5. SUMMARY

The objectives of this study are to find out extra promising areas for the purpose of agriculture development in a region of the Eastern Desert west of the Gulf of Suez from El Zaafarana to Ras Ghareb. The study also will serve extrapolation approache for other areas based on the correlated wide variation of terrain data in the study area. The northern part of the study area includes Wadi Araba and the mountains of calcareous rocks (El Galala El Bahariya and El Galala El Qibliya). The southern part includes the coastal areas and the highlands of igneous and metamorphic rocks. Remote sensing data of the satellites ETM 2006 and EgyptSat-1 2009 were analyzed within the Geographic Information System (GIS). This analysis aimed to delineate the promising areas for the agricultural land use from the point view of physiographic features, soil attributes and flora habitats. The results of this study are summarized as follows:

1-Digital Elevation Model (DEM)

Digital Elevation Model (DEM) was produced as GIS layout to infer many interesting associations among locations as formulating the details of the peaks in the highlands and wadis in the lowlands. Accordingly, the map reader can clarify the relationship between terrain and other required land utilization types.

2-Physiographic units

The spectral signatures of the land patterns as projected by both Enhanced Thematic Mapper (ETM) 2006 and EgyptSat-1 2009 were delineated as the following physiographic units:

(a) Dissected highlands

These dissected highlands are elevated mountains that include Gabal El Galala El Bahariayh and Gabal El Galala El Kebliayh of dissected limestone parent rock by dendritic drainage pattern. In highlands aligning the lowlands west of the Gulf, the

dissection is a resultant of the erosion action by sub-parallel drainage pattern on the basement complex rocks.

(b) Piedmonts

Piedmonts are formed at the base of a mountain range. They occur in areas of sloping surfaces having sediments that are close to the highlands and partly include areas of pediments. These pediments are the resultants of physical weathering that act on rocky surfaces.

(c) Bajadas

Bajadas are prominent features aligning the sides of wadi Araba where the mountain stream runs to flatter surfaces at the front of a mountain system. It is a depositional broad slope of debris spread along the lower slopes of mountains by descending streams that form several alluvial fans in coalescing patterns. They have gently sloping gullied and gravelly surfaces.

(d) Alluvial terraces

Alluvial terraces are old sediments of the paleodrainage actions. They were inherited from the basement complex parent rock having gullied surfaces that follow the general slopes. Dduring rather fluvial periods in relatively recent eras, these terraces represent sites which most probably were left out after regional erosion processes as a result of other later fluvial eras.

(e) Wadis

These wadis are the resultant of dissection action of the surrounding landscape as the interaction of erosion and depositional processes in the fluvial period. They receive seasonal flush flooding running through different directions in the study area within two regions as:

i- Wadis that have their alluviums from the highlands of limestone parent rocks flowing southwards and northwards from the mountains of El-Galalaa El Bahariayh and El Galalaa El Qibliayah, respectively via dendritic drainage patterns linking the main wadi of braided system in Wadi Araba.

ii- Wadis, that have their alluviums from igneous and metamorphic parent rocks, are draining eastwards within watersheds of a sub parallel drainage pattern. They run generally from west to east joining many secondary wadis in the lowlands, which finally link the sediments in the main wadis of braided system. These braided wadis flow towards the Gulf of Suez crossing terraced landscape, deltaic plains and marine sediments.

(f) Deltaic plains

Deltaic plains are identified in the range of coastal environments aligning the shoreline with curved fronts. They have almost flat surfaces but are locally separated from that shoreline by the marine sediments. The deltaic plains that were derived from the limestone parent rocks have relatively small areas compared with those deltaic plains of the basement complex parent rocks.

(g) Marine sediments

Marine sediments are mainly deposited by sea water due to wind, waves and currents. They were formed in elongated separate strips along the shore line. These sediments are dominated by chalk concretions which were most probably derived and transported from the coral reefs.

3- Soil series

Eight tentative soil series were formulated and established to represent the different physiographic units considering the range of characteristics that realize establishment of these soil series as members within the family level. Four series belong to Aridisols and four belong to Entisols.

