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Agricultural Sustainability in some Areas North Nile Delta, Egypt

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THE EVALUATION of agricultural sustainability status helps in identifying specific indicators that constrain the achievement of sustainable agriculture. The agricultural sector in Egypt is facing major sustainability constraints such as, scarce land and water resources, environmental degradation, rapid population growth, institutional arrangement including land tenure and farm fragmentation, agricultural administration, lack of infrastructure, credit utilization and high interest rates. This study aims to evaluate the agricultural sustainability in some areas in the north of the Nile Delta; the international framework for evaluating sustainable land management (FESLM) was used for realizing this objective.

The physiographic-soils map of the studied area was produced depend upon the aerial photographs and Landsat ETM$^+$ images, the results indicate that the area include three main landscapes, *i.e.*, and alluvial plain, lacustrine plain and marine plain. The characteristics of productivity, security, protection, economic viability and social acceptability in the different mapping units were assessed. The agricultural sustainability reflecting from sustainable land management in the studied area was worked out, the obtained data refer that the studied area includes two sustainability classes as the following:

Class III: Land management practices are marginally below the requirements of sustainability, representing the physiographic units in the alluvial plain, and Class IV: Land management practices do not meet sustainability requirements, representing the physiographic units in the lacustrine and marine plain. The sustainability constrains in the studied area are related to the soil productivity, economic viability and social acceptability.

Keywords: Agricultural sustainability, Physiography-soils map, North Nile Delta.

The importance of sustainable agriculture is no longer in any doubt; it is at the heart of a new social contract between society as a whole and its farmers. But, implementing sustainability remains a difficult issue. The concept of sustainability has yet to be made operational in many agricultural situations (Gafsi *et al.*, 2006). Sustainable agriculture is defined as the way of practicing agriculture, which seeks to optimize skills and technology to achieve long-term stability of the agricultural enterprise, environmental protection and consumer safety. It is achieved through management strategies which help the producer select hybrids and varieties, soil conserving cultural practices, soil fertility programs and pest management programs (Hansen, 1996 and Gold, 1999). It is an agriculture that follows the principles of nature to develop systems for raising crops and livestock that are, like nature, self-sustaining. Sustainable agriculture is also the agriculture of social values; one whose success is indistinguishable from vibrant rural communities, rich lives for families on the farms and wholesome food for everyone (Richard, 2005). The sustainable land management (SLM) requires the integration of technologies, policies and activities in the rural sector, particularly agriculture, in such a way as to enhance economic performance while maintaining the quality and environmental functions of the natural base. To evaluate sustainable land management five criteria are needed, these include productivity, security, protection, viability and acceptability Dumanski (1997). The decision supporting system (DSS) based on the framework of sustainable land management (SLM) is an expert system technology which used to evaluate the current condition of sustainability through the calculation of productivity, security, protection, viability and acceptability indices (Smith & Dumanski, 1993). The concept of sustainable development integrates economic, ecological and social aspects; it can only be achieved when the appropriate methods for measuring these different components are available.

In Egypt, a sharp conflict exists between land supply and demands due to the lack of necessary macro control of land use especially legal regulations and economic adjustments to market economy and also due to improper micro management. Over population posed a bear heavy burden to farmland, which was intensively used without sufficient protection, so sustainable land use is urgently required to solve this conflict and reduce the heavy burden. Sustainable Land use can be defined as temporarily and spatially simultaneous use of the soil functions. Major sustainability constraints in Egypt could be identified as scarce land and water resources, environmental degradation, rapid population growth, institutional arrangement including land tenure and farm fragmentation, agricultural administration, lack of infrastructure, credit utilization and high interest rates.

The study area represents the traditional cultivation in the Nile Delta, Egypt; it includes both old cultivated and newly reclaimed soils. It is located in the north west of the Nile Delta between longitudes 30° 22′ 15″ and 30° 43′ 30″ and latitudes 31° 15′ 00″ and 31° 30′ 15″, incorporating an area of 584.65 Km^2 (Fig. 1). This area belongs to the Pleistocene sediments, which include marine, lacustrine and alluvial deposits (Said, 1993). It is a subject of different processes of land degradation, *i.e.*, water logging, salinity, alkalinity and compaction which threat the sustainable land use.

This study aims to use the geographical information system (GIS) and the international Framework for Evaluating Sustainable Land Management (FESLM) to evaluate the agricultural sustainability in some areas northwest of the Nile Delta, Egypt.

