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Correlation Between the USDA and FAO Classification of the Soils in the Nile Delta, Egypt

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Abstract: The Nile delta is the most productive and intensively used agricultural land in Egypt. The main objective of this study to characterize the type of soils in this area and to compare the USDA and FAO classifications of these soils. According to project of Soil Map of Egypt the soils in Nile delta are classified in to 3 orders: Entisols, Vertisols and Aridisols. Entisols include 4 great subgroups, Typic Torrifluvents, Typic Ustifluvents, Vertic Ustifluvents and Typic Quartzipsamments. Vertisols, include two great subgroups, Typic Torrerts and Typic Salitorrerts. In Aridisols there is only one great subgroup, Aquollic Salorthids. According to the FAO classification, the soils in the Nile delta can be put into two groups and 7 subgroups: 1- Fluvisols with Gleyi-Salic Fluvisols, Hapli-Sodic Fluvisols, Sodi-Salic Fluvisol, Hapli-Salic Fluvisols, and Hapli-Eutric Fluvisols. 2- Vertisols with Hapli-Eutric Vertisol and Eutric-Salic Vertisols.

Key words: Nile delta, soils, USDA classification, FAO classification

INTRODUCTION

The Nile delta is the most productive and intensively used agricultural land in Egypt. Monitoring reclamation and land use planning of the soils are very important from the economical and conservation point of view. The Nile delta measures about 10,000 km^2 (863723 ha) from Cairo to the north coast. The main objective of this study to characterize the type of soils in this area and to compare the USDA and FAO classification of these soils. This will help to transfer the knowledge between similar soils in the area.

The most comprehensive review of Egyptian soils is provided in the FAO Soil Map of the World[1]. Mappable soils, those with even the slightest degree of horizonation, cover about 80000 km^2 or 83 percent of Egypt**.** In the late 1980 the legend for the FAO/UNESCO Soil map of the world was revised[2]. This revised legend affects many of soils in Egypt.

MATERIALS AND METHODS

The soils of Nile delta were selected from the[3], to compare the classification according to the[4] and [2] classification system.

A digital soil map of the area was made to show the different types of soils.

RESULTS AND DISCUSSIONS

Geomorphology of the Nile delta: The Delta of the Nile measures about 175 km from south to north, and some 220 km from east to west along its base at the north. Most of the southern part is now cultivated, while a part of the northern delta is being occupied by extensive shallow lakes and marches, and in part consists of low-lying salty ground which is under reclamation.

1-The young Deltaic plain: The surface of the young deltaic plain confined between the two branches of the Nile is practically flat and slopes gently in the northern direction at the rate of 0.1m/km. The surface is dominated by a layer, about 10 m thick, of the recent deposit of Nile suspended matter, underlain by a sandy and gravely section having a thickness of about 300m. The young deltaic plain slopes northwards from 15 m in the south to 2 m in the north.

2- The Mediterranean Coastal plain: The northern part of the Delta is occupied by the coastal plain which extends inland for about 20 km with a relief of zero to +2m sloping northwards. The surface of the coastal plain is occupied by beach deposits, littoral sand dunes rising in places more than 10m, and lacustrine clay with dominant shells.

The surface of the coastal plain is affected by three main factors; the alluvial action of the Nile as represented by inundated flood plains, the Aeolian actions as represented by the dune ridges and sand sheets and the marine action represented by a variety of features including tidal flats, modern beach, beach ridges and low swales between the ridges.

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The Nile delta has two geomorphic units:

1- The young Deltaic plain
2- The Mediterranean Coastal plain

In the central portion of the Nile delta, the following soil types are recognized with in each geomorphic unit.

I- In the zone of the young deltaic plain:
a) Flood plain soils
b) Aeolian deposits

II- In the coastal plain the following soil units are known:
a) Fluviomarine soils
b) Lagoonal deposits
c) Beach deposits
d) Coastal Aeolian deposits

Classification of soils in Nile delta according to USDA: The great soil sub-groups distinguished in Egypt according to[4] are:

1. Entisols:

1.1. Fluvents
1.1.1. Torrifluvents
1.1.2. Ustic Torrifluvents
1.1.3. Vertic Torrifluvents

1.2. Orthents
1.2.1. Torriorthents
1.2.2. Lithic Torriorthents

1.3. Psamments
1.3.1. Torripsamments
1.3.2. Quartzipsamments

2. Vertisols:

2.1. Torrerts
2.1.1. Salitorrerts
2.1.2. Gypsitorrerts
2.1.3. Calcitorrerts

2.2. Usterts

3. Aridisols:

3.1. Orthrids
3.1.1. Calciorthids
3.1.2. Lithic Calciorthids
3.1.3. Gypsiorthids
3.1.4. Salorthids
3.1.5. Aquollic Salorthids
3.1.6. Petrogypsic Gypsiorthids

According to[3] we can classify the Nile delta in Egypt as follows:

Entisols: Cover the major part of the Delta. These soils are of recent Nile alluvium deposits, having no diagnostic horizons, almost flat or having very gentle slope, very deep, dark greyish brown in colour and have a low amount of organic carbon that decreases regularly with depth. These soils comprise the levees of Dammietta, Rosetta and the old river branches, the fluviomarine and lagoonal deposits located adjacent to Lake Burullus and the coastal Aeolian deposits in the extreme north of the Delta, Map (1). The Entisols include the following great groups and subgroups:

1- Typic Torrifluvents: The soils of the river levees, the fluviomarine and the lacustrine deposits are very deep, having a gentle slope and texture of sandy loam or finer. They are arid climate and have a torric moisture regime and most of them are almost calcareous and show salinity in some places. Therefore, these characteristics place them to the order Entisols and the great group Torrifluvents and subgroup Typic Torrifluvents.

2-Typic Ustifluvents: This subgroup of the Entisols occurs mainly in the two large areas, south of lake Burllus, west Behr Tira and north Shalma in Kafr El-Sheikh Governorate (map 1). These soils are most likely the levee deposits of old creeks and rivers.

They are very deep, moderately to highly saline, crypto calcareous and having a texture of clay in the surface layer and loam to clay loam in the subsoil. Generally these soils are almost similar to those of the subgroup Typic Torrifluvents but due to the prevailing ustic moisture regime in the northern Delta, they are placed to the subgroup Ustifluvents.

3- Vertic Ustifluvents: The soils of this great subgroup are formed on the fluviomarine deposits, they occur only south and east of lake Burullus. These soils are characterized by clayey texture, moderately to highly saline, having deep wide cracking and crypto calcareous

4- Typic Quartzipsamments: The soils of this subgroup are formed on the coastal barrier plains and beaches in the extreme northern limit of the Nile delta from east Rosetta to Ras El-Bar, (map 1). Generally, these soils contain a

Table 1: Soil association distribution in Egypt.

Major soil associations	Area	
	Km^2	% Land area
Calcaric fluvisols	5771	6.0
Solonchaks	3283	3.4
Gleyic	797	0.8
Haplic	2307	2.4
Takyric	179	0.2
Haplic xerosols	107	0.1
Yermosols	53351	55.7
Not subdivided	19695	20.6
Calcic	32335	33.8
Haplic	1321	1.4
Regosols	2084	2.2
Calcaric	628	0.7
Eutric	1456	1.5
Lithic leptosols	1214	1.3
Lithic leptosols and calcic yermosols	720	0.6
Lithic leptosols and regosols	13069	13.7
Rock debris and detritus	86	0.1
Dunes and shifting sands	16084	16.8

Source:FAO-UNESCO[2]

sand fraction of more than 95%, crypto calcareous, slightly saline and 2% slope.

Vertisols: The Vertisols include two great subgroups in Nile delta.

1-Typic Torrerts: These soils occupy the extensive flood plains in the proper delta, (map 1), that contain a high proportion of shrink type of clay. They may crack to depths of 1m. Generally, these soils contain clay > 35%, montmorillonitic, crypto calcareous, non saline to moderately saline and 1-2% slope.

2- Typic Salitorrerts: These soils are almost similar to those of the subgroup Typic Torrerts but due to the show highly saline they are placed to the subgroup Typic Salitorrerts

Aridisols: In the Nile delta there is only one great subgroup.

Aquollic Salorthids: These soils are located mainly in the sandy coastal plains and the beaches between Lake Burullus and the sea as well as in the fluvio-marine deposits south of the lake, (map 1). At the family level the soils of the Aquollic salorthids are classified to three families as follows:

a) Sandy, siliceous, crypto calcareous, highly saline and 1-2% slope.
b) Fine loamy, mixed, crypto calcareous, highly saline and 1-2% slope
c) Clayey, montmorillonitic, calcareous, highly saline and 1-2% slope.

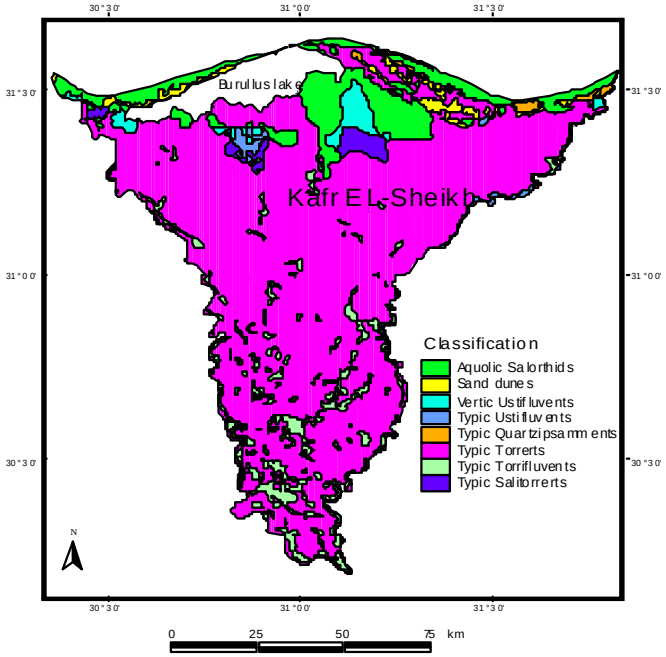
Classification of soils in Nile delta according to FAO: The main objective of the FAO classification is to reach an international agreement on the major soil groupings to be recognized at a global scale as well as on the criteria and methodology to be applied for defining and identifying them. Such an agreement was meant to facilitate the exchange of information and experience, to provide a common scientific language, to strengthen the applications of soil science and to enhance communication with other disciplines.

