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LAND SUITABILITY CLASSIFICATION OF SOME SOILS OF TOSHKI AREA, SOUTH EGYPT

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ABSTRACT

Landsat Thematic Mapper (TM) data have been used for delineating and mapping the area of branch_1, Toshki area. The studied area covers about 120,000 fed Twenty three soil profiles and seventeen minipits were examined to represent the soils of the studied area.

The soils of the studied area are classified as Typic Haplocalcids, Typic Haplosalids and Typic Torriorthents. The soils are slightly to extremely saline (EC values range from 1.1 to 73.4 dSm^{-1}). Soil texture is generally sand to sandy clay loam in most areas. Soil pH values range from 7.3 to 8.5. Organic matter content is very low with maximum value of 0.5%. Calcium carbonate content ranges between 0.6 and 15.9% and gypsum content ranges from 0.2 to 13.1%. Available fraction of nitrogen, phosphorus and potassium ranges from 0.2 to18.8 ppm, 0.3 to 8.5 ppm and 10 to 81 ppm, respectively.

The data reveal that current suitability of soils are moderately suitable (S_2), marginally suitable (S_3) and permanently not suitable (N_2). The soils of class S_2 form 56.5% of the studied area (~ 67844 fed). It includes one subclass S_2 x, as the texture is the limiting factor. The soils of class S_3 cover an area of about 44356 fed (37 %) and it contains three subclasses namely S_3xn (texture and salinity are the limiting factors), S_3 wxd (drainage, texture and depth are the limiting factors) and S_3 txn (topography, texture and salinity are the limiting factors). The soils of class N_2 cover an area of about 7800 fed (~ 6.5 %). Potential suitability reveals that the soils of subclasses S_3 xn and S_3txn could be improved to subclass S_2 x.

Eight crops were selected to asses their convenience for cultivation in the studied area: for field crops: canola, corn and wheat, for vegetable crops: tomato and onion, for fibber crops: cotton and for fodder crops: alfalfa and cowpea.

Results indicate that 37% of the studied area (~ 44356 fed) are not suitable for most of the selected crops under current conditions. Potential suitability indicates that these areas are suitable for most of the selected crops and not suitable only for tomato and onion

INTRODUCTION

Agriculture expansion in the Western Desert is one of the most vital objectives of the Egyptian policy to meet the food security requirements of the tremendous increase in population.

Toshki area represents a promising and strategic region for agriculture, settlement project and urban extension. It is one of the most important national projects in Egypt.

Land suitability is essential for any new area in order to provide the planners with the necessary information they needed. However, sometimes the survey data are difficult to be understood by them. When, the variables are translated into productivity terms, they become more relevant and supporting. Land capability systems are the tools to convert the figures and

specialized expression of soil characteristics into meaningful language for decision makers and non specialized users.

According to El-Sayed (2001) and Mekheal (2003) the most effective parameters that influence the suitability classification in Toshki area are soil texture including gravel content, topography, salinity and soil depth.

The present work aims to evaluate the potentiality of the soils of Toshki covered by Branch_1. Land evaluation was performed using adapted system to fit the conditions of the area under investigation. Eight crops were selected to asses their convenience for cultivation in the studied area. Suitability maps for soil and selected crops are included.

MATERIALS AND METHODS

The area under investigation is located between latitudes 22° 59′ 26″ and 23° 22′ 06″ N and longitudes 31° 29′ 38″ and 31° 42′ 49″ E (Fig. 1). Landsat Thematic Mapper TM scene acquired on July the 21th 2002, (Path 175 and Raw 44) have been used for delineating the physiographic mapping units of the studied area. The interpretation was done on a false colour composite scale 1:100,000 of bands 2,3 and 5.

Twenty three representative soil profiles and 17 minipits were collected and subjected for the following analyses: Particle size distribution (Piper, 1950), calcium carbonate, electric conductivity (ECe) in the soil paste extract, soluble cations and anions, soil pH, organic matter content and available K (Jackson, 1973); cation exchange capacity and exchangeable sodium (Black, 1982). Available P (Soltonpour, 1985), and available nitrogen (Black, 1982).

Land suitability techniques were done using the tables of rating suggested by Sys and Verheye (1978); FAO (1976 and 1983) and Sys (1985, 1991) according to the equation:

$$Ci = t \times \frac{w}{100} \times \frac{s_1}{100} \times \frac{s_2}{100} \times \frac{s_3}{100} \times \frac{s_4}{100} \times \frac{n}{100}$$

Where:

Ci = Capability index (%)
t = Slope (t)
w = Drainage conditions (w)
s_1 = Texture (x)
s_2 = Soil depth (d)
s_3 = $CaCO_3$ content (k)
s_4 = Gypsum content (y)
n = Salinity and alkalinity (n)

Eight crops were selected to asses their convenience for cultivation in the studied area. The selected crops are: canola, corn, wheat, tomato, onion, cotton, alfalfa and cowpea. Soil characteristics of the different mapping units were compared and matched with the requirements of each crop. The matching led to the current and potential suitability for each land use using the parametric approach and land index mentioned by Sys et al. (1993).

