# EVALUATION OF LAND SUITABILITY FOR AGRICULTURE IN WADI ABU SHIEH- ASSIUT GOVERNORATE.

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**ABSTRACT**

The studied area is located between latitudes 26° 49` 26= & 26° 56`14= North and longitudes 31° 30`41= & 31° 41`48= East Fig (1).

Total space of studied area is 233 km$^2$. The aim of this study is to evaluate the physiographic soil units including soil classification and its suitability for agriculture.

The studied area has almost flat to undulating topography. The soils are deep sand to sandy clay loam with dominance of coarse texture and high gravel content in most of soil profiles with some stones in the old terraces and fans and outwash plain units. All studied soils have also low gypsum content and moderate calcium carbonate content, whereas some soils of old terraces have calcic diagnostic horizon. Soil salinity levels varied between non-saline into highly saline.

The physiographic units of studied soils were attributed as:

(1) Old colluvial terraces. Including soil taxonomic units;
- *Typic Haplocalsids, Sandy skeletal, mixed, hyperthermic.*

(2) Wadi bottom. Including soil taxonomic units;
- *Typic Torriorthents Sandy skeletal, mixed, hyperthermic.*

(3) Wadi plains. Including soil taxonomic units;
- *Typic Torriorthents Sandy, mixed, hyperthermic.*
- *Typic Torriorthents, Coarse-loamy, mixed, hyperthermic.*

(4) Fans and outwash plains. Including soil taxonomic units;
- *Typic Torriorthents Sandy-skeletal, mixed, hyperthermic*.

Current suitability of soil physiographic units could be categorized into three classes as; moderately suitable (S2) for some soils in wadi bottoms and wadi plains, marginally suitable (S3) in fans and outwash plains and some soils of wadi bottom and wadi plain, and not suitable (N1) for old colluvial terraces.

Data of potential suitability levels reveal that the soils of wadi plain have the highest suitability levels followed by wadi bottoms, fans and outwash plains and old colluvial terraces, respectively.

The potential land suitability for certain crops could be classified as follow;

**(a)** Highly suitable (S1) in wadi plain soils for alfalfa and olives and in wadi bottom soils for olives.

**(b)** Moderately suitable (S2) in soils of;
- Wadi plain for wheat, barley, maize, cotton, sunflower, sorghum, onion, banana, citrus, guava and mango.
- Wadi bottom for maize, alfalfa, tomato, watermelon and citrus.
- Old colluvial terraces and fans and outwash plains for olives.

**(c)** Marginally suitable (S3) in soils of;

- Wadi bottom for wheat, barley, cotton, sorghum, sunflower, onion, banana, guava and mango.
- Fans and outwash plains for maize, cotton, sesame, sunflower, alfalfa, sorghum, onion, tomato, watermelon, citrus, guava and mango.
- Old colluvial terraces for maize, sesame, sunflower, alfalfa, sorghum, tomato, watermelon, citrus and mango.

**(d)** Not suitable (N) in soils of;
- Fans and outwash plains for wheat, barley and banana.
- Old colluvial terraces for wheat, barley, cotton, onion, banana and guava.

## INTRODUTION

The major aim of agriculture policy is proportional directed to develop the desert land. Wadi Abu Shieh has an important situation covering about 233 $km^2$ about (55303 feddans) and considers a promising area for cultivation. This is due to its location near to eastern portion of Nile valley in a very high population density area (Assiut City) and its irrigation source is either from River Nile or artesian wells.

Many workers studied the geology of Eastern Desert among them Said (1990, 2000) and Abo El- Izz (2000). Using the Geological Map of Egypt (1981) Wadi Abu Shieh basin composed of undivided Quaternary deposits, wadi and playa deposits, followed by Pliocene deposits formed with nonmarine origin outside the Nile Valley surrounded by Eocene limestone plateau with minor clay beds from high cliffs and plateau overlooking the Nile between Esna and Cairo.

Hasanin (2012) studied sand mineralogy of Wadi Abu Shieh and mentioned that the mineralogical composition of light sand fraction of Wadi Abu Shieh composed of quartz with few amounts of feldspars, while pyroboles dominates heavy minerals which reflect that soils are young.

The main objective of this work is to evaluate land suitability for sustainable agriculture in Wadi Abu Shieh in Assiut governorate using field study and GIS techniques.

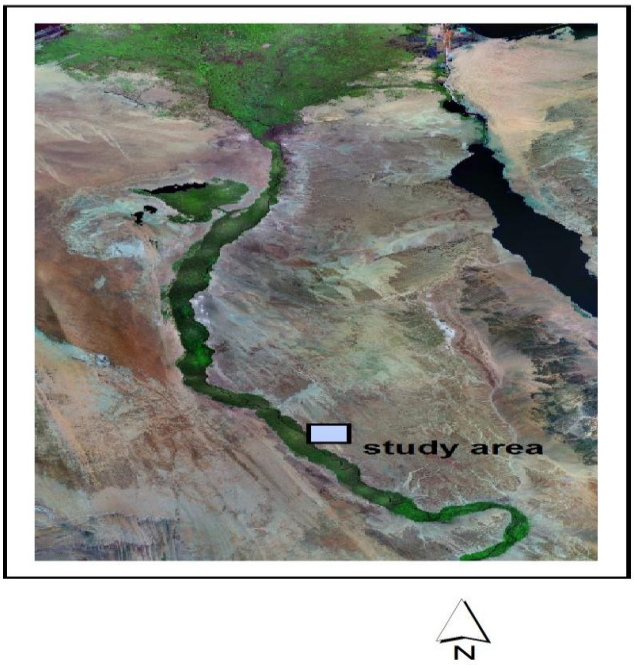
## MATERIALS AND METHODS

### Location of study area

The suited area is located between latitudes 26° 49` 26= & 26° 56`14= North and longitudes 31° 30` 41= & 31° 41`48= East Covering 233 $km^2$ (55303 feddans) Fig (1).

### Geographic Information Systems (GIS)

Physiographic units of the studied area were identified using (GIS) techniques. Reconnaissance soil survey map by High Dam Soil Survey (HDSS, 1965) has been dealt with GIS integrations to analyze and manage features for the final map. Soil profiles were integrated together to represent the different soil map units. To unify the georeferance of subjects, the former maps were geometrically corrected and projected to the ETM (Egyptian Transfer Mercator) projection.