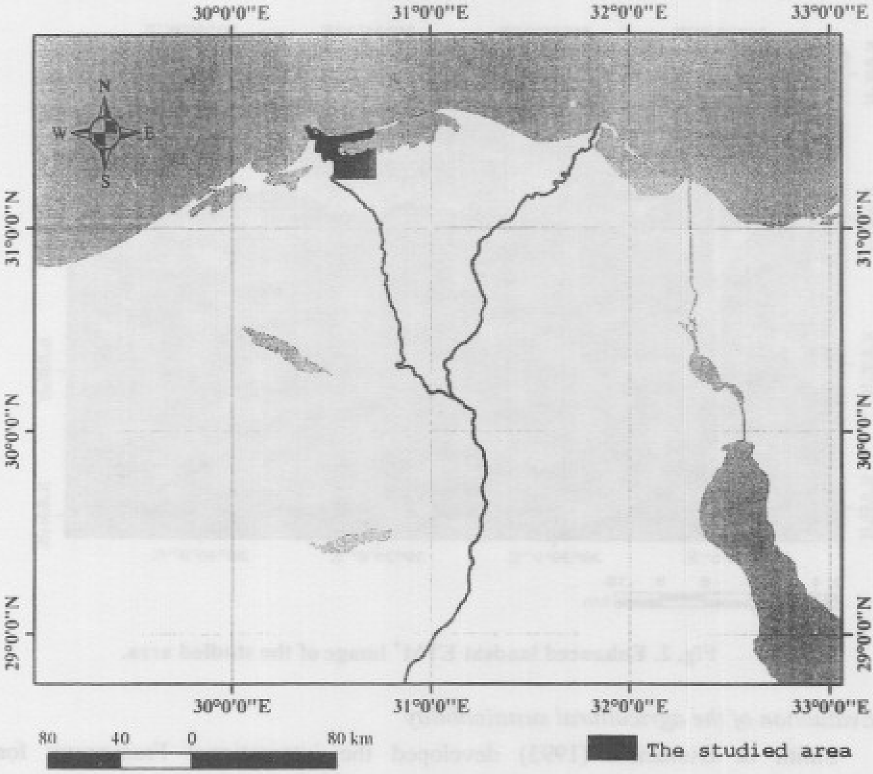

Fig. 1. Location of the studied area.

Material and Methods

Physiography and soils mapping

Twenty four Panchromatic aerial photographs scale (1: 40.000) taken during the year, 1991 has been used to produce the physiographic map of the studied area, the "physiographic analysis" detailed by Goosen (1967); Ligterink (1968); Bennema & Gelons (1969) and Zink & Valenzuala (1990) was used for this purpose. Updating of the physiographic map was carried out using the Landsat ETM+ image (path 177, row 39) taken during the year 2003 (Fig. 2). The different mapping units were represented by 10 soil profiles and 10 water samples, the morphological descriptions of the soil profiles were carried out using FAO guidelines (2006). The laboratory analyses of the soil and water samples were carried out using the soil survey laboratory methods manual

(USDA, 2004). The American Soil Taxonomy, (USDA, 2006) was used to classify the different soil profiles to sub great group level and then the correlation between the physiographic and taxonomic units was designed, after Elbersen & Catalan (1986).

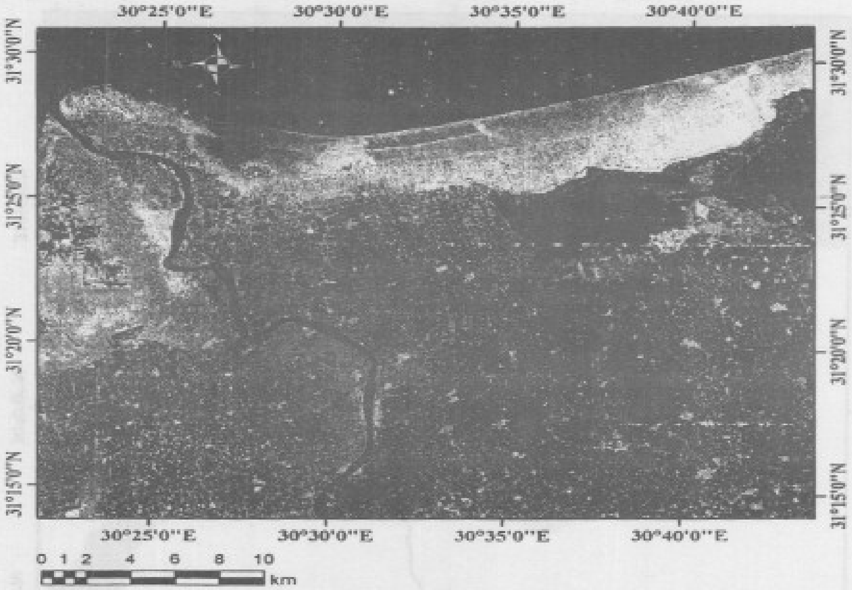

Fig. 2. Enhanced landsat ETM^{+} image of the studied area.