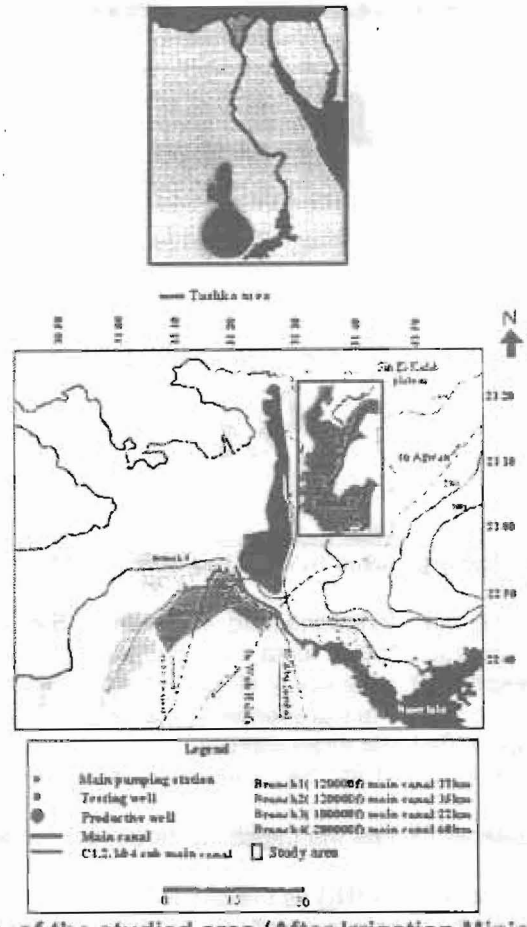

Fig. 1 Location of the studied area (After Irrigation Ministry 1997).

RESULTS AND DISCUSSIONS

Physiographic soil map:

The visual interpretation and spectral supervised classification of the landsat data has resulted in a physiographic map of the studied area.
Incorporating the physiographic units with Soil Taxonomy and soil field data using Geographic Information System (GIS) resulted in the physiographic soil map (Fig., 2 and Table 1). The soil characteristics of the mapping units are shown in Table (2).

The studied soils are classified as Typic Haplocalcids, Typic Haplosalids and Typic Torriorthents (Table 1).

Current land capability

From the agriculture point of view, soils of the studied area are considered as virgin soils. Evaluating their capability is an essential stage for future practical use. Current land capability refers to the capability for a

defined use of land in its present condition, without major improvement (FAO, 1976).

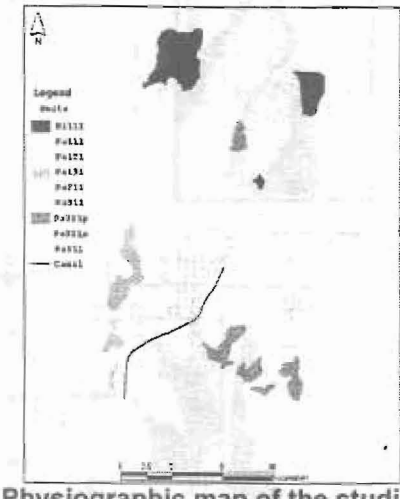

Fig. 2 Physiographic map of the studied area.

BY applying the aforementioned equation of Sys et al. (1991) for the obtained soil characteristics data, accordingly the rating values were calculated to express the suitability of land characteristics. The rating values and the kind of limitations are presented in Table (3). Accordingly, the studied area could be classified into three classes:

- Moderately suitable (S_2) as the capability index (Ci) ranges between 50 – 75 %.
- Marginally suitable (S_3) as the capability index (Ci) ranges between 25 – 50 %.
- Permanently not suitable (N_2) as the capability index (Ci) less than 25 %.

Land capability subclasses reflects the kinds of limitations, accordingly, four subclasses (S_2x, S_3xn, S_3wxd, and S_3txn) were recognized in the studied area. The distribution of the current land capability subclasses over the studied area is shown in Fig. 3a.

Current class S_2:

This class includes the soils which are moderately suitable. Only one subclass S_2x was found in this class.

Subclass S_2x: This subclass includes the moderately suitable soils which occupies an area of ~ 67844 fed (56.5% of the total area). The soils of this subclass are affected by moderate limitations. Texture is the limiting factor for these soils whereas texture is ranging from loamy sand to sandy loam (Table 2). The soils have capability index Ci varies between 50.9 and 60.5 %. It includes three mapping units:

1. Pa211 covers an area of about 22.3 % of the studied area (26720 fed).
2. Pa311s covers an area of about 14 % of the studied area (16871 fed).
3. Pa311 covers an area of about 20.2 % of the studied area (24253 fed).

Table 1: Legend of the physiographic mapping units

Landscape	Relief	Lithology	Landform	Phase	Symbol	Area		Soil classification
						Fed	%	
Hills (Hi)	Low Hills (Hi1)	Brown ferruginous sandstone and limestone	Slope facet complex	Rock outcrops	Hi111	7800	6.5	Miscellaneous of rock outcrops
Plain (Pa)	Undulating	Limestone	Slope facet complex	---	Pa111	11541	9.6	Typic Haplocalcids Typic Haplosalids
		White to purple sandstone	Slope facet complex	---	Pa121	20132	16.8	Typic Torriorthents
		Brown ferruginous sandstone and limestone	Slope facet complex	---	Pa131	4125	3.4	
	Gently undulating	White to purple sandstone	Slope facet complex	---	Pa211	26720	22.3	
	Nearly level	White to purple sandstone	Tread	---	Pa311	24253	20.2	
				Desert pavement	Pa311p	5056	4.2	
				Sand sheet	Pa311s	16871	14	
	Flat	Alluvium and Colluvium	---	---	Pa411	3502	3	

Fed = 4200 m^2

Table 2: Mean average chemical, physical and fertility characteristics of the physiographic units.

