SUSTAINABLE LAND USE PLANNING OF EL-QAA PLAIN, SOUTH SINAI, EGYPT.

By

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B.Sc. Agric. Sc. (Soil Science), Ain Shams University, 1997.

M.Sc. Agric. Sc. (Soil Science), Moshtohor, Zagazig University, 2003.

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ABSTRACT

Mohamed Mahmoud Ahmed Metwaly: Sustainable Land Use Planning Of El-Qaa Plain, South Sinai, Egypt. Unpublished Ph.D. Thesis, Department of Soil Science, Faculty of Agriculture, Ain Shams University, 2013.

Excessive population growth and lack of food security in Egypt are the driving power to increase production per unit area, expand the cultivated land, and utilize the land with respect to its potentiality in an appropriate way that will best meet the needs of the people while safeguarding resources for the future generations for sustainable agricultural development. Therefore, this study aims at integrating soil and water quality with remote sensing data and Geographic Information System (GIS) to produce a database for the land resources, and assess the sustainable land management (SLM) as a base of sustainable land use planning for El-Qaa plain, South Sinai, Egypt. Two SPOT5 images were classified using unsupervised classification technique; each class represents different mapping units. The field works was carried out as follows: The base map of the study area (obtained from unsupervised classification and visual interpretation) was used in the field to check, confirm, correct and modify the physiographic mapping unit boundaries. Four sample areas were selected to represent the different landforms. Detailed morphological description of 26 soil profiles were selected to represent the different landforms. 73 disturbed soil samples were collected for determining different soil properties, and 15 ground water samples were collected for laboratory analyses. The physiographic units were identified and classified into subgroup level on the basis of the key to soil taxonomy. The results show that soils in the study area include: Sand sheet (Low, moderate, and high altitude sand sheet) classified as Typic Torripsamments and Typic

Haplosalids. Wadis classified as Typic Torripsamments and Sodic Haplocalcids. Basin classified as Typic Torriorthents. Sabkhas classified as Typic Aquisalids, and Sodic Psammaquents. Land suitability classification was carried out to determine the current and potential land suitability for selected crops.

A spatial model was designed according to soil and groundwater quality to identify the priority areas for agriculture development within study area.

Decision Support System for sustainable land management (DSS-SLM) model was used for sustainable land management assessment on the bases of "An International Framework for Evaluating Sustainable Land Management “FESLM”. The sustainable land management constraints of the study area were identified. Sustainable land management program for sustainable land use planning has been suggested to overcome sustainability constraints or reduce them to the acceptable limits.

Key words: Land use, Remote sensing, GIS, Sustainable land management, Sustainable land use planning, South Sinai.

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1. INTRODUCTION

Egypt area is about one million square kilometer. The cultivated land is concentrated in the river Nile delta and valley, which occupy's no more than 4 % of the whole area. The rest of Egypt is desert.

The excessive population growth and the food gab are the driving power to increase production per unit area, horizontal expansion of the cultivated land, and utilize the land with respect to its potentiality in an appropriate way.

New cultivated areas have gained considerable interest and attention from both governmental authorities and scientific organizations to create and provide the basis of development plans in new areas on a sound scientific basis.

Sinai Peninsula is considered as one of the most promising areas for sustainable development. Under these circumstances, the government of Egypt decided to implement the "National Plan for Development of Sinai" (NPDS) starting from 1994. The plan aims at achieving comprehensive development of Sinai over the period from 1994 to 2017. Expanding agricultural activities is the core resolution to re-draw the demographic map of Sinai Peninsula which is urgently required to the national security of Egypt.

EL-Qaa Plain is ranked as the high priority development area in South Sinai, as it has natural resources that could facilitate establishing new societies.

Also, development of Sinai Peninsula is a strategic concept (national security issue). Population immigration should be encouraged to reformulate the demographic map of the area.

Sustainable land use planning should be studied to select and implement those land uses in order to meet the needs of the people while safeguarding resources for the future generations.

Planning of proper land use requires thorough knowledge of the natural resources, and reliable estimate of what they are capable of

producing, so that reliable predictions and recommendations can be made. In addition to production potential, the conservation of soil and water resources for use by future generations requires consideration in the present planning land development.

Land evaluation is an important step in the process of land use planning where the resources are limited. Land use programming for sustainable use causes the optimum profitability. In this frame of programming, land is evaluated and their suitability for the possible uses will be specified.

