10	0.11	0.69
15	30° 08' 34.62" N 31° 15' 38.86" E	0 - 20	62.80	14.16	23.04	*Clay*	6.20	0.16	0.77
		20 - 80	61.77	25.23	13.00	*Clay*	5.90	0.09	0.63
		80 - 150	70.31	15.98	13.71	*Clay*	6.10	0.11	0.55
16	30° 08' 26.78" N 31° 15' 39.18" E	0 - 30	77.16	10.44	12.40	*Clay*	5.30	0.16	0.81
		30 - 80	68.04	19.10	12.86	*Clay*	4.80	0.21	0.75
		80 - 150	68.24	21.61	10.15	*Clay*	3.70	0.18	0.61
17	30° 08' 23.28" N 31° 15' 48.36" E	0 - 25	68.21	21.31	10.48	*Clay*	5.10	0.15	0.86
		25 - 75	68.24	21.61	10.15	*Clay*	5.70	0.13	0.77
		75-150	59.81	20.63	19.56	*Clay*	4.20	0.11	0.61
18	30° 08' 16.71" N 31° 16' 06.21" E	0 - 20	61.93	23.33	14.74	*Clay*	5.90	0.13	0.90
		20 - 70	61.64	18.05	20.31	*Clay*	5.30	0.09	0.85
		70 - 150	61.10	17.60	21.30	*Clay*	4.80	0.11	0.72
19	30° 08' 27.69" N 31° 15' 18.13" E	0 - 30	62.60	15.20	22.20	*Clay*	4.55	0.14	0.61
		30 - 80	65.26	24.23	10.51	*Clay*	4.52	0.08	0.54
		80 - 150	70.31	16.98	12.71	*Clay*	4.30	0.06	0.39
20	30° 08' 51.80" N 31° 15' 16.85" E	0 - 25	65.50	25.96	8.54	*Clay*	3.90	0.07	0.78
		25 - 75	60.80	25.63	13.57	*Clay*	4.60	0.06	0.75
		75 - 150	61.90	25.02	13.08	*Clay*	4.80	0.06	0.69
21	30° 09' 26.87" N 31° 17' 03.89" E	0 - 20	60.50	20.20	19.30	*Clay*	6.10	0.08	0.88
		20 - 80	60.60	20.80	18.60	*Clay*	6.00	0.07	0.79
		80-150	53.50	24.70	21.80	*Clay*	5.80	0.07	0.68
22	30° 09' 31.80" N 31° 17' 07.24" E	0 - 20	59.60	22.20	18.20	*Clay*	3.80	0.13	0.88
		20 - 70	56.50	21.10	22.40	*Clay*	4.50	0.11	0.53
		70 - 150	53.50	29.70	16.80	*Clay*	4.70	0.08	0.49
23	30° 09' 06.97" N 31° 15' 57.49" E	0 - 20	61.90	25.02	13.08	*Clay*	5.80	0.19	0.77
		20 - 50	62.04	23.05	14.91	*Clay*	5.60	0.13	0.63
		50 - 150	63.68	28.34	7.98	*Clay*	4.70	0.10	0.59

Table (2); Soil chemical properties of the studied area.

An attempt to the land suitability:

Land suitability according to the FAO framework for land evaluation by Sys and Verheye (1978). The evaluation of land characteristics are achieved as in the following (Table 3):

Table (3): Rating of current suitability of the representative soil profile.

Topography	Wetness	Physical characteristics				Salinity and alkalinity	Suitabilty Index (Ci)	Suitability Class
		Texture	Depth	CaCO3	Gypsum			
100	90	75	100	95	90	100	57.71	S2

Data in Table (3) show that the suitability indices for irrigation (Ci) is 57.71 which indicate a moderate limitations (S2) which is affected by the clay texture class as moderate limitation level in all soils of the studied area.

The urban encroachment:

The urban encroachment is one the most important factor of soil desertification or loss of highly fertile cultivated soil in Egypt. Salem (2002) estimated the loss of the fertile agricultural soils in Egypt with about 35000 fed./year. El-Baas (2002) concluded from the reports of Economic Affairs Sector (2001 and 2002) that the fertile agricultural soils will finish after 60 years.