Mapping unit	Texture	pHe	ECe dSm-1	$CaCO_3$ %	Gypsum %	OM %	CEC (Cmol / kg)	ESP %	Depth cm	Available water %
Pa111	S to SL	7.4 – 8.1	30.4 -73.4	2.2 - 15.9	5.9 – 11.3	0.1 – 0.3	7.0 – 17.9	10.0 -13.9	>150	5.6 – 10.7
Pa121	SL to SCL	7.3 -8.2	15.1 – 21.1	0.6 - 6.1	7.6- 13.1	0.1 – 0.4	6.8 – 19.2	8.6 – 17.3	>150	8.3 – 17.8
Pa131	SL to SCL	7.5 – 8.2	27.3 – 49.4	6.4 - 15.0	4.4- 11.9	0.1 – 0.3	13.2 – 20.2	11.3 – 14.8	>150	9.6 – 12.7
Pa211	LS to grv. SL	7.6 – 8.0	4.2 – 10.3	2.6 - 8.9	0.2 – 1.1	0.1 – 0.3	7.0 -16.2	8.0 – 14.3	>150	5.9 – 10.3
Pa311	LS to SL	7.3 – 8.5	1.1 – 10.5	2.0 - 6.1	0.5 – 1.9	0.1 – 0.4	4.1 – 17.6	8.9 – 14.5	>150	3.0 – 13.9
Pa311p	grav. LS to grav. SCL	7.3 – 8.3	6.7 – 19.7	0.8 - 2.6	8.5 – 12.2	0.1 – 0.3	7.5 – 20.7	10.0 – 14.8	50 - 80	7.3 – 16.1
Pa311s	grav. SL	7.4 – 8.1	1.5 – 7.2	1.1 - 4.8	1.2 – 2.0	0.1 – 0.3	5.1 – 16.3	6.2 – 12.5	>150	4.2 – 12.0
Pa411	SC to C	7.5 – 7.8	12 – 20.0	2.1 - 4.5	1.6 – 8.5	0.3 – 0.5	18.0 – 36.6	10.1 – 14.0	>150	16.7 – 31.0

Mapping unit	Total macro nutrients (ppm)			Available macro nutrients (ppm)		
	N	P	K	N	P	K
Pa111	30 - 91	90 - 202	120 - 220	0.2 - 18.2	0.4 - 6.6	15 - 55
Pa121	35 - 119	44 - 314	99 - 199	1.0 - 10.2	0.9 - 2.1	20 - 61
Pa131	40 - 100	60 - 300	130 - 200	1.1 - 4.3	1.1 - 1.7	23 - 65
Pa211	35 - 99	70 - 199	120 - 380	0.5 - 2	0.5 - 3.1	12 - 60
Pa311	32 - 149	60 - 200	66 - 330	0.4 - 4.5	0.3 - 2.3	13 - 35
Pa311p	39 - 102	99 - 280	105 - 340	0.2 - 14.5	0.3 - 1.9	20 - 60
Pa311s	32 - 109	30 - 99	180 - 350	0.2 - 4.5	0.4 - 1.5	10 - 25
Pa411	92 - 180	100 - 450	170 - 350	6.6 - 18.8	1.1 - 8.5	35 - 81

S = Sand – SL = Sandy loam – LS =Loamy sand – SCL = Sandy clay loam – C = Clay – SC = Sandy clay – grav. =Gravelly

Table 3: Rating of limitations and current land capability classes and subclasses of the studied area.

Mapping Unit	Prof No.	*Slope* (t)	Drainage (w)	Soil Characteristics (s)					Capability Index (CI) %	*Class*	Subclass
				Texture (x)	Depth (d)	$CaCO_3$ (k)	Gypsum (y)	Salinity and Alkalinity(n)			
Pa111	13	80	100	60	100	90	90	75	29.2	S_3	S_3 *txn*
	22	80	100	70	100	100	100	75	42.0	S_3	
Pa121	9	80	100	70	100	100	90	75	37.8	S_3	
	18	80	100	70	100	100	90	80	40.3	S_3	
	20	80	100	70	100	100	100	80	44.8	S_3	
Pa131	15	80	100	70	100	90	90	80	36.3	S_3	
	16	80	100	70	100	90	90	80	36.3	S_3	
Pa211	2	90	100	70	100	100	95	90	53.9	S_2	S_2 *x*
	4	90	100	70	100	100	95	85	50.9	S_2	
	11	90	100	70	100	100	95	90	53.9	S_2	
	12	90	100	70	100	100	95	90	53.9	S_2	
Pa311	6	100	100	70	100	100	90	90	56.7	S_2	S_2 x
	7	100	100	60	100	100	90	96	51.8	S_2	
	8	100	100	60	100	100	90	96	51.8	S_2	
	14	100	100	70	100	100	90	96	60.5	S_2	
	17	100	100	70	100	100	90	90	56.7	S_2	
Pa311p	5	100	80	70	75	100	90	85	32.1	S_3	S_3 wxd
	19	100	80	70	70	90	100	85	30.0	S_3	
	10	100	80	70	75	100	100	85	35.7	S_3	
Pa311s	1	100	100	70	100	100	90	96	60.5	S_2	S_2 x
	3	100	100	70	100	100	90	96	60.5	S_2	
Pa411	21	100	90	80	100	90	100	70	45.4	S_3	S_3 xn
	23	100	90	80	100	90	100	70	45.4	S_3	
Hi111	-	-	-	-	-	-	-	-	-	N_2	N_2