Availability of advanced technologies, for managing this significant quantity of data related to Sinai, will help the planners and decision makers to organize the information, understand their spatial association and provide powerful tools for analyzing and synthesizing information about them. Moreover, the launching of space-born satellite for gathering information about the state of land over time allows planners and decision makers to view the changes in land use and land cover during a sequence of periods. These advanced technologies are termed Remote Sensing (RS) and Geographic Information System (GIS), which are “state-of-the art” for handling geo-referenced data in digital format.

Therefore, this study aims at integrating soil and water quality with remote sensing data and Geographic Information System (GIS) to assess sustainable land management (SLM) as a base of sustainable land use planning for El-Qaa plain, South Sinai, Egypt.

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2. REVIEW OF LITRATURE

2.1. Geology.

Many authors like **Shata** (1960); **Said** (1962) and (1990); **Taha** (1968); **Bunter** (1982); **El-Refai** (1984); **Webster and Riston** (1992); **WRRI and JICA** (1999); and **UNESCO (**2004) have studied the stratigraphic succession of El-Qaa plain. Sinai Peninsula is differentiated namely on a regional base into two main geologic regions: The northern region and the southern region.

The sedimentary rocks in Sinai could be grouped into: Paleozoic (Pre-carboniferous and Carboniferous), Mesozoic (Triassic, Jurassic and Cretaceous), Tertiary (Eocene, Miocene and Pliocene) and Quaternary (Pleistocene and Holocene).

The southern region is dominated by several igneous and metaraorphic peaks (e.g. Gebel Katherina, +2641 m; Gebel Musa, +2280 m; Gebel Um Shomer, +2585 m; and Gebel Serbal, +2070 m).

Henry and Chorowicz (1986) classified the basement complex in southern Sinai into three subgroups using Landsat Satellite image:

1) Granitic and granodioritic batholiths "recent granitic". These batholiths are outcropping in a small area south Sinai and sometimes their composition makes them vulnerable to erosion.

2) High reflectance rocks: mainly granites and granodiorites "old granites". These rocks are outcropping widely and have a composition making them little resistant to erosion.

3) Low reflectance rocks; mainly volcanic and meta-sediments rocks. They are metamorphic or volcanic terrains, basic or ultra basic intrusive rocks and occupy a considerable portion of south Sinai.

The granitic hills are bounded on the western side by an elongated depression called El-Qaa plain. Its northern portion is composed mainly of fine gravels and sand and becomes coarser southward of El-Tur. Miocene rocks with patches of igneous rock outcrops are present in the southern part.

Series of elongated ridges bound El-Qaa plain. Meanwhile the western side extends from wadi Feiran to El-Tur in the following sequence: **1)** Gabal Hammam Saidna Musa; **2)** Gabal Abu Suweira; **3)** Gabal El-Qabeliate; **4)** Gabal Ikma; **5)** Gabal Araba; **6)** Gabal Abu Haswa; and **7)** Gabal Abu Durba.

Escarps of these ridges are composed of alternating beds dating back to the Cretaceous, Eocene, and Miocene ages, with pink granitic mass exposed mainly on Gabal Araba, Gabal Abu Haswa and Gabal Abu Durba. Table (2-1) shows a brief description of the dominant geological formation of El-Qaa plain.

UNESCO (2004) reported that south Sinai (in El-Tur and Hurghad sheets) comprises Igneous, metamorphic, Cretaceous and Neogene sediments which overlie basement rocks. Quaternary deposits also cover some parts.

The main land forms in this area are igneous (granites G1, G2 & G3 with ultramafic and mafic intrusions) and metamorphic mountains, major fault scarps, EL-Qaa plain and coastal plains. The rugged basement (Precambrian) mountains rise up to 2641 m a.s.l. (Jabal Katherine). They are dissected by steep-sided drainage that braid across coastal plains (**Academy of Scientific Research and Technology**, 1990). The Phanerozoic rocks commence with the Paleozoic sequence mostly composed of clastic rocks and is distinguished into several rock units based on lithological characteristics. The Mesozoic rocks occupy large areas of the western and the northeastern parts of area. They consist of a continental section of sandstones, kaolin, paleosoils and conglomerates at the base followed upwards by marine units. The Cretaceous rocks crop out above the basement rocks in the western part. They are made up of sandstone beds exposed as sporadic patches in the southern extension of EL-Qaa plain. The area shows the deposits of the Triassic and Jurassic whereas the upper marine units are of