FAO legend includes 30 soil groups, the number of lower level units in the legend or soil classification has continued to grow: from 106 in 1974 to 152 in 1988 to 209 in 1994. At the same time a serious effort was undertaken to expand this second level further with the introduction of third level units [5] .The main Egyptian soil associations in decreasing order are: calcisols and gypsisols mixed leptosols and regosols; calcaric fluvisols; solonchaks; regosols; lithic leptosols and mixed lithic leptosols; and calcisols and gypsisols (Table 1). In addition there are minor occurrences of gleysols, vertsols, and solonetz soils within the major associations.

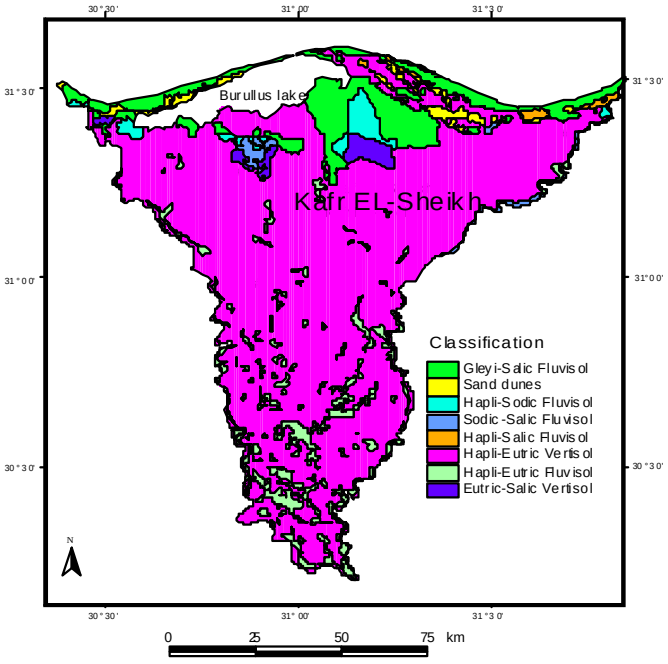
According to[2] the soils in Nile delta can be but into two soils group and 7 subgroups (map 2) as follows:

1- Fluvisols:

a) Gleyi-Salic Fluvisols: this subgroup equals Aquollic Salorthids in USDA classification.
b) Hapli-Sodic Fluvisols: this subgroup equals Vertic Ustifluvents in USDA classification.
c) Sodi-Salic Fluvisols: this subgroup equals Typic Ustifluvents in USDA classification.
d) Hapli-salic Fluvisols: this subgroup equals Typic Quartzipsamments in USDA classification.
e) Hapli-Eutric Vertisols: this subgroup equals Typic Torrerts in USDA classification.



Map 1 Soil map of the Nile delta according to Soil Taxonomy 2003



Map 2 Soil map of the Nile delta according to FAO 1988

Table 2: Characteristics and classification of soils in Nile delta.

Characteristics	Classification[2]	Classification[4]	Area (%)
Sandy to clay, Highly saline, 1-2% slope	Gleyi-Salic Fluvisols	Aquolic Salorthids	9.9
Sand dunes	Sand dunes	Sand dunes	1.7
Fluviomarine, clay, highly saline, 1-2% slope	Hapli-Sodic Fluvisols	Vertic Ustifluvents	2.0
Fine loamy, highly saline, 1% slope	Sodi-Salic Fluvisols	Typic Usifluvents	1.1
Sandy, slightly saline, 2% slope	Hapli-Eutric Fluvisols	Typic Quartzipsamments	0.6
Clay, non saline, 1-2% slope	Hapli-Eutric Vertisols	Typic Torrerts	77.1
Sandy loam, Fluvial, non saline	Hapli-Eutric Fluvisols	Typic Torrifluvents	6.0
Clay, highly saline, 1-2% slope	Eutri-Salic Vertisols	Typic Salitorrerts	1.5

f) Hapli-Eutric Fluvisols: this subgroup equals Typic Torrifluvents in USDA classification.
g) Eutric-Salic Vertisols: this subgroup equals Typic Haplosalids in USDA classification.

Table 2 shows the summary of the difference between USDA and FAO classification.

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