(a) Soil series of Aridisols are:

i- Galala gravelly sandy loam, gently sloping 1.5 to 2.5 percent in bajada-natural vegetation. The soils are very deep, well drained formed in alluvium of mainly limestone parent rocks. (*Loamy skeletal, mixed, hyperthermic. Typic Haplocalcids).*

ii- Shokair loamy sand, almost flat 0.5 to 1.0 percent in marine sediments-natural vegetation. The soils are moderately deep, poorly drained in mixed parent materials (*Sandy, carbonitic, hyperthermic, Calcic Aquisalids).*

iii- Tinasib gravelly sandy loam, gently sloping 2.0 to 3.5 percent slope, in alluvial terraces. The soils are very deep, well drained alluvium, mainly derived from igneous and metamorphic parent rocks. (*Loamy skeletal, mixed, hyperthermic, Typic Calcigypsids).*

iv- Zaafarana gravelly sandy loam, nearly level 1.0 to 1.5 percent in deltaic plain. The soils are very deep and well drained derived from limestone parent rocks (C*oarse loamy, carbonatic hyperthermic, Sodic Haplocalsids).*

(b) Soil series of the Order Entisols are:

i- Abu Had gravelly loamy sand, nearly level 1.5 to 2.5 percent in wadis-vegetated. The soils are very deep and somewhat excessively well drained alluvium of igneous and metamorphic parent rocks (*Loamy skeletal, mixed, hyperthermic, Typic Torrifluvents*

ii- Araba very gravelly loamy sand, nearly level 1 to 2 percent in wadis-vegetated. The soils are very deep well drained alluvium, mainly derived from limestone parent rocks *(Coarse loamy, mixed "calcareous", hyperthermic, Typic Torrifluvents*)

iii- Bakr slightly gravelly sandy loam, nearly level 1.0 to 1.5 percent in wadis-vegetated. The soils are very deep and well drained of igneous and metamorphic parent rocks (*course loamy, mixed, hyperthermic, Typic Torrifluvents*.

iv- Ras Ghareb slightly gravelly sandy loam, nearly level 1to 1.5 percent. The soils are very deep and well drained of igneous and metamorphic parent rocks (*Course loamy, mixed, hyperthermic Typic Torriorthents*).

4- Flora habitats.

Flora diversities were mapped using EgyptSat-1 data with the aid of Land Cover Classification System (LCCS) 2004. Two land cover categories were delineated as vegetated areas and non vegetated ones.

(a) Vegetated areas

These vegetated areas include (i) *zerophytes* and (ii) *halophytes.*

i- Vegetated areas of *zerophytes* are characterized as follows:

- Very open tall forbs of Bean-caper (*Zygophyllum coccineum*)*;* Edhress (*Zilla spinosa*) *and* See-blite (*Suaeda vera*) were defined in wadis that include Abu Had and Bakr soil series of basement complex parent rocks.
- Very open medium tall forbs of Egyptian Henbane (*Hyosysamus muticus*) and sparse high shrubs of Karamoza *(Accacia tortilis)* were defined in wadis that inclue Araba soil series of limestone parent rocks
- Sparse short forbs of Bean-caper (*Zygophyllum coccineum)* in Bajada that includes Galala soil series of limestone parent rocks.

ii- Vegetated areas of halophytes include very open tall forbs of Sandfish (*Haloxylon saliconicum*) and sparse medium tall forbs of Salt tree (*Nitraria retusa*). They are adapted to the marine sediments that include Shokair soil series of mixed parent materials.

(b) Non vegetated areas

Non vegetated areas include the consolidated areas of bare rocks and unconsolidated ones of bare soils in piedmont, alluvial terraces and deltaic plains. Artificial surfaces of settlements and the infra structures are also included within the non vegetated areas.

5-Land evaluation

The land of the study area was evaluated for irrigated agriculture to satisfy the target of managing certain kinds and

levels of land utilization types within the different physiographic units. Land suitability sub-classes were categorized according to the limitation order that define the suitability sub-classes. This land evaluation was processed following the system of Sys (1991) which is valid for irrigation purposes in arid and semi arid regions.

The proposed land utilization types for the study area are grain crops (barley and wheat) fodder crop (alfalfa and sorghum), oil seed crops (maize, canola and olives). Some trees like date palm, guava and grapes were included.

The gross current land suitability indicates that the main limiting factors in the study area are calcareousness, texture, coarse fragments and salinity (in marine sediments). The most affected crops are alfalfa, barley, maize, sorghum, wheat and date palm which are mostly marginally suitable. The supreme land suitability was managed by the alternatives of cultivating specific crop in certain physiographic unit.

The gross potential land suitability expresses the suitability level after executing specified major land improvements. These major improvements are recommended are for salinity and sodocity problems. The alternatives of shifting each crop to be adapted with certain physiographic unit made it possible_for using the land in the study area as profitable agricultural land realizing the ability of extra crops to be more adapted to the improved land qualities.

Assessment of supreme profitable potential land suitability indicates that, the most suitable profitable utilization can be realized by managing the soils in different physiographic units for canola and olive cultivation that are highly suitable (S1) for most of physiographic units. The study area is highly promising to be introduced as canola and olive cultivation land for a mass of seed oil production.