Evaluation of the agricultural sustainability

Smith & Dumanski (1993) developed the international Framework for Evaluating Sustainable Land Management (FESLM); it combines technologies, policies and activities aimed at integrating socio-economic principles with environmental concerns so as to simultaneously satisfy the five pillars of SLM, which include productivity, security, protection, viability and acceptability. All the SLM indicators developed along the five pillars of FESLM are used in this study.

The sustainability index (SI) considers the grand values of five criteria as sustainability pillars, viz.: productivity (A), security (B), protection (C), economic viability (D) and social acceptability (E), where:

Sustainability Index (SI) = A x B x C x D x E

The values of sustainability index are classified as the following classes:

Values	Land use/ management status	Class
0.6 – 1	Meet the sustainability requirements	I
0.3 – 0.6	Marginally but above the threshold of sustainability	II
0.1 – 0.3	Marginally but below the threshold of sustainability	III
0 – 0.1	Do not Meet the sustainability requirements	IV

Results and Discussion

Physiographic-soils units of the studied area

The main physiographic-soils units in the studied area are represented in Table 1 and Fig . 3; the obtained data indicate that the area includes the following:

TABLE 1. Legend of the physiographic-soils map.

Physiography	Landforms	Mapping unit	Area (km^2)	Soil profile	Soil taxonomy
Flood plain	River terraces: High Moderately high low	T1	36.86	9	Vertic Torrifluvents
		T2	56.23	--	--
		T3	70.78	4	Typic Aquisalids
	River levees: High Moderately high low	L1	8.78	--	--
		L2	18.53	10	Typic Torrifluvents
		L3	14.75	--	--
	Swales	S	2.47	--	--
	Isolated hills	I	0.33	--	--
	Overflow basins	B1	56.80	8	TypicTorrifluvents
	Decantation basins	B2	64.44	5	Typic Natrargids
Lacustrine plain	Dried lake bed	DL	22.94	6	Sodic Aquicambids
	Fish ponds	F	46.44	--	--
	Dried fish ponds	FD	8.20	--	--
	Wetlands	W1	30.80	7	Typic Natrargids
	Wet sabkhas	W2	9.96	--	--
Marine plain	Sand sheets: High elevated Low elevated	S1	49.47	1	Typic Torripsamments
		S2	22.94	2	Typic Torripsamments
	Seasonally submerged land	SL	2.42	--	--
	Sand dunes	D1	30.06	--	--
	Hammocks	D2	31.47	3	Typic Torripsamments
	Water bodies	W			

Total area = 584.65 Km2.

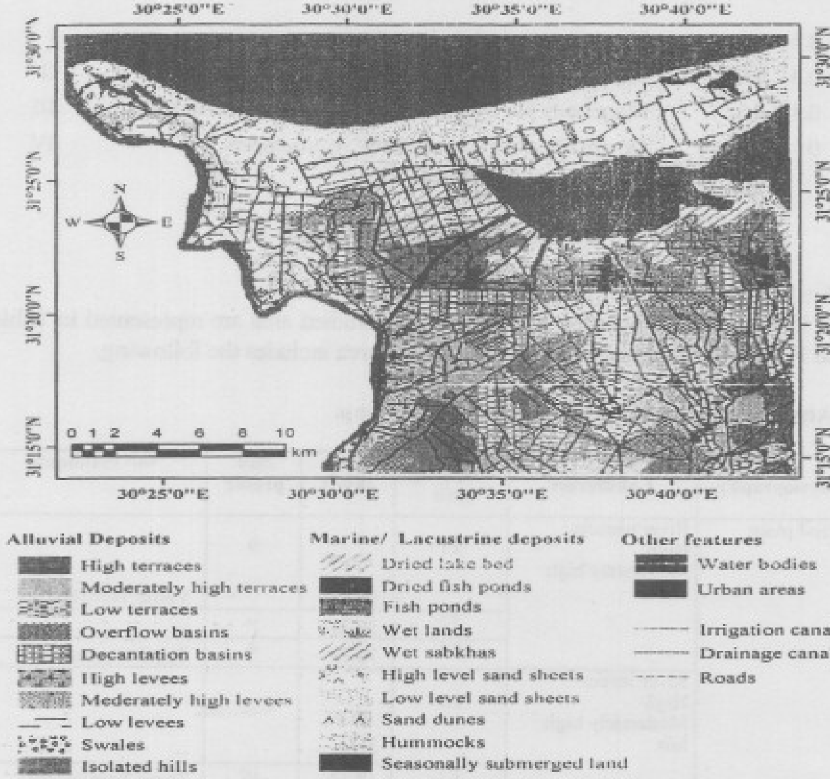

Fig. 3. Physiography and soils map of the studied area.