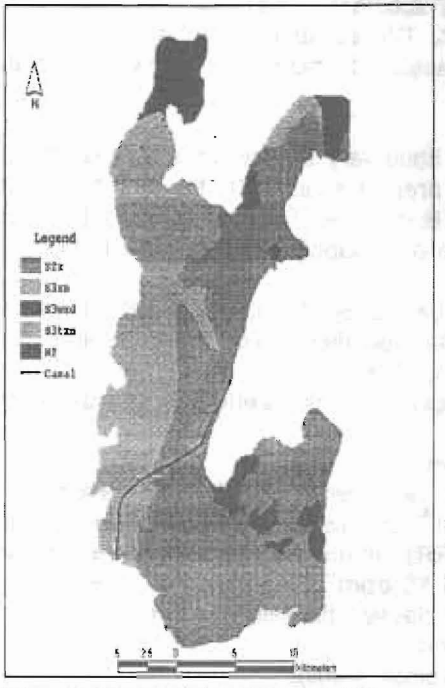

Fig. 3a Current land capability map of the studied area.

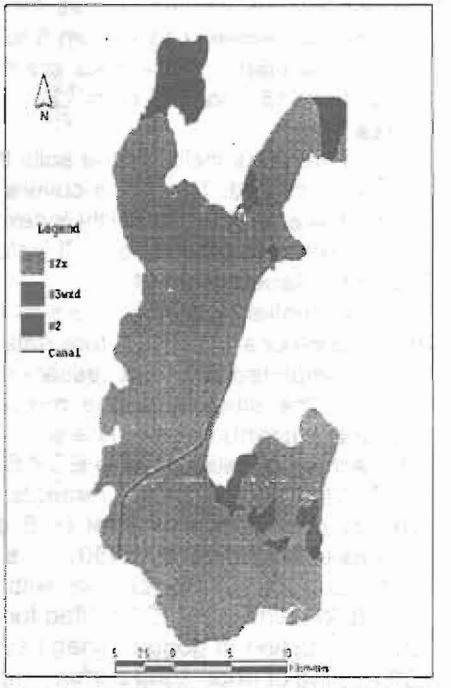

Fig. 3b Potential land capability map of the studied area.

Current class S_3:

This class includes the soils which are marginally suitable. The soils have moderate limitations. It forms about 37 % of the studied area (44356 fed). Three subclasses were recognized in this class as follows:

Subclass S_3 xn: It occupies an area of about 3502 fed (3 % of the studied area). The soils have capability index Ci 45.4 %. It includes the soils of flat topography (Pa411), which are affected by some moderate limitations. Texture and salinity are the limiting factors for these soils as soil texture is clayey and EC values vary between 12.0 to 20.0 dSm^{-1} (Table 2).

Subclass S_3 wxd: It occupies an area of about 5056 fed (4.2% of total studied area). The soils have capability index Ci ranges between 30.0 and 35.7 %. It is represented by soils of unit Pa311p which covered by desert pavement (75 % of surface area). Drainage, texture and depth are the limiting factors in theses soils. The soils are imperfectly drained, gravelly loamy sand to gravelly sandy clay loam and soil depth ranges from 50 to 80 cm.

Subclass S_3txn: It covers an area of about 35798 fed (~ 29.8 % of total studied area). The capability index Ci value ranges from 29.2 to 44.8 %. It includes three mapping units:

1.Pa111 covers about 9.6 % of the studied area (11541 fed)
2.Pa121 covers about 16.8 % of the studied area (20132 fed).
3. Pa131 covers an about 3.4 % of the studied area (4125 fed).

The soils are affected by moderate limitations. Slope, texture and salinity are the limiting factors for this subclass. The soils have undulating surface with slope ranges from 6 to 8 %. The soil texture ranges from sand to sandy clay loam. These soils are moderately to extremely saline (EC values range from 15.1 to 73.4 dSm^{-1}).

Class N_2:

This class includes the soils that have very severe limitations which can not be corrected. This class covers an area of about 7800 fed (~ 6.5 % of the studied area). The capability index Ci is < 25 %. The soil is not suitable for agriculture as it is rocky land. It includes one mapping unit which is Hi111.

Potential land capability

Potential capability refers to the capability of units for a defined use, in their conditions at some future data, after specified major improvements have been completed where necessary (FAO, 1976).

In the study area the major improvements needed to overcome the current (present) limitations are:

1)Leaching of salinity (up to EC < 6 dSm^{-1}).

The leaching requirements for reclamation (LRR) to maintain soil salinity at a minimum level (< 6 dSm^{-1}) are calculating using the equation proposed by Hoffman (1980). The (LRR) values for coarse texture soils are 1050 to 5100 m^3/fed for soils with EC 15 dSm^{-1} and 73 dSm^{-1}, respectively. The (LRR) value is 4200 m^3/fed for the clayey soils with EC 20 dSm^{-1}.