**Fig(1) Location of studied area**

## Field work:

Nine soil profiles were chosen to represent the identified physiographic units. Soil profiles were dug deep to 150 cm unless hindered by bedrock and morphologically described in the field according to FAO (2010). Soil samples were air dried, crushed, sieved and used for physical and chemical analysis. Soil color is defined according to the Munsel Color (2009).

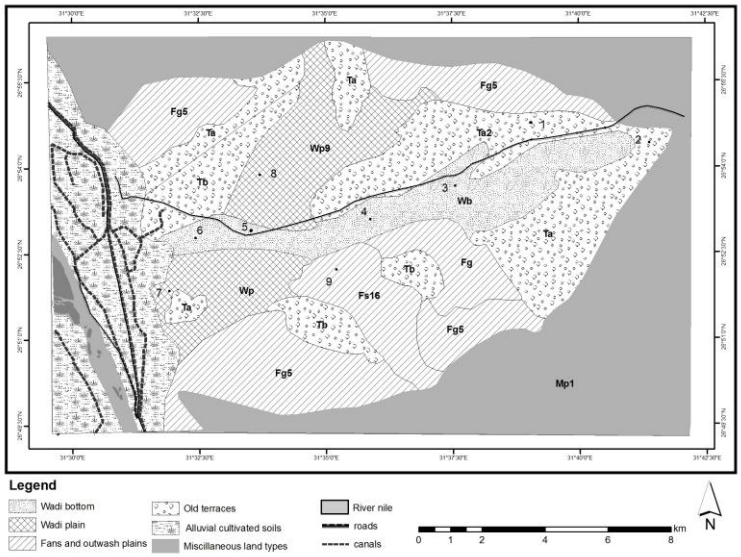


**Fig (2) physiographic units and location of studied profiles**

**Laboratory analysis**:

- Particle fractionation was carried out using pipette method for fine fraction, namely, Kohn method (Arnold, 1986).
- Soil reaction pH was determined in the soil paste, electrical conductivity in soil paste extract and ESP, calcium carbonate and gypsum contents were determined according Page et al (1982).

**Soil classification and land evaluation:**

Soils were classified to family level according to Soil Taxonomy system (Soil Survey Staff, 1999) and using the keys of Soil Taxonomy (Soil Survey Staff, 2010).

Land evaluation and its suitability were achieved according the system of Sys and Verheye (1978) and Sys et at (1993).

**RESULTS AND DISCUSSION**

**Remote Sensing and GIS technique:**

GIS technique is a powerful tool for accurate mapping unit delineation especially by integration with geologic and topographic data. Mapping units component of soil-taxa is achieved by field investigation based on Reconnaissance soil survey map which conducted by High Dam Soil Survey (HDSS 1965), which helped with satellite data to unify the certain boundary between each physiographic unite and each other.

Interpretation of the Enhanced Thematic Mapper (Fig 1) (ETM path 178 row40 ) data, false color composition (FCC) 7,4and 2 as well as screen digitized image are useful for producing map of mean physiographic units of Wadi Abu Shieh soils. Field observation of physiographic units was corrected with their reflection patterns to produce a physiographic map, Fig (2).

Visual interpretations of remote sensed data reveal the following physiographic units, (1) Wadi bottom, (2) Wadi plains, (3) Fans and outwash plains, (4) Old colluvial terraces, (5) Miscellaneous land types, Fig (2). Area of each physiographic unit is shown in Table (1).

**Table (1) Areas of the identified Physiographic units**

| No | Physiographic name | Area_feddan | Area_km2 | % |
|---|---|---|---|---|
| 1 | Old colluvial terraces | 12147 | 51 | 21.9 |
| 2 | Wadi bottom | 4588 | 19 | 8.2 |
| 3 | Wadi plain | 6103 | 26 | 11.2 |
| 4 | Fans and outwash plains | 13055 | 55 | 23.6 |
| 5 | Miscellaneous land types | 19410 | 82 | 35.2 |
| Sum | | 55303 | 233 | 100 |

Morphological description, physical and chemical properties and soil classification of the studied profiles are presented in tables, 2, 3 and 4.

**Physiographic and Soil Taxonomic units**

**Old colluvial terraces**

The soils of colluvial terraces pertaining to materials formed under gravity effect on broken stones and coarse gravels of high lands surrounding the studied area, covering 51 $km^2$ (about 21.9 % of the studied area) . Soils of this unit are found mainly in the north-eastern portion of the studied area and found in other part of the studied valley. These soils are gently undulating to undulating relief with surface completely covered by gravel and stones. Soils have very gravelly coarse texture range from sand to sandy loam with high gravel content from 33 to 67 % and clay content from 3.3 to 13.5%. Lime content from 25.1 to 38.5% and gypsum content is few. Soils are non-saline to highly saline, EC values range from 2.3 to 24.5 (dS/m). Soils are slightly alkaline pH ranges from 7.4 to 7.7.

Soil Taxonomic units of these soils are attributed as;

*Typic Haplocalcids, Sandy skeletal, mixed, hyperthermic (profiles1 and 2).*

**Wadi bottoms**

This unit is extended North East to the South West in the middle of the studied area, covering about 19 $km^2$ (8.2 % of the studied area). This unit is presented by soil profiles, 3, 4, 5 and 6. It occupies along relatively narrow almost flat or gently sloping areas. The surface is locally covered with sand sheet and scattered desert

shrubs. Soil texture is mainly sand to sandy loam with gravel content varied widely from 15 to 55 % and clay content from 3.4 to 15.1 %. Soil reaction is neutral to slightly alkaline with pH values from7.2 to 7.6. Lime content ranges from 8.8 to 19.6% with very few gypsum content. Soils are non-saline to highly saline EC values range from 3.2 to 16.6 (dS/m). Soils of this unit haven't any diagnostic horizons.