- Alluvial plain: this landscape represents 56.44 % of the total area; it includes the landforms of river terraces (T1, T2, & T3), levees (L1, L2 & L3), swales (S) and basins (B1 & B2). The soils classifications of these units are: Typic Torrifluvents, Vertic Torrifluvents, Typic Aquisalids and Typic Natrargids sub great groups.

- Lacustrine plain: this landscape includes the dried lake bed (DL), fish ponds (F), dried fish ponds (FD) wetlands (W1), wet sabkha (W2) landforms and they represent 20.24 % of the total area. The main taxonomic units in this landscape are Typic Natrargids and Sodic Aquicambids.

- Marine plain: it includes the sand sheets (S1 & S2), sand dunes (D1), hammocks (D2) and seasonally submerged land (SL) and representing 23.32 % of the total area. The soils of this landscape are belongs to the Typic Torripsamments sub great group.

Some chemical and physical analyses of the studied soil profiles and the electric conductivity of water samples (Ecw) are shown in Table 2.

TABLE 2. Some physical and chemical characteristics of the representative soil profiles.

Profile No.	Mapping unit	Depth (cm)	Particle size distribution %				Texture class	pH 1:2.5	O.M %	Cacao$_3$ %	Ec $_{(1:1)}$ dS/ m	Ec$_w$ dS/ m	CEC meq/100 g. soil	Esp	Available macro nutrients (ppm)		
			C.sand %	F.sand %	Silt %	Clay %									N	P	K
1	S1	0-30	4.32	93.08	1.70	0.90	Sandy	8.0	0.4	1.50	25.2	0.96	1.1	7.11	0.3	0.6	3.0
		30-60	3.16	95.74	0.70	0.40	Sandy	8.0	0.1	1.10	18.2		0.6	8.92	-	-	-
		60-90	4.00	94.60	0.90	0.50	Sandy	8.0	0.1	0.90	20.1		0.6	7.48	-	-	-
2	S2	0-20	6.80	90.10	2.00	1.10	Sandy	7.7	0.5	2.31	38.4	0.81	1.3	10.12	0.2	0.6	2.7
		20-80	7.21	90.49	1.30	1.00	Sandy	7.8	0.1	1.42	31.6		1.1	9.84	-	-	-
		80-120	8.00	90.20	0.80	1.00	Sandy	7.7	0.2	1.13	41.8		0.8	8.17	-	-	-
3	D2	0-25	6.00	91.00	1.40	1.60	Sandy	8.0	0.4	1.00	7.80	1.17	1.2	7.51	0.2	0.7	1.7
		25-70	5.32	92.98	1.00	0.70	Sandy	8.1	0.2	0.81	18.31		3.6	7.00	-	-	-
		70-100	5.10	93.70	0.60	0.60	Sandy	7.8	0.1	0.42	22.70		0.4	8.24	-	-	-
4	T3	0-20	0.40	13.99	21.81	60.20	Clay	8.2	1.7	1.2	16.4	0.62	51.3	15.0	41.6	8.7	91.2
		20-60	0.60	16.50	31.60	51.30	Clay	8.2	1.0	1.7	41.9		40.1	15.3	-	-	-
5	B2	0-30	0.16	31.94	26.30	41.60	Clay	8.3	1.8	0.9	8.4	0.68	31.2	16.2	52.6	10.2	110.3
		30-80	0.84	7.26	30.10	61.80	Clay	8.2	0.9	1.3	7.8		47.4	20.1	-	-	-
6	DL	0-20	0.23	35.69	22.26	41.82	Clay	8.5	1.6	1.4	9.1	0.7	29.2	16.3	50.3	7.9	100.1
		20-75	0.71	29.96	29.17	40.16	Clay	8.6	1.1	2.0	4.2		31.4	20.8	-	-	-
7	W1	0-20	0.45	22.23	34.91	42.41	Clay	8.6	1.6	1.1	4.3	0.83	31.6	18.2	48.1	9.4	116.4
		20-80	0.96	16.14	20.20	62.70	Clay	8.7	0.8	1.0	2.4		51.2	27.8	-	-	-
8	B1	0-20	0.51	46.46	31.42	21.61	SCL	7.3	1.00	1.2	3.16	0.77	14.6	11.3	10.1	3.1	39.4
		20-80	0.63	58.47	24.80	16.10	SL	7.6	0.40	0.8	4.20		11.2	10.1	-	-	-
		80-120	0.40	67.82	21.66	10.12	SL	7.9	0.16	0.9	6.00		7.1	11.8	-	-	-
9	T1	0-30	0.50	28.93	30.11	41.00	Clay	8.2	1.61	0.8	6.10	0.71	31.8	15.0	30.2	8.1	91.8
		30-90	0.41	36.03	21.26	42.30	Clay	8.2	1.00	0.6	4.81		33.6	15.1	-	-	-
		90-130	0.32	36.17	21.81	41.70	Clay	8.3	0.60	0.6	3.00		31.0	15.4	-	-	-
10	L2	0-25	0.66	27.94	31.20	40.20	Clay	8.2	1.52	1.00	5.92	0.64	30.1	15.2	41.1	10.4	110.4
		25-70	0.40	21.67	34.53	43.40	Clay	8.2	1.10	0.7	19.80		36.4	15.0	-	-	-