2)Construction of good drainage systems.

3)Leveling of undulating surface (up to slope < 4%).

In addition to recommended irrigation systems in coarse texture areas (drip and sprinkler), that save water and prevent rise of ground water table.

By applying these improvements the potential capability classes of the studied area are developed as S_2, S_3 and N_2 Fig.3b.

Potential class S_2:

This class represented by the soils which are moderately suitable. It includes one subclass S_2x

Potential subclass S_2x: It covers an area of about 107144 fed (about 89.3 % of the studied area). It includes the three subclasses in current land capability: S_2x (56.5%), S_3xn (3 %) and S_3txn (29.8%).

The current subclasses of S_3 xn and S_3txn could be improved by leaching salinity in both of them and by leveling the slightly undulating in S_3txn. Texture is still the limiting factor for soils in these two subclasses and subclass S_2x. It includes the mapping units Pa111 (11541 fed), Pa121 (20132 fed), Pa131 (4125 fed), Pa211 (26720 fed), Pa311 (24253 fed), Pa311s (16871 fed) and Pa411 (3502 fed).

Potential subclass S_3 wxd: This subclass is the current capability subclass S_3 wxd occupying the mapping unit Pa311p. Texture, depth and drainage are still the limiting factors in the soils. Modern irrigation systems could be used to cultivate some shallow rooted crops.

Class N_2:

This class is the current not suitable N_2, which is represented by the mapping unit Hi111 (about 6.5 % of the studied area). The soils of this class are not suitable for agriculture as it is a rocky land and could not be improved.

Land suitability for specific crops:

Eight crops were selected to asses their convenience for cultivation in the studied area. The crop selection based on the crops recommended by Agriculture Ministry (1997). Selected crops can be grouped into four categories as follows:

1. Field crops: canola, corn and wheat.
2. Vegetable crops: tomato and onion.
3. Fibber crops: cotton.
4. Fodder crops: alfalfa and cowpea.

Soil characteristics of the different mapping units were compared and matched with the crop requirements of each land use type (crops). The matching led to the current and potential suitability (Table 4) for each crop using the parametric approach and land index as mentioned by Sys et al. (1993).

The current and potential suitability maps of the selected crops are shown in Table 4 and Figs. 4a – 7a and 4b – 7b.

Table 4: Current and potential suitability of mapping units for the selected crops

Crop		Mapping units																	
		Undulating						Gently undulating		Nearly level						Flat		Hills	
		Pa111		Pa121		Pa131		Pa211		Pa311		Pa311p		Pa311s		Pa411		Hi111	
		Cs	Ps	Cs	Ps	Cs	Ps	Cs	Ps	Cs	Ps	Cs	Ps	Cs	Ps	Cs	Ps	Cs	Ps
Field crops	canola	N_1	S_2	N_1	S_2	N_1	S_2	S_2	S_1	S_2	S_1	N_1	S_3	S_2	S_1	S_3	S_1	N_2	N_2
	Corn	N_1	S_3	N_1	S_3	N_1	S_3	S_2	S_1	S_2	S_1	N_1	S_3	S_2	S_1	S_3	S_2	N_2	N_2
	wheat	N_1	S_3	N_1	S_3	N_1	S_3	S_3	S_2	S_3	S_2	N_1	S_3	S_3	S_2	N_1	S_3	N_2	N_2
Vegetables crops	Tomato	N_1	N_1	N_1	N_1	N_1	N_1	S_2	S_2	S_2	S_2	N_1	N_1	S_2	S_2	N_1	N_1	N_2	N_2
	Onion	N_1	N_1	N_1	N_1	N_1	N_1	S_2	S_2	S_2	S_2	N_1	N_1	S_2	S_2	N_1	N_1	N_2	N_2
Fibber Crops	Cotton	N_1	S_3	N_1	S_3	N_1	S_3	S_2	S_1	S_1	S_1	N_1	S_3	S_1	S_1	S_3	S_2	N_2	N_2
Fodder crops	Alfalfa	N_1	S_3	N_1	S_3	N_1	S_3	S_2	S_1	S_1	S_1	N_1	S_3	S_1	S_1	N_1	S_3	N_2	N_2
	Cowpea	N_1	S_3	N_1	S_3	N_1	S_3	S_3	S_2	S_2	S_1	N_1	S_3	S_2	S_1	N_1	S_3	N_2	N_2

Cs = Current suitability Ps = Potential suitability

Current suitability:

1- Soils of undulating:

These soils are saline, and sandy to sandy clay loam. The slope ranges from 6 to 8 %. The soils are not suitable (N_1) in its current conditions for all the selected crops. It covers an area of about 35798 fed (~ 29.8% of the studied area). It includes three physiographic mapping units Pa111 (11541 fed), Pa121 (20132 fed) and Pa131 (4125 fed).

2- Soils of gently undulating:

The soils of gently undulating with slope about 3 - 4 % includes the physiographic unit Pa211 and cover an area of 26720 fed (22.3% of the studied area). The soils are sandy loam and slightly to moderately saline. These soils are suitable for all the selected crops. The degree of suitability differs according to the land use type (crop) requirements as follows:

Moderately suitable (S_2) for canola, corn, cotton, onion, tomato, and alfalfa.