Soil Taxonomic units of these soils are attributed as;

*Typic Torriorthents Sandy skeletal, mixed, hyperthermic, profiles(3, 4,5 and 6).*

## Table (2) Morphological description of studied soil profiles

| Physiographic units | Profile No. | Topography | Elevation | Surface cover | Vegetation | Depth (cm) | Texture | Coarse fragments % | Color | | Structure | Consistency | Effervescence | Secondary formation | | Boundary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | dry | moist | | | | $CaCO_3$ | $CaSO4\ 2H2O$ | |
| Old colluvial terraces | 1 | Und | +81 | 80% GR+ST | Non | 0-30 | S | 65 | 7.5YR6/6 | 7.5YR4/6 | Ma | Sh | st | Mod | - | grs |
| | | | | | | 30-80 | S | 64 | 7.5YR7/6 | 7.5YR6/6 | Sg | Loose | st | Manyy | - | cs |
| | | | | | | 80-120 | LS | 33 | 7.5YR6/6 | 7.5YR5/6 | Ma | Sh | st | many | - | |
| | 2 | G und | 105+ | 70-80% GR+ST | Non | 0-15 | SL | 67 | 10YR7/4 | 10YR5/4 | Ma | Sh | St | Mod | - | cs |
| | | | | | | 15-45 | S | 66 | 10YR6/4 | 10YR5/4 | Sg | Loose | Mo | Mod | - | grw |
| | | | | | | 45-75 | S | 54 | 10YR7/4 | 10YR5/4 | Sg | Loose | St | Many | - | cw |
| | | | | | | 75-130 | LS | 33 | 7.5YR6/6 | 7.5YR5/6 | Ms | Soft | Mo | Many | - | |
| Wadi bottom | 3 | AF | +63 | 40-50% GR (f-c) | %5-10 Desert shrubs | 0-40 | SL | 16 | 10YR8/4 | 10YR6/6 | Ma | Sh | Mo | Few | - | cs |
| | | | | | | 40-80 | LS | 36 | 10YR7/4 | 10YR5/6 | Sg | Loose | Mo | Few | - | grw |
| | | | | | | 80-130 | LS | 25 | 10YR8/4 | 10YR5/6 | Sg | Loose | Mo | Few | - | |
| | 4 | AF | +52 | 20-30% GR (F+M) | Cultivated beans | 0-30 | LS | 33 | 10YR6/4 | 10YR5/4 | Ma | Soft | Mo | Few | - | abs |
| | | | | | | 30-45 | S | 38 | 7.5YR5/4 | 7.5YR4/4 | Sg | Loose | Mo | Few | - | cs |
| | | | | | | 45-70 | LS | 43 | 7.5YR6/4 | 7.5YR5/4 | Ma | Friable | St | Few | - | cs |
| | | | | | | 70-130 | S | 35 | 7.5YR5/4 | 7.5YR4/4 | Ma | Friable | St | Few | - | |
| | 5 | AF | +58 | - | 10-20% Desert shrubs | 0-40 | SL | 15 | 10YR8/6 | 10YR6/6 | Sg | Loose | St | Few | - | cs |
| | | | | | | 40-60 | SL | 36 | 10YR7/4 | 10YR5/6 | Ma | Soft | Mo | Few | - | ab |
| | | | | | | 60-100 | S | 49 | 10YR7/6 | 10YR5/6 | Sg | Loose | St | Few | - | ab |
| | | | | | | 100-150 | SL | 55 | 7.5YR6/4 | 7.5YR4/4 | Ma | Sh | St | Few | - | |
| | 6 | AF | +50 | 60% GR (F-M) | 10-15% Desert shrubs | 0-30 | S | 20 | 10YR8/4 | 10YR5/4 | Sg | Loose | St | Few | - | cs |
| | | | | | | 30-50 | S | 30 | 10YR8/4 | 10YR5/6 | Sg | Loose | St | Few | - | grs |
| | | | | | | 50-75 | S | 46 | 10YR7/4 | 10YR5/4 | Sg | Loose | St | Few | - | grs |
| | | | | | | 75-120 | S | 50 | 7.5YR6/4 | 7.5YR4/4 | Sg | Loose | St | Few | - | |
| Wadi plain | 7 | AF | +78 | 10% GR (F-C) | Cultivated Citrus | 0-20 | SL | 22 | 10YR6/4 | 10YR4/4 | Ma | Sh | St | Few | - | cs |
| | | | | | | 20-35 | S | 23 | 10YR7/4 | 10YR6/4 | Ma | Soft | St | Few | - | cs |
| | | | | | | 35-90 | S | 18 | 10YR7/4 | 10YR6/4 | Sg | Loose | Mo | Few | - | grs |
| | | | | | | 90-120 | S | 5 | 7.5YR5/4 | 7.5YR4/4 | Sg | Loose | St | Few | - | |
| | 8 | AF | +63 | 10-20% GR (F-C) | 15-30% Desert shrubs | 0-30 | LS | 18 | 10YR8/4 | 10YR6/4 | Ma | Sh | St | Few | - | cs |
| | | | | | | 30-70 | SCL | 10 | 10YR7/4 | 10YR6/4 | Sg | Loose | St | Few | - | grs |
| | | | | | | 70-85 | SL | 13 | 7.5YR6/4 | 7.5YR4/4 | Sg | Loose | St | Few | - | cs |
| | | | | | | 85-120 | LS | 9 | 7.5YR5/4 | 7.5YR4/4 | Sg | Loose | St | Few | - | |
| Fans and outwasl plains | 9 | G und | +88 | 50% GR (F-C) +ST | 5% Desert grasses | 0-35 | S | 44 | 10YR8/4 | 10YR6/6 | Sg | Loose | St | Few | - | cs |
| | | | | | | 35-60 | S | 65 | 10YR7/4 | 10YR5/6 | Sg | Loose | St | 10% | 5% | ab |
| | | | | | | 60-80 | SL | 7 | 10YR8/4 | 10YR5/6 | Ma | Sh | St | 7% | - | ab |
| | | | | | | 80-150 | S | 64 | 10YR8/4 | 10YR5/6 | Sg | Loose | St | Few | - | |