Data in Table (4) appear the urban area through years 1965, 1984 and 2013 as follows:

Table (4): Urban encroachment and density of population in Shubra El-Khima district up to 2013.

Year	Urban area (fed.)	Increasing of urban area (fed.)	Population number (person)	Increasing of population number (person)	Rate of increasing of population (person/fed.)	Density of population (person/fed.)
1965	382.61	-	280000	-	-	731.82
1984	3608.48	3225.87	407907	127907	39.66	113.06
2013	5748.43	2139.95	497236	89329	365.23	86.50

Data in Table (4) and Maps 2, 3 and 4 show that total urban area is 382.61 feddans in year 1965. It developed to 3608.48 and 5748.43 feddans in years 1984 and 2013, respectively, which point to the highly fertile cultivated soils were loss 3225.87 and 2139.95 feddans through 19 and 29 years, respectively. So, data in Table (4) reveal to increasing of population number increase highly fertile cultivated soils loss. Fig. (1)

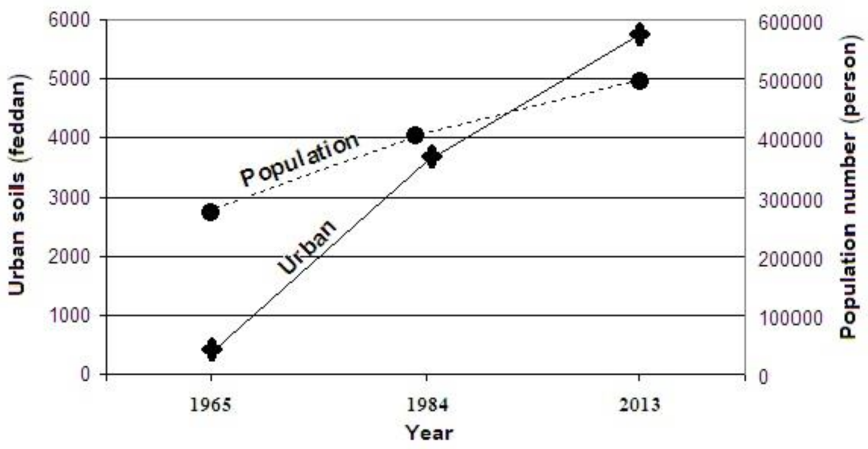


Fig. (1): The relationship between population number and area of urban soil through the studied period.

Appears the relationship between urban area (fed.) and population number (person) through the studied years, which indicate a positive correlation between them. On the other hand, data of density of population in Table (4) show a decrease number of populations for the unit area of urban soil, may be, due to the income of real estate investment is higher than agriculture investment.

Recommendations:-

To protect the fertile agriculture soils against encroachment:

1. Construct the new cities on desert lands.
2. Execute of family planning programs.
3. Aggravate of punishment encroachment and/or the trickery of leaving soil uncultivated.

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دراسة وضع أراضى مركز شبرا الخيمة محافظة القليوبية، مصر

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يقع مركز شبرا الخيمة على الحدود المتاخمة للعاصمة القاهرة والتى تنتمى إلى السهل الفيضى الرسوبى فى النطاق الحرارى Thermic والنطاق الرطوبى Torric ولم تظهر احتواءها على أى من الآفاق التشخيصية ولذا فقد قسمت طبقاً للنظام USDA, 2014 إلى:

"Typic Haplotorrerts, fine, smectitic, thermic, very deep"

كما تم تقييم مدى ملائمة الأراضى تحت الدراسة للإستخدام الزراعى طبقاً لنظام Sys and Verheye 1978 والذى أوضح أنها تنتمى إلى moderate limitation (S2) متأثرة بالقوام الطينى خلال جميع منطقة الدراسة وبطول القطاع.

أظهرت الدراسة أن مساحة العمران سنة ١٩٦٥ كانت ٣٨٢.٦١ فدان بينما كان الفقد فى الأراضى الزراعية عالية الخصوبة ٣٢٢٥.٨٧ و ٢١٣٩.٩٥ فدان قد سجلت خلال العامين ١٩٨٤ و ٢٠١٣ وكان السبب وراء هذا التدهور هو الزيادة فى التعداد السكانى وكذلك لأن الاستثمار العقارى أعلى عائداً من الاستثمار الزراعى.