Marginally suitable (S_3) for wheat, and cowpea.

3- Soils of nearly level:

These soils occupy an area of about 46180 fed (38.4% of the studied area). The slope is less than 2 %. It includes three physiographic mapping units as follows:

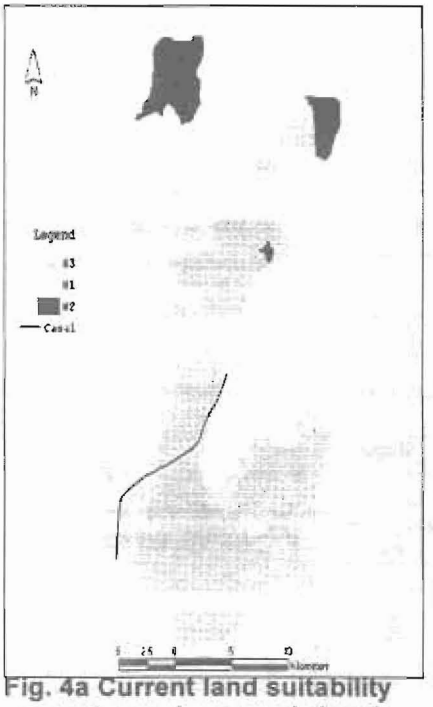

Fig. 4a Current land suitability map for grain crops (wheat).

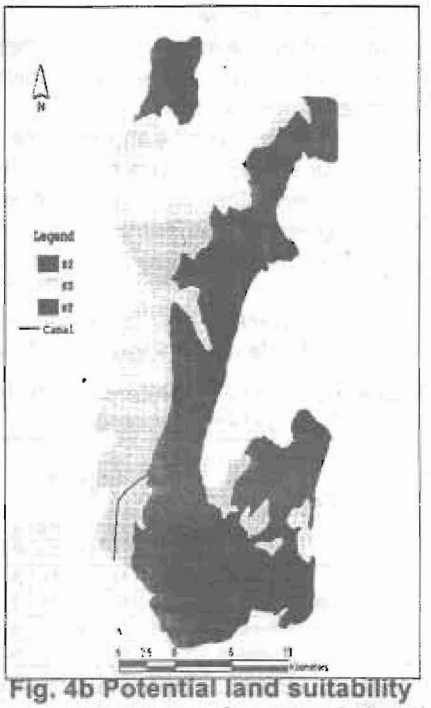

Fig. 4b Potential land suitability map for grain crops (wheat).

a) Soils of Pa311 and Pa311s: They cover an area of about 24253 fed (20.2%) and 16871 fed (14 %), respectively. The soils are deep, sandy loam, non saline and well drained. They are suitable for all selected crops. The suitability subclasses are as follows:

Highly suitable (S_1) for cotton and alfalfa,

Moderately suitable (S_2) for canola, corn, onion, tomato and cowpea.

Marginally suitable (S_3) for wheat.

b) Soil of Pa311p: which covers an area of 5056 fed (4.2% of the studied area). These soils are shallow (soil depth 50-80 cm), gravelly textured and imperfectly drained. The soils are not suitable (N_1) for all selected crops.

Potential suitability

1- Soils of undulating:

The area includes three physiographic mapping units: Pa111 (11541 fed), Pa121 (20132 fed) and Pa131 (4125 fed).

The soils are not suitable (N_1) for all selected crops (except olive) in their current conditions. Applying some improvements (leaching salinity and leveling of slightly undulating areas) the soils of these mapping units become:

Moderately suitable (S_2) for canola.

Marginally suitable (S_3) for corn, wheat, cotton, alfalfa and cowpea.
Not suitable (N_1) for onion and tomato, whereas these crops are highly sensitive for gypsum (Sys et al., 1993).

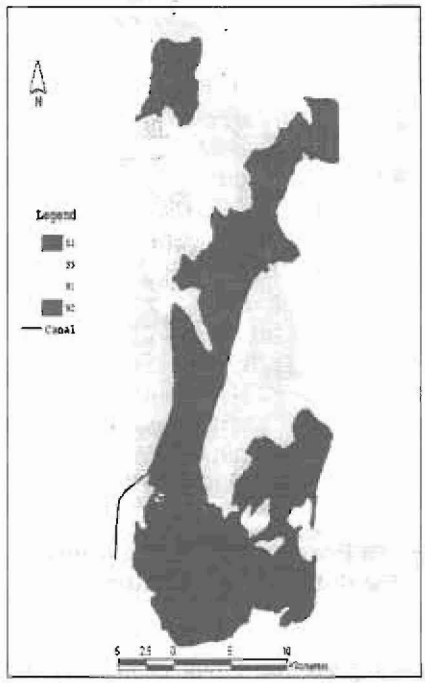

Fig. 5a Current land suitability map for canola

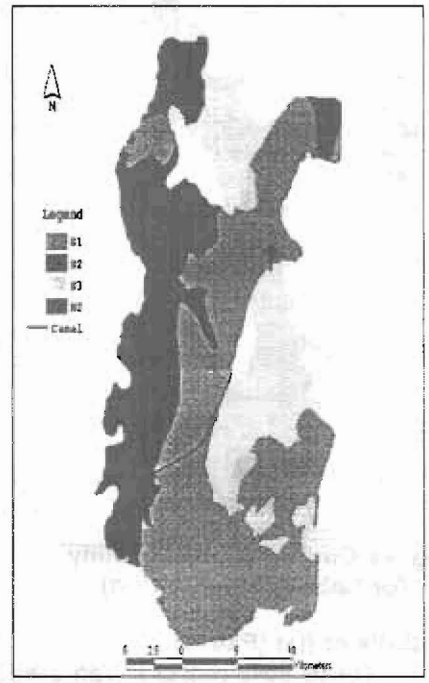

Fig. 5b Potential land suitability map for canola.