Sustainable land use assessment

To assess the sustainability of the agricultural system in the studied area, the five indicators of the sustainable land management, were examined as the following:

Productivity index

Table 3 shows the productivity characteristics of the different mapping units in the studied area. The obtained data indicate that the land productivity in the alluvial plain landforms are marginally but above the requirements of sustainability (class II), while it marginally but below the requirements of sustainability (class III) in the lacustrine and marine plains. The low values of the productivity in the studied area are due to the decrease of relative yield, cation exchange capacity, available nitrogen, and increase of salinity. The data of productivity indices are illustrated in Table 4.

TABLE 3. Productivity characteristics of the mapping units.

Profile no.	Units	A*	Nutrient availability						H	I	J
			B	C	D	E	F	G			
1	S1	0.49	0.21	8.0	1.1	0.3	0.6	3.0	90	21.2	7.9
2	S2	0.53	0.26	7.8	1.3	0.2	0.6	2.7	120	37.3	9.4
3	D2	0.56	0.21	8.0	1.2	0.2	0.7	1.7	100	16.3	7.6
4	T3	0.70	0.89	8.2	51.3	41.6	8.7	91.2	60	29.2	15.2
5	B2	0.61	0.95	8.3	31.2	52.6	10.2	110.3	80	8.1	16.7
6	DL	0.73	0.84	8.5	29.2	50.3	7.9	100.1	75	6.7	18.6
7	W1	0.64	0.84	8.6	31.6	48.1	9.4	116.4	80	3.4	23.0
8	B1	0.69	0.53	7.3	14.6	10.1	3.1	39.4	120	4.5	11.1
9	T1	0.92	0.85	8.2	31.8	30.2	8.1	91.8	130	4.6	15.2
10	L2	0.87	0.80	8.2	30.1	41.4	10.4	110.4	70	28.7	15.1

The productivity index considering the value (V) of ten indicators as determining soil productivity, viz.: relative yield % (A), organic carbon % (B), pH (C), CEC in meq/100 g. soil (D), available nitrogen in ppm (E), available phosphorous in ppm (F), available potassium in ppm (G), soil depth in cm (H), EC per dS/m (I) and ESP (J). *Yield reduction of the community average.

TABLE 4. Productivity indices of the mapping units.

Profile no.	Units	A	Nutrient availability						H	I	J	V
			B	C	D	E	F	G				
1	S1	70	90	100	85	80	90	90	95	85	100	0.28
2	S2	70	90	100	85	80	90	90	100	80	100	0.28
3	D2	70	90	100	85	80	90	90	95	85	100	0.28
4	T3	80	95	95	100	90	95	90	95	85	90	0.40
5	B2	80	95	95	100	95	100	90	95	90	90	0.48
6	DL	80	95	95	100	90	95	90	90	95	90	0.42
7	W1	80	95	90	100	90	95	90	95	100	90	0.45
8	B1	100	95	100	100	80	90	90	100	95	90	0.56
9	T1	100	95	95	100	85	95	90	100	95	90	0.56
10	L2	90	95	95	100	90	100	90	95	85	90	0.48

$V = A/100 \times B/100 \times C/100 \times D/100 \times E/100 \times F/100 \times G/100 \times H/100 \times I/100 \times J/100.$

Security and protection indices

Table 5 represents the security and protection characteristics in the different mapping units in the studied area. The security and protection indices (Table 6) indicate that the security and protection in soils of alluvial plain are meet the requirements of the sustainability as the indices of security and protection range between 0.72 and 0.9, and between 1.0 and 0.6 respectively. In the soils of lacustrine and marine plains the security and protection are in general marginally but above the threshold of sustainability, this due to moisture availability, biomass, erosion hazard and the cropping system.

TABLE 5. Security and protection characteristics of the mapping units.