*Soil structure: Sg (single grain), Ma (massive).*
*Topography: AF=almost flat, G=gently, Un= undulating.*
*Effervescence: st: strong, mo: moderate, Consistency: Sh= slightly hard,*
*Lower boundary :ab=abrupt, cs=clear smooth, cw: clear wavy and gw: gradual Wavy*
*Surface features: GR= gravels, S=stones*
*Fine earth: S=Sand, LS=Loamy sand, SL=Sandy loam and SCL=Sandy clay loam.*

**Table (3) physical and chemical properties of the studied area**

| Physiographic units | Profile No. | Depth (cm) | Particle size distribution | | | | Texture classes | ESP | pH | ECe (dS/m) | CaSO4 .2H2O | CaCO3 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coarse sand | Fine sand | Silt | Clay | | | | | | |
| Old colluvial terraces | 1 | 0-30 | 54.6 | 37.5 | 4.4 | 3.5 | S | 10.6 | 7.4 | 2.3 | 2.4 | 32.5 |
| | | 30-80 | 48.3 | 42.6 | 5.3 | 3.8 | S | 14.2 | 7.7 | 24.5 | 1.6 | 38.5 |
| | | 80-120 | 29.5 | 56.3 | 7.4 | 6.8 | LS | 10.4 | 7.5 | 8.3 | 1.9 | 31.4 |
| | | **Mean** | 43.6 | 45.9 | 5.8 | 4.7 | S | 14.2 | 7.6 | 13.6 | 1.9 | `34.6 |
| | 2 | 0-15 | 33.6 | 38.5 | 14.4 | 13.5 | SL | 14.5 | 7.7 | 13.6 | 1.4 | 25.1 |
| | | 15-45 | 55.6 | 34.8 | 5.8 | 3.8 | S | 13.6 | 7.5 | 17.7 | 1.8 | 28.6 |
| | | 45-75 | 58.6 | 33.4 | 4.7 | 3.3 | S | 12.5 | 7.5 | 6.3 | 2.6 | 38.4 |
| | | 75-130 | 48.9 | 36.9 | 6.3 | 7.9 | LS | 13.6 | 7.6 | 11.0 | 2.9 | 32.5 |
| | | **Mean** | 50.9 | 35.7 | 6.8 | 6.5 | LS | 14.5 | 7.6 | 11.8 | 2.4 | 32.1 |
| Wadi bottom | 3 | 0-40 | 40.7 | 38.4 | 10.6 | 10.3 | SL | 13.8 | 7.4 | 5.4 | 1.7 | 13.8 |
| | | 40-80 | 51.2 | 36.8 | 5.8 | 6.2 | LS | 11.7 | 7.2 | 16.6 | 1.5 | 16.8 |
| | | 80-130 | 48.8 | 35.6 | 8.5 | 7.1 | LS | 9.8 | 7.6 | 13.8 | 0.8 | 18.3 |
| | | **Mean** | 47.1 | 36.8 | 8.3 | 7.8 | LS | 13.8 | 7.5 | 12.0 | 1.3 | 16.4 |
| | 4 | 0-30 | 46.3 | 36.6 | 8.3 | 8.8 | LS | 13.8 | 7.6 | 6.4 | 1.8 | 13.8 |
| | | 30-45 | 50.2 | 40.6 | 4.3 | 4.9 | S | 13.4 | 7.5 | 5.8 | 1.9 | 10.6 |
| | | 45-70 | 43.3 | 40.9 | 7.7 | 8.1 | LS | 12.5 | 7.5 | 6.6 | 2.3 | 9.8 |
| | | 70-130 | 47.6 | 42.9 | 3.6 | 5.9 | S | 13.3 | 7.3 | 8.6 | 1.6 | 11.4 |
| | | **Mean** | 46.7 | 40.8 | 5.6 | 6.9 | LS | 13.8 | 7.4 | 7.4 | 1.8 | 11.5 |
| | 5 | 0-40 | 29.6 | 42.9 | 12.4 | 15.1 | SL | 13.8 | 7.5 | 15.3 | 2.1 | 14.3 |
| | | 40-60 | 30.9 | 40.7 | 14.9 | 13.5 | SL | 14.3 | 7.4 | 11.9 | 1.9 | 9.9 |
| | | 60-100 | 49.6 | 41.6 | 5.4 | 3.4 | S | 11.6 | 7.4 | 4.8 | 1.8 | 13.6 |
| | | 100-150 | 32.9 | 39.6 | 13.8 | 13.7 | SL | 10.4 | 7.4 | 3.2 | 1.4 | 8.8 |
| | | **Mean** | 36.2 | 41.2 | 11.3 | 11.3 | SL | 14.3 | 7.4 | 8.0 | 1.8 | 11.7 |
| | 6 | 0-30 | 53.9 | 38.4 | 4.1 | 3.6 | S | 10.4 | 7.5 | 11.6 | 2.3 | 10.6 |
| | | 30-50 | 56.8 | 35.9 | 3.9 | 3.4 | S | 12.8 | 7.5 | 8.9 | 1.9 | 14.4 |
| | | 50-75 | 52.4 | 36.3 | 5.4 | 5.9 | S | 12.3 | 7.4 | 8.8 | 1.4 | 10.8 |
| | | 75-120 | 50.9 | 38.8 | 4.8 | 5.4 | S | 13.6 | 7.5 | 7.9 | 1.8 | 19.6 |
| | | **Mean** | 52.5 | 37.5 | 5.1 | 4.9 | S | 13.6 | 7.5 | 8.9 | 2.1 | 15.6 |
| Wadi plain | 7 | 0-20 | 23.9 | 46.1 | 15.2 | 14.8 | SL | 14.1 | 7.6 | 8.4 | 2.2 | 9.9 |
| | | 20-35 | 54.2 | 35.9 | 4.8 | 5.1 | S | 13.2 | 7.5 | 5.6 | 1.8 | 13.6 |
| | | 35-90 | 50.6 | 37.9 | 6.2 | 5.3 | S | 13.4 | 7.5 | 4.8 | 1.7 | 14.6 |
| | | 90-120 | 51.4 | 38.7 | 4.8 | 5.1 | S | 11.2 | 7.4 | 3.2 | 1.8 | 18.9 |
| | | **Mean** | 46.8 | 39.2 | 7.2 | 6.8 | LS | 14.1 | 7.5 | 5.1 | 1.7 | 14.8 |
| | 8 | 0-30 | 35.3 | 36.9 | 12.5 | 15.3 | SL | 12.5 | 7.4 | 4.9 | 2.1 | 11.3 |
| | | 30-70 | 19.8 | 30.7 | 22.6 | 26.9 | SCL | 13.6 | 7.5 | 5.5 | 1.8 | 19.4 |
| | | 70-85 | 29.9 | 42.8 | 14.2 | 13.2 | SL | 11.2 | 7.5 | 6.8 | 1.6 | 14.5 |
| | | 85-120 | 45.9 | 40.4 | 6.4 | 7.3 | LS | 10.8 | 7.5 | 5.4 | 1.7 | 19.5 |
| | | **Mean** | 32.5 | 36.6 | 14.3 | 16.6 | SL | 13.6 | 7.5 | 5.5 | 1.8 | 16.8 |
| Fans and outwash plains | 9 | 0-35 | 58.6 | 32.3 | 4.5 | 4.6 | S | 11.3 | 7.4 | 10.3 | 2.2 | 11.4 |
| | | 35-60 | 52.5 | 37.4 | 5.3 | 4.8 | S | 12.6 | 7.4 | 23.9 | 2.4 | 18.5 |
| | | 60-80 | 37.3 | 41.5 | 9.6 | 11.6 | SL | 13.8 | 7.5 | 18.6 | 1.8 | 16.6 |
| | | 80-150 | 49.5 | 40.6 | 4.8 | 5.1 | S | 11.8 | 7.3 | 26.7 | 1.3 | 14.5 |
| | | **Mean** | 50.5 | 38.2 | 5.5 | 5.8 | S | 13.8 | 7.4 | 21.3 | 1.6 | 15.3 |