2- Soils of gently undulating:

It includes one physiographic mapping unit Pa211(26720 fed). The soils are: Highly suitable (S_1) for canola, corn, cotton and alfalfa.
Moderately suitable (S_2) for wheat, onion, tomato, and cowpea.

3- Soils of nearly level: These soils include three physiographic mapping units as follows:

a) Soils of Pa311 (24253 fed) and **Pa311s** (16871 fed): They cover an area of about 34.2 % of the studied area. These soils are deep, sandy loam, non saline and well drained. They are suitable (S_1, S_2 and S_3) for all the selected crops in their current conditions and (S_1 and S_2) in their potential conditions. The degree of suitability differs in the potential suitability as follows:
Highly suitable (S_1) for canola, corn, cotton, alfalfa and cowpea.
Moderately suitable (S_2) for wheat, onion and tomato.

b) Soil of Pa311p: It covers an area of 5056 fed These soils are not suitable (N_1) for all selected crops in the current conditions. Applying some improvements the soils become not suitable (N_1) for only onion and tomato and marginally suitable (S_3) for other crops.

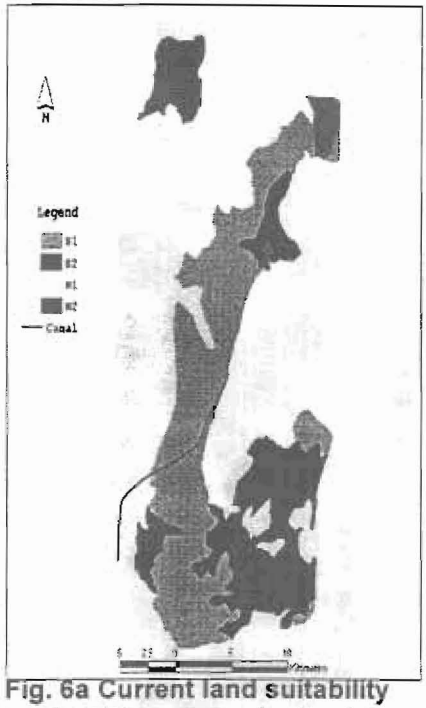

Fig. 6a Current land suitability for fibber crops (cotton)

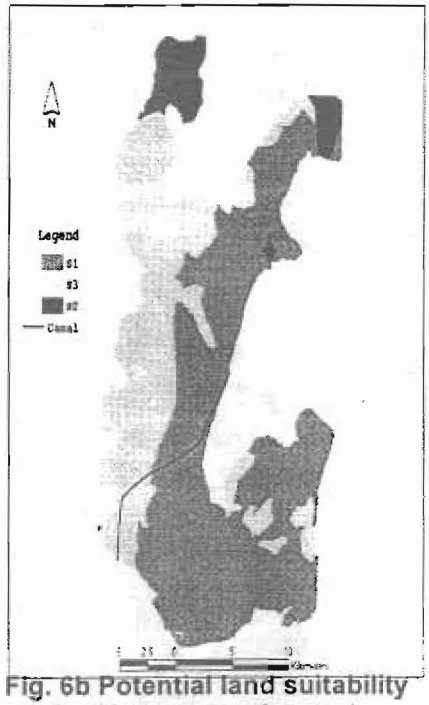

Fig. 6b Potential land suitability for fibber crops (cotton)

4- Soils of flat (Pa411):

These soils represent an area of about 3502 fed (3 % of the studied area). Applying some improvements (leaching salinity) these soils become not suitable (N_1) for onion, and tomato. These crops can not tolerate gypsum content more than 5 %.

The soils are: Highly suitable (S_1) for canola, moderately suitable (S_2) for corn and cotton and marginally suitable (S_3) for wheat, alfalfa and cowpea.

In conclusion the results indicate that about 6.5 % of the studied area (7800 fed) is permanently not suitable for agriculture due to its rocky nature. This is the area which covers the northern part of the studied area.

The results also indicate that about 44356 fed (37 % of the studied area) are not suitable for most the selected crops under current conditions. These areas occurred in mapping units Pa111, Pa121, Pa131 Pa311p and Pa411 with areas 11541 fed (9.6 %), 20132 fed (16.8 %), 4125 (3.4 %) 5056 fed (4.2 %) and 3502 fed (3 %), respectively. These areas with improvements could be improved to become suitable for most of the selected crops and not suitable only for tomato and onion.