Profile no.	Units	Security			Protection		
		A	B	C*	E	F	G
1	S1	<90	0.96	< 16%/ more one year	Small gullies	No	No cropping pattern
2	S2	<90	0.81	< 16%/ more one year	Small gullies	No	No cropping pattern
3	D2	<90	1.17	< 16%/ more one year	Small gullies	No	No cropping pattern
4	T3	365	0.62	< 16%/ more one year	No evidence	No	Double cropping pattern
5	B2	365	0.68	< 16%/ more one year	No evidence	No	Double cropping pattern
6	DL	365	0.70	< 16%/ more one year	No evidence	No	Double cropping pattern
7	W1	365	0.83	< 16%/ more one year	No evidence	No	Double cropping pattern
8	B1	365	0.77	< 16%/ more one year	No evidence	No	No cropping pattern
9	T1	365	0.71	< 16%/ more one year	No evidence	No	Double cropping pattern
10	L2	365	0.64	< 16%/ more one year	No evidence	No	Double cropping pattern

The security index consider the value (V) of three indicators, *i.e.*, moisture availability per month/ season (A), EC of irrigation water (B), and Biomass % (C) as determining security. The erosion hazard, *i.e.* , evidence of erosion indicators (E), flooding hazard viz. evidence of submerged areas (F) and cropping pattern (G) indicators were used to determine the protection of the natural resources.* Biomass% = percentage of crop residue ploughed back to land.

TABLE 6. Security and protection indices of the mapping units.

Profile no.	Units	Security				Protection			
		A	B	C	SV	E	F	G	PV
1	S1	70	90	70	0.44	70	100	60	0.42
2	S2	70	90	70	0.44	80	100	60	0.48
3	D2	70	90	70	0.44	80	100	60	0.48
4	T3	100	100	80	0.80	100	100	100	1.00
5	B2	100	100	80	0.80	100	100	100	1.00
6	DL	100	90	90	0.81	100	100	100	1.00
7	W1	70	90	70	0.44	70	100	60	0.42
8	B1	100	90	80	0.72	100	100	60	0.60
9	T1	100	90	100	0.90	100	100	100	1.00
10	L2	100	100	90	0.90	100	100	100	1.00

Security index (SV) = A/100 x B/100 x C/100, Protection index (PV) = E/100 x F/100 x G/100.

Economic viability

Table 7 represents the characteristics of economic viability in the studied area. The obtained data indicate that the economic viability of the different landforms in the marine plain (S1, S2 & D2) is marginally but above the requirements of the sustainability where the economic viability index in these areas ranges between 0.33 and 0.37 (Table 8). The rest of the area has an economic viability that meets the sustainability requirements, where the economic viability index ranges between 0.58 and 0.73. The low economic viability in the studied area is due to the decrease of benefit to coasts ratio, low availability of farm labour, small size of farm holding, and low percentage of farm production in market.

TABLE 7. Economic characteristics of the mapping units.

Profile no.	Units	A	B	C	D	E	F	G
1	S1	1.15	20.00	12.30	1.00	1.00	31.50	20.00
2	S2	1.20	26.00	12.30	1.00	1.00	31.50	20.00
3	D2	1.24	22.00	12.30	1.00	1.00	31.50	20.00
4	T3	1.38	35.00	20.00	3.00	10.00	31.50	40.00
5	B2	1.40	35.00	20.00	3.00	10.00	31.50	46.00
6	DL	1.43	40.00	20.00	3.00	8.00	31.50	67.00
7	W1	1.48	41.63	25.10	3.00	9.00	31.50	67.00
8	B1	1.10	31.00	14.30	1.00	3.00	31.50	30.00
9	T1	1.63	50.00	25.10	4.00	12.00	31.50	90.00
10	L2	1.66	50.00	25.10	4.00	12.00	31.50	90.00

The economic viability index consider the value of seven indicators as determining economic viability, viz.; benefit cost ratio (A), percentage of off farm income (B), difference between farm gate price and the nearest main market % (C), availability of farm labour man/ feddan (D), size of farm holding in feddan (E), availability of farm credit %(F) and percentage of farm produce sold in market %(G).

TABLE 8. Economic availability indices of the mapping units.

Profile no.	Units	A	B	C	D	E	F	G	V
1	S1	80	90	100	80	80	90	80	0.33
2	S2	80	100	100	80	80	90	80	0.37
3	D2	80	100	100	80	80	90	80	0.33
4	T3	80	100	90	100	100	90	90	0.58
5	B2	80	100	90	100	100	90	90	0.58
6	DL	90	100	90	100	100	90	100	0.73
7	W1	90	100	90	100	100	90	100	0.73
8	B1	80	100	100	80	100	90	90	0.52
9	T1	90	100	90	100	100	90	100	0.73
10	L2	90	100	90	100	100	90	100	0.73

Economic viability index (V) = A/100 x B/100 x C/100 x D/100 x E/100 x F/100 x G/100.