**Table (4) Classification of the studied soils (USDA, 2010)**

| Physiographic units. | Order | Suborder | Great group | Sub great group | family | erepresentativR profiles |
|---|---|---|---|---|---|---|
| **Old colluvial terraces** | Aridisols | Calcids | Haplocalcids | Typic | Sandy-skeletal, mixed, hyperthermic | 1,2 |
| ***Wadi bottom*** | Entisols | Orthents | Torriorthents | Typic | Sandy-skeletal, mixed , hyperthermic | 3,4,5,6 |
| ***Wadi plain*** | Entisols | Orthents | Torriorthents | Typic | Sandy, mixed , hyperthermic | 7 |
| | Entisols | Orthents | Torriorthents | Typic | Coarse-loamy, mixed , hyperthermic | 8 |
| ***Fans*** | Entisols | Orthents | Torriorthents | Typic | Sandy-skeletal, mixed , hyperthermic | 9 |

**Wadi plain**

This unit occupies the middle portion of the studied area covering is about 26 $km^2$ (11.2 % of the studied area). This unit is presented by two soil profiles, 7 and 8.

The slope of this unit is almost flat or gently sloping. The surface is locally covered with sand sheet with many desert shrubs. Soil texture ranges from sand to sandy clay loam with relatively low gravel content that varied from 5 to 23 % and clay content from 5.1 to 26.9%. Soil reaction is slightly alkaline pH values from7.4 to 7.6. Lime content ranges from 9.9 to 19.5% with very few gypsum content. Soils are non-saline to moderately saline EC values range from 3.2 to 8.4 (dS/m). Soils of this unit haven't any diagnostic horizons.

Soil Taxonomic units of these soils are attributed as;

*Typic Torriorthents Sandy, mixed, hyperthermic,( profile, 7)*

*Typic Torriorthents, Coarse-loamy, mixed, hyperthermic,( profile, 8).*

**Fans and outwash plains**

This unit composes mainly of the debris flow deposits, so it found on the ends of the escarpments and considers the body of alluvium. The soil surface forms a segment of cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. It consists of a broad, gently-inclined, piedmont slope formed by lateral coalescence of series of alluvial fans. The total area is 55 $km^2$ (about 23.6 % of the study area). This unit is presented by soil profile, 9. Soils are almost flat, and the surface covered with angular gravel and some stones. Soils texture ranges from sand to sandy loam with high gravel and stones content from 7 to 65% and clay content from 4.6 to 11.6. Soil reaction is slightly alkaline pH values from7.3 to 7.5. Soils EC values varied from 10.3 to 26.7 dS/m. Lime content from 11.4 to 18.5 % partly as secondary accumulations with few gypsum content partly as secondary accumulations. Soils of this unit haven't any diagnostic horizons.

Soil Taxonomic units of these soils are attributed as;

*Typic Torriorthents Sandy-skeletal, mixed, hyperthermic profile (9).*

**Land evaluation**

The integrated soil limitations without any improvement process with respect to the virgin land may reduce its current suitability. The current and potential suitability associated with soil limitations are shown in Table (5), Figs (3 and 4). Data reveal that the suitability index (Ci) of the studied soils ranged from 21.4 (N1) to 64.1 (S2) for current suitability and from 43.2 (S3) to 76.8 (S1) for potential suitability. Soil profiles could be categorized into three classes according to Sys and Verheye (1978) as;

-Moderately suitable soils (S2), (Ci from 75to 50), represented by profiles 5 (wadi bottoms) and 8 (wadi plains).

-Marginally suitable (S3), (Ci 50:25), represented by profiles 3, 4 and 6(wadi bottoms), 7 (wadi plains) and 9 (fans and outwash plains).

-Not suitable (N1), (Ci< 25), represented by profiles 1 and 2 (old colluvial terraces).