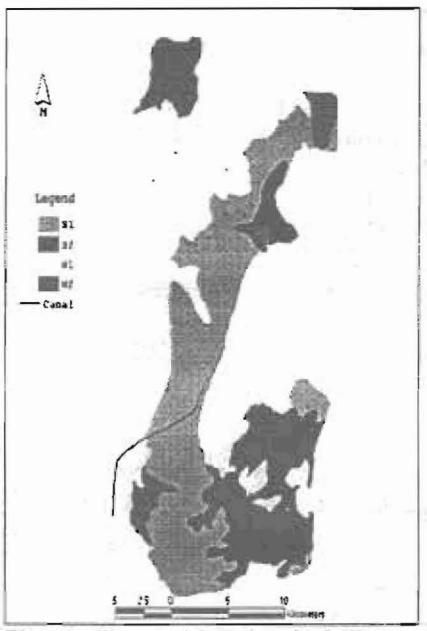

Fig. 7a Current land suitability map for fodder crops (alfalfa).

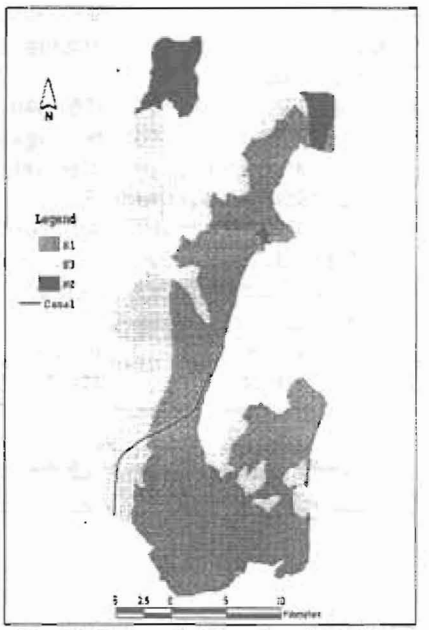

Fig.7bPotential land suitability map for fodder crops (alfalfa).

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تصنيف صلاحية الأرض للزراعة في بعض مناطق توشكى – جنوب مصر

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تم استخدام بيانات القمر الصناعي الامريكي لاندسات لتحديد الوحدات الخريطية لمنطقة الفرع الاول لمشروع توشكى جنوب مصر ، والتي تغطي مساحة ١٢٠ ألف فدان.

ولقد تم عمل خريطة التربة لمنطقة الدراسة و تم جمع عدد ثلاثة وعشرين قطاعا أرضيا ممثلا للوحدات الخريطية وسبعة عشر حفرة صغيرة.

ولقد بينت النتائج أن التربة تختلف في ملوحتها حيث تتراوح درجة التوصيل الكهربي (EC) من ١,١ – ٧٣,٤ ديسيسمينز م$^{-1}$ ، كما أن الارض فقيرة في المادة العضوية (٠,١ – ٠,٥ %) والنتروجين الميسر (٠,٢ – ١٨,٨ جزء في المليون) والفوسفور الميسر (٠,٣ – ٨,٥ جزء في المليون) والبوتاسيوم الميسر (١٠–٨١ جزء في المليون) وتراوحت قيم كربونات الكالسيوم من ٠,٦ – ١٥,٩ % أما بالنسبة للجبس فتتراوح قيمه من ٠,٢ – ١٣,١ %.

وبتقييم الصلاحية الحالية والمستقبلية (المتطورة) للاراضي أوضحت الدراسة أن أراضي المنطقة تقع في أقسام متوسطة الصلاحية (S_2) وحدية الصلاحية (S_3) وغير صالحة للزراعة (N_2). وتبين النتائج أن حوالي ٥٦,٥ % من اجمالي منطقة الدراسة(٦٧٨٤٤ فدان) هي أراضي متوسطة الصلاحية (S_2) في ظروف التربة الحالية وأن العامل المحدد هو قوام التربة (S_2 x) . أما الاراضي حدية الصلاحية (S_3) فهي تغطي مساحة ٣٧ % من اجمالي منطقة الدراسة (٤٤٣٥٦ فدان) وتشمل تحت أقسام: S_3xn حيث يعتبر القوام والملوحة العاملان المحددان ، و S_3wxd حيث تشمل العوامل المحددة الصرف والقوام والعمق ، S_3txn حيث يشكل الميل والقوام والملوحة العوامل المحددة. أما الاراضي غير صالحة للزراعة فتمثل مساحة ٦,٥ % من اجمالي منطقة الدراسة حوالي ٧٨٠٠ فدان.

وباتباع بعض طرق التحسين يمكن تحسين تحت الاقسام S_3xn و S_3txn لتصبح S_2x.

وقد تم اختيار ثمانية محاصيل لتقييم مدى ملائمتها للزراعة في منطقة الدراسة ، وتشمل محاصيل حقلية (القمح – الذرة الرفيعة – الكانولا) ومحاصيل خضر (الطماطم – البصل) ومحاصيل ألياف (القطن) ومحاصيل أعلاف (البرسيم الحجازي – لوبيا العلف).

ولقد أوضحت النتائج أن ٣٧ % من اجمالي منطقة الدراسة (٤٤٣٥٦ فدان) غير صالحة لمعظم المحاصيل المدروسة تحت الظروف الحالية وباجراء التحسنات اللازمة تصبح هذه الاراضي صالحة لمعظم المحاصيل المقترحة ،وغير صالحة فقط للطماطم والبصل.