Social acceptability

Table 9 represents the characteristics of social acceptability in the studied area, which extracted form C.A.P.M.A.S. (2005). The social acceptability indices (Table 10) indicate that the social acceptability in the areas of marine plain is marginally but below the requirements of sustainability where the social acceptability index in these areas is 0.21, which is rather low. The social acceptability in the lacustrine plain and some parts of the alluvial plain (B1 & B2) is marginally but above the threshold of sustainability, *i.e.*, social acceptability is ranges between 0.43 and 0.48. The social acceptability in the rest of the area is rather high as it reaches to value of 0.65, which meets the sustainability requirements. The low value of the social indicator in the studied area is mainly due to the shortage in health and educational facilities in the villages and there is no or not enough training allocated for the land users on soil and water conservation.

TABLE 9. Social characteristics of the mapping units.

Profile no.	Units	A	B	C	D	E	F	G
1	S1	Not official	Low	Non	20	Not available	Not available	Non
2	S2	Not official	Low	Non	20	Not available	Not available	Non
3	D2	Not official	Low	Non	20	Not available	Not available	Non
4	T3	Long term	Moderate	Shortage	36	Not available	Limited	Limited
5	B2	Long term	Moderate	Shortage	36	Not available	Limited	Limited
6	DL	Long term	Moderate	Shortage	36	Not available	Limited	Full access
7	W1	Not official	Low	Non	20	Not available	Not available	Non
8	B1	Long term	Moderate	Shortage	36	Not available	Limited	Limited
9	T1	Long term	Full	Shortage	36	Not available	Available	Full access
10	L2	Long term	Full	Shortage	36	Not available	Available	Full access

The social acceptability index consider the value (V) of seven indicators as social acceptability, viz.: land tenure (A), support for extension services (B), Health and education facilities in the village (C), percentage of subsidy for conservation packages (D), training of farmers on soil and water conservation (E) availability of agro-inputs within 5–10 km (F) and village roads access to main road (G).

TABLE 10. Social acceptability indices of the mapping units.

Profile no.	Units	A	B	C	D	E	F	G	V
1	S1	80	80	80	80	80	80	80	0.21
2	S2	80	80	80	80	80	80	80	0.21
3	D2	80	80	80	80	80	80	80	0.21
4	T3	90	90	90	90	80	90	90	0.43
5	B2	90	90	90	90	80	90	90	0.43
6	DL	90	90	90	90	80	90	100	0.47
7	W1	80	80	80	80	80	80	80	0.21
8	B1	90	90	90	90	80	90	90	0.48
9	T1	100	100	90	90	80	100	100	0.65
10	L2	100	100	90	90	80	100	100	0.65

Social acceptability index (V) = A/100 x B/100 x C/100 x D/100 x E/100 x F/100 x G/100.

According to the analyses of the above mention indicators, the agricultural sustainability reflecting from sustainable land management in the studied area tends to be unsustainable as shown in Fig. 4 and Table 11. The results indicate that the studied area includes two sustainability classes as the following:

Class III: Land management practices are marginally below the threshold for sustainability as occurred in the units with values range (0.1 to 0.3), *i.e.*, B2, DL, W1, T1 and L2, and *Class IV*: Land management practices do not meet sustainability requirements as occurred in the units with values < 0.1, which include S1, S2, D1, T3 and B1.