**Table (5): Degree of soil limitations and suitability classes of the studied soils**.

| Physiographic unit | Profile No. | Topography (t) | | Wetness (w) | | Texture s1 | | Soil depth s2 | CaCO3 S3 | CaSo4 S4 | Salinity & Alkalinity (n) | | Capability index (Ci) | | Suitability Class | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | P | C | P | C | P | | | | C | P | C | P | C | P |
| Old terrace | 1 | 80 | 100 | 100 | 100 | 35 | 50 | 100 | 90 | 100 | 85 | 96 | 21.4 | 43.2 | N1 | S3 |
| | 2 | 90 | 100 | 100 | 100 | 35 | 50 | 100 | 90 | 100 | 85 | 96 | 24.1 | 43.2 | N1 | S3 |
| | Mean | 85 | 100 | 100 | 100 | 35 | 50 | 100 | 90 | 100 | 85 | 96 | 22.3 | 43.2 | N1 | S3 |
| Wadi bottoms | 3 | 95 | 100 | 100 | 100 | 50 | 60 | 100 | 100 | 100 | 90 | 96 | 42.3 | 57.6 | S3 | S2 |
| | 4 | 95 | 100 | 100 | 100 | 50 | 60 | 100 | 100 | 100 | 90 | 96 | 42.3 | 57.6 | S3 | S2 |
| | 5 | 95 | 100 | 100 | 100 | 65 | 75 | 100 | 100 | 100 | 85 | 96 | 52.5 | 72.0 | S2 | S2 |
| | 6 | 95 | 100 | 100 | 100 | 35 | 50 | 100 | 100 | 100 | 85 | 96 | 28.3 | 48.0 | S3 | S3 |
| | Mean | 95 | 100 | 100 | 100 | 50 | 61 | 100 | 100 | 100 | 88 | 96 | 41.3 | 58.8 | S3 | S2 |
| Wadi pla | 7 | 100 | 100 | 100 | 100 | 50 | 60 | 100 | 100 | 100 | 90 | 96 | 45.0 | 57.6 | S3 | S2 |
| | 8 | 95 | 100 | 100 | 100 | 75 | 80 | 100 | 100 | 100 | 90 | 96 | 64.1 | 76.8 | S2 | S1 |
| | Mean | 97.5 | 100 | 100 | 100 | 63 | 70 | 100 | 100 | 100 | 90 | 96 | 54.6 | 67.2 | S2 | S2 |
| Fans and outwash plains | 9 | 90 | 100 | 100 | 100 | 35 | 50 | 100 | 100 | 100 | 80 | 96 | 25.2 | 48.0 | S3 | S3 |

*Where:* *C= current suitability* *P= potential suitability*
*S1= highly suitable* *S2= moderately suitable* *S3= marginally suitable*
*N1= currently not suitable*
*Limitation degrees*
*No= (100-95)* *Slight= (95-85)* *Moderate= (85-60)*
*Severe= (60-45)* *very severe= (< 45)*

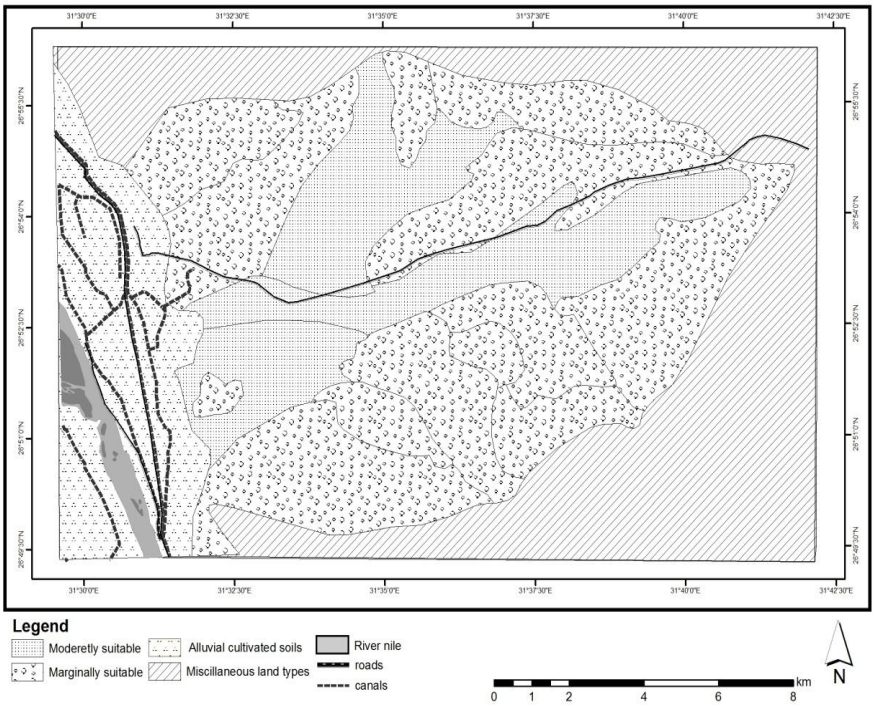



**Fig (3) current suitability classes**

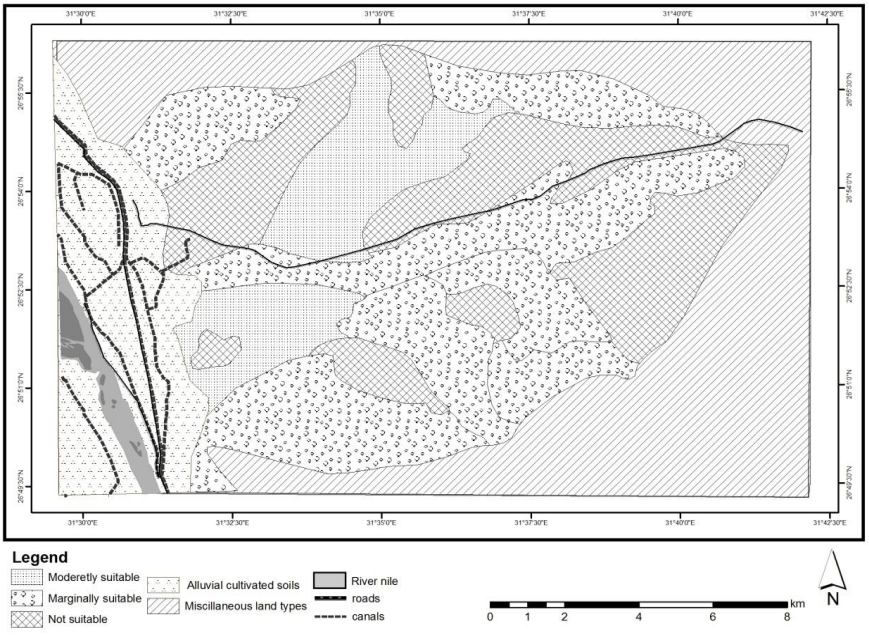



**Fig (4) Potential suitability classes**

Land suitability classes for cultivating certain crops;

Land suitability for cultivating different crops were sorted by matching rates of its characteristics and limitations with crop water requirements; Sys et al (1993) to give the maximum output.

Current and potential suitability for different crops for the studied soil profiles are shown in Table (6). Data is focused to give the best land utilization. The proposed crops are attributed as potential suitability classes as follow;

1- Highly suitable (S1) in wadi plain soils for alfalfa and olives and in wadi bottom soils for olives covering about 19.4% of total area (10700 feddans).

2- Moderately suitable (S2) in soils of;

- Wadi plain for wheat, barley, maize, cotton, sunflower, sorghum, onion, banana, citrus, guava and mango covering about 11.2% of total area (6100 feddans).
- Wadi bottom for maize, alfalfa, tomato, watermelon and citrus covering about 8.2% of total area (4600 feddans).
- Old colluvial terraces and fans and outwash plains for olives covering about 45.5% of total area (25202 feddans).

3- Marginally suitable (S3) in soils of;

- Wadi bottom for wheat, barley, cotton, sorghum, sunflower, onion, banana, guava and mango covering about 8.2% of total area (4600 feddans).
- Fans and outwash plains for maize, cotton, sesame, sunflower, alfalfa, sorghum, onion, tomato, watermelon, citrus, guava and mango covering about 23.6% of total area (13000 feddans).
- Old colluvial terraces for maize, sesame, sunflower, alfalfa, sorghum, tomato, watermelon, citrus and mango covering about 21.9% of total area (12150 feddans).

4- Not suitable (N) in soils of;

- Fans and outwash plains for wheat, barley and banana23.6% of total area (13000 feddans).
- Old colluvial terraces for wheat, barley, cotton, onion, banana and guava covering about 21.9% of total area (12150 feddans).

**Irrigation water quality**

Tow deep well water samples representing profiles 4 and 7 were analyzed according to Ayers and Westcot (1985). Chemical composition of irrigation water samples are shown in Table (7). Irrigation water samples are characterized by high salinity levels with low alkalinity hazard.

The classes of its quality are attributed as C4S1 for profile 4 and C3S1 for profile 7. Data reveal that irrigation water has low quality with non-restrictions or no problem with either limits of chloride or boron toxicity.

Table (6)

**Table (7) chemical composition of irrigation water**

| Sources of water | pH | EC | Soluble cations (mmole $L^{-1}$) | | | | Soluble anions (mmole $L^{-1}$) | | | | Boron | RSC | pHc | SAR | adj. SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (dS $m^{-1}$) | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{=}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{=}$ | (mg $L^{-1}$) | | | | |
| P.4 | 6.9 | 2.9 | 12.4 | 7.1 | 9.6 | 0.9 | 0.0 | 2.0 | 20.4 | 7.6 | 0.38 | **0.0** | **6.8** | 3.1 | 8.0 |
| P.7 | 7.3 | 2.2 | 10.2 | 6.3 | 6.1 | 0.6 | 0.0 | 1.5 | 15.0 | 6.7 | 0.41 | **0.0** | **7.3** | 2.1 | 4.5 |

## Conclusion and recommendations:

Wadi Abu Shieh is more promising for agriculture development. This due to its nearness situation of eastern portion of Nile Valley; Assiut governorate, covering about 55000 feddans and its irrigation water source is from artesian wells or River Nile.

The maximum outcome could be achieved by cultivating about 65% of the total area with olive trees. About 20% of the studied area representing wadi plain and wadi bottom units are highly suitable for olives and moderately suitable for wheat, barley, maize, cotton, alfalfa, sorghum, tomato, onion, watermelon and citrus. Whereas, about 45% of total area representing old colluvial terraces and fans and outwash plains are moderately suitable for olives and marginally suitable for maize, sesame, sunflower, sorghum, alfalfa, tomato, citrus and mango.

It could be recommended to use modern irrigation systems (trickle and sprinkler) in order to avoid land leveling processes, which lead not only to deteriorate some physio-chemical properties of soil but also to enhance its costs.

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**تقييم صلاحية الأرض للزراعة بوادي أبوشيح- محافظة أسيوط.**

**أحمد محمد عمران و عبد اللطيف دياب عبد اللطيف و ياسر ربيع امين سليمان**

معهد بحوث الاراضي والمياه والبيئة- مركز البحوث الزراعية

تقع منطقة الدراسة بين دائرتي عرض ٤٩ / ٢٦° الي ٥٦ / ٢٦° شمالا ، وبـين خطي طول ٣٠ / ٣١° الي ٤٠ / ٣١° شرقا، وتغطي مساحة ٢٣٣ كيلو متر مربع. وتهدف الدراسة الي تقسيم وتقييم صلاحية الوحدات الفيزيوجرافية للزراعة.

اثبتت الدراسة ان تلك الاراضي شبه مستويه الي متموجة السطح وذات قطاع ارضي عميق وذات قوام من الرملي الي الطميي الطيني الرملي و اللون يميل الي البني الباهت مع سيدة القوام الخشن و ارتفاع نسبة الحصي في معظم الاراضي المدروسة مع وجود بعض الاحجار في اراضي الشرفات القديمة واراضي المروحيات والسهول المجروفة. جميع الاراضي المدروسة ذات محتوي منخفض من الجبس ونسبة متوسطة من كربونات الكالسيوم مع وجود افاق جيرية في اراضي الشرفات القديمة، وتراوحت مستويات ملوحه التربة من غير ملحية الي عالية الملوحة.

و قد قسمت الوحدات الارضية لوادي ابو شيح الي:

١- أراضي الشرفات السفحية القديمة وقسمت الي:.Typic Haplocalsids, Sandy skeletal, mixed, hyperthermic

٢- أراضي قيعان الوديان وقسمت الي: .Typic Torriorthents Sandy skeletal, mixed, hyperthermic

٣- أراضي سهول الوديان وقسمت الي: .Typic Torriorthents Sandy, mixed, hyperthermic

- Typic Torriorthents, Coarse-loamy, mixed, hyperthermic.