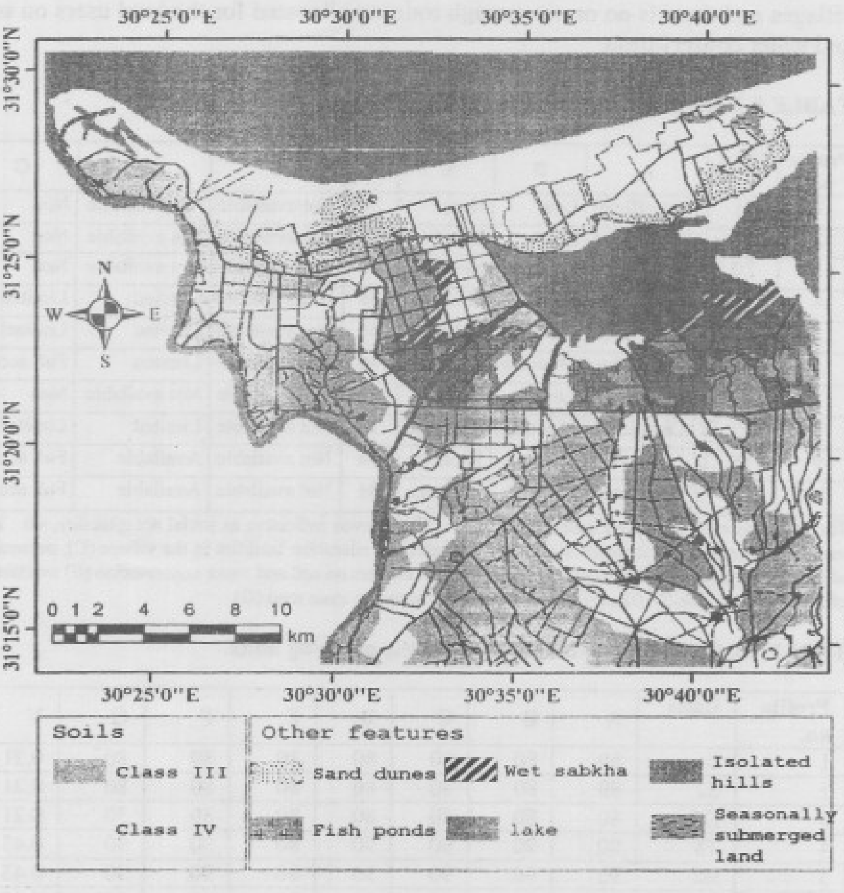

Fig. 4. Sustainability classes in the studied area.

TABLE 11. Sustainability classes of the mapping units.

Profile no.	Units	Productivity	Security	Protection	Economic viability	Social acceptability	Total value	Sustainability class
1	S1	0.28	0.44	0.42	0.33	0.21	0.004	IV
2	S2	0.28	0.44	0.48	0.37	0.21	0.005	IV
3	D2	0.28	0.44	0.48	0.33	0.21	0.004	IV
4	T3	0.40	0.80	1.00	0.58	0.43	0.08	IV
5	B2	0.48	0.80	1.00	0.58	0.43	0.10	III
6	DL	0.42	0.81	1.00	0.73	0.47	0.12	III
7	W1	0.45	0.81	0.42	0.73	0.21	0.02	IV
8	B1	0.56	0.72	0.60	0.52	0.48	0.06	IV
9	T1	0.56	0.90	1.00	0.73	0.65	0.24	III
10	L2	0.48	0.90	1.00	0.73	0.65	0.20	III

Conclusion

Analysis of the results of this study can be concluded that numerous constrains, such as, soil productivity, social acceptability and economic viability face the issue of agricultural sustainability in the studied area. To overcome these constrains; farm management, infrastructure and social services must be improved to reach the standards of agricultural sustainability in the investigated area. The international framework for evaluating sustainable land management (FESLM) offers an integrated model for quantitative assessment of the agricultural sustainability; it gives the capability of using the results in the geographic information system (GIS) to produce the thematic maps.

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الاستدامة الزراعية لبعض مناطق شمال دلتا النيل – مصر

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إن تقييم الاستدامة الزراعية من العوامل الهامة التى تسهم فى تحديد العوامل التى تعيق استدامة استخدام الاراضى فى الاغراض الزراعية. ويواجة القطاع الزراعى فى مصر بعض العوامل التى تعيق استدامة استخدام الاراضى للزراعه ومن اهم هذه العوامل، تدهور الاراضى، التدهور البيئى، النمو السكانى المتزايد، تفتيت الحيازة الزراعية، غياب الاداره المزرعية الرشيده ونقص البنية التحتية. وتهدف هذه الدراسة الى تقييم استدامة استخدام الاراضى للزراعه ببعض مناطق شمال الدلتا بمصر، حيث استخدم النظام الدولى لتقييم استدامه استخدام الاراضى (FESLM). وقد تم انتاج الخريطه الفيزيوجرافية-الارضية لمنطقة الدراسة باستخدام الصور الجوية وصور القمر الصناعى Landsat ETM حيث وجد ان المنطقة تشتمل على ثلاث وحدات رئيسية هى السهل الفيضى، السهل البحيرى والسهل البحرى. وقد تم تقييم كل من انتاجية الارض، الامان والحماية من التدهور، وايضا العوامل الاقتصاديه والاجتماعية بالوحدات الخريطية المختلفة ومن ثم امكن تقييم استدامة استخدام الارض للزراعة، حيث وجد ان الاراضى الزراعية بمنطقة الدراسة لا تتوافر بها مقومات الاستدامة الزراعية بصفة عامة حيث تشتمل المنطقة على الاتى: أراضى محدوده الاستدامة وهى تشمل مناطق الترسيبات النهرية وأراضى لا تتوافر بها عوامل الاستدامة وهى تشمل مناطق الترسيبات البحيرية والبحرية . وتعتبر انتاجيه التربة والعوامل الاقتصادية والاجتماعية أهم معوقات الاستدامة بالمنطقة.