٤-أراضي المروحيات والسهول المجروفة وقسمت الي:.Typic Torriorthents Sandy-skeletal, mixed, hyperthermic

و قد تم تقييم صلاحية اراضي الوحدات الفيزيوجرافية المدروسة للزراعة الي ثلاث درجات وهي:

١- متوسطة الصلاحية (S٢) لبعض اراضي سهول وقيعان الوديان.

٢- حدية الصلاحية (S٣) لاراضي المروحيات والسهول المجروفة وبعض اراضي سهول وقيعان الوديان.

٣- غير صالحة (N١) لاراضي الشرفات السفحية القديمة.

وقد تباينت درجات الصلاحية المستقبلية لتلك الوحدات من عالية الصلاحية لاراضي سهول الوديان يتبعها اراضي قيعان الوديان يليها المروحيات والسهول المجروفة ثم اراضي الشرفات القديمة، علي الترتيب.

بالنسبه لصلاحية الاراضي المدروسة لزراعة محاصيل معينة فقد امكن تقييم صلاحية الاراضي للزراعة المستقبلية لتحقيق أعلي عائد الي:

أ- عالية الصلاحية (S١) وتوجد في:

١- اراضي سهول الوديان لزراعة البرسيم والزيتون.

٢- بعض اراضي قيعان الوديان لزراعة الزيتون.

ب- متوسطة الصلاحية (S٢) وتوجد في:

١- اراضي سهول الوديان لزراعة القمح، الشعير، الذرة، القطن، عباد الشمس، الذرة الرفيعة، البصل، الموز، الموالح، الجوافة، المانجو.

٢- اراضي قيعان الوديان لزراعة الذرة، البرسيم، الطماطم، البطيخ، الموالح.

٣- اراضي المروحيات والسهول المجروفة واراضي الشرفات القديمة لزراعة الزيتون.
ج- حدية الصلاحية (٣S) وتوجد في
١- ارضي قيعان الوديان لزراعة القمح، الشعير، القطن، البصل عباد الشمس، السمسم ، الموز، الجوافة، المانجو.
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د- عديمة الصلاحية (N) وتوجد في.
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تم اختيار تسعة قطاعات ارضية تمثل الوحدات الفيزيوجرافية المختلفة لمنطقة وادي أبو شيح بمحافظة أسيوط لدراسة الصفات المميزه لها وتصنيف تربتها و التركيب المعدني لكلا من مكون الرمل والطين بها وتقييم مدي صلاحيتها للزراعة. وقد اشتملت الوحدات الفيزيوجرافية علي أراضى الشرفات السفحية القديمة، أراضي قيعان الوديان، أراضي سهول الوديان، أراضى المروحيات والسهول المتكونة من جرف السيول.

وقد بينت الدراسة ان تلك الاراضي شبه مستوية الي متموجة السطح، كما اظهرت تباين في بعض المظاهر السطحية مثل المنسوب وغطاء سطح الارض. وبينت الصفات المميزة لتلك الوحدات ان قطاع التربة عميق وذات قوام يختلف من الرملي الي الطميي الطيني الرملي مع لون يميل غالبا الي البني الباهت مع سيادة نسبيه للقوام الخشن وارتفاع نسبة الحصي في معظم طبقات القطاع الارضي مع ظهور بعض الاحجار في اراضي الشرفات القديمة واراضي المروحيات. وجميع اراضي المنطقة ذات نسب منخفضة من الجبس بينما اظهرت نسب متوسطه غالبا من كربونات الكالسيوم مع وجود تراكم بنسبة مرتفعه نسبيا في بعض اراضي الشرفات السفحيه القديمة ظهرت علي هيئة افاق جيرية تشخيصية .

وتراوحت قيم تفاعل التربة (pH) غالبا بين التأثير القلوي الخفيف الي المتوسط مع تباين مستويات الملوحة من غير الملحية الي المرتفعة في بعض طبقات القطاع الارضي .

وصنفت قطاعات التربة تبعا للنظام الامريكي الي عدد من العائلات تابعه لتحت رتبة Orthents كأراضي حديثة التكوين وتحت رتبة Calcids التي تطورت تحت ظروف الجفاف.

دراسة التركيب المعدني لمكون الرمل اظهرت ان المعادن الخيفية تتكون كلها تقريبا من الكوارتز مع نسبة قليلة من معادن الفلسبارات. وبالنسبة للمعادن الثقيلة كانت السيادة للمعادن الغير معتمة مع سيادة الزيركون علي المعادن الغير معتمة متبوعا بالامفيبول والبيروكسين والروتيل بتوزيع عشوائي لنسب المعادن داخل القطاع. كانت النسبة بين المعادن المقاومة بدون نظام معين مما يدل علي التطابق داخل القطاع او ان الاراضي تكونت تحت نظم ترسيب مختلفة، ونسبة معاملات التجوية ايضا لم يكن لها نظام معين داخل القطاع مما يدل علي اختلاف نظم الترسيب.

دلت نتائج دراسة التركيب المعدني للطين علي سيادة معدن الكاؤلينيت مع وجود نسبة قليلة من الايليت والسمكتيت والباليجورسكيت مع وجود اثار من الكلوريت والفيرميكوليت.

وتم تقييم مدي صالحية الاراضي بالمنطقة للزراعه المروية بعد تحديد درجة محددات التربة ومدي تأثيرها علي درجة الصالحية سواء في حالتها الراهنه او بعد عمليات التحسين الرئيسية الواجب اجرائها باستخدام نظام سايز وفرهاي (١٩٧٨)، واسفرت عن ان كل الاراضي تحت الدراسة يمكن استخدامها زراعيا بنجاح باتباع الاساليب المناسبة. ووجد بها بعض العوامل المعوقة ( المحددة) واهمها القوام وارتفاع نسبه الحصي. وتبعا لهذا النظام من التقييم فان تلك الاراضي تقع تحت درجات صلاحية تراوحت بين المتوسطة الصلاحية الي الاراضي الغير صالحه للزراعة تحت الظروف الحالية والتي يمكن تحسينها للتراوح بين المتوسطة الصلاحية الي الحدية الصلاحية. من دراسة صلاحية مياه الري وجد انها منخفضة الصلاحية.