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Geomatic Monitoring Applications to Geomorphological Changes of longitudinal Dunes and their Hazards to Agricultural Development in Suez Canal Lakes Region

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ABSTRACT

The Study Area astronomically extends between latitudes °30 ′10 and °30 ′36 N, and longitudes °32 ′15 and °32 ′35 E. The area of the region is about 1482 km2. The study seeks to identify the emergence and development of longitudinal dunes, and to examine the extent of their impact on various human uses, specifically the SCLR agricultural lands. In addition, it develops solutions to overcome the hazards of the consequence that the region suffers. The study also attempts to provide solutions that maintain the ecological balance.

This section focuses on the contributions of the study. It is divided into seven parts: (a) geographical distribution of the longitudinal dunes, (b) morphometric characteristics of the longitudinal dunes, (c) movement of the longitudinal dunes, (d) factors affecting the longitudinal dunes movement,(e) Planted Reins (f) hazards of longitudinal dunes movement on agricultural development, and (g) protection from the environmental hazards related to the longitudinal dunes movement. Each part fathoms out a particular aspect of the research in terms of the data, the procedures of analysis, and the results. As elaborated below, significant elements of each part, if any, are introduced and thoroughly explained.

Keywords: Geomatics, geomorphological changes, longitudinal dunes, agricultural development, Suez Canal lakes.

Introduction

The sand forms are among the most important geomorphological forms in the Suez Canal Lakes region (SCLR, henceforth). The area is covered by many different forms, especially the longitudinal dunes that are mostly spread along the eastern side.

The environmental hazards, caused by the sand drift in the SCLR agricultural lands, are by all means serious problems threatening human societies, as well as bringing about deterioration in the ecosystem. in an age of over – population crises and abuses of natural resources, environmental hazards could also direct the tracks of national development in terms of their ongoing and future plans This deterioration is one of the direct reasons for the occurrence of environmental hazards. Added to the disastrous nature of situation is the inability of the region to overcome such dangers.

The movement of sand dunes is an accumulation of sand that drifts down from one place to another in the direction of the prevailing winds. This movement signifies a serious threat to various human activities, especially in areas of weak ecosystems, where the vital natural resources are scarce. Therefore, the impact of wind increases the sand movement that, in turn, adds to the negative effects on both natural and human resources.

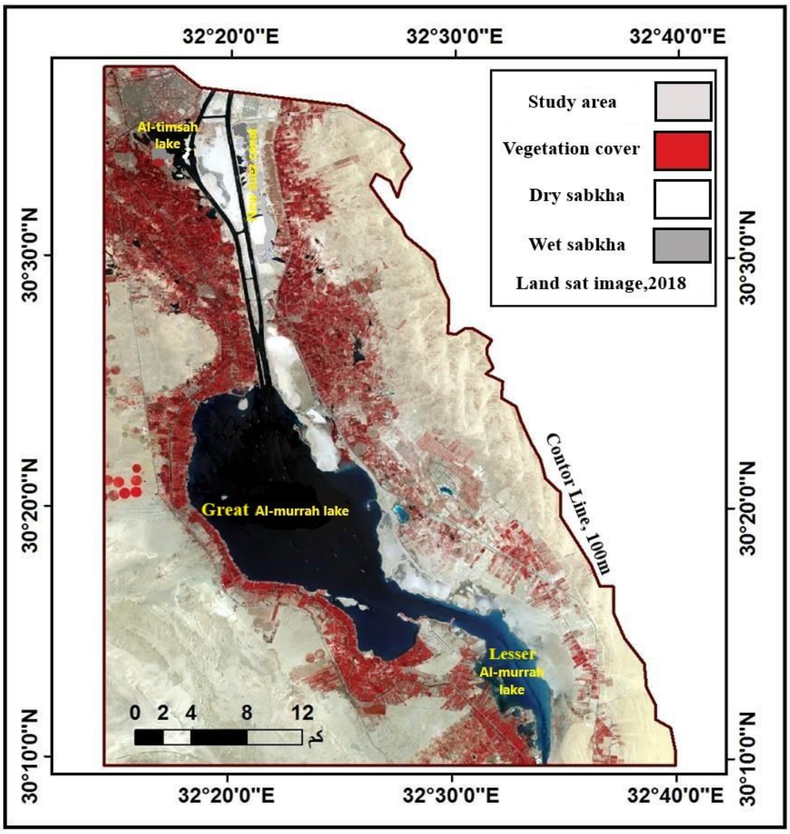
Objective of the Study

The study seeks to identify the emergence and development of longitudinal dunes, and to examine the extent of their impact on various human uses, specifically the SCLR agricultural lands. In addition, it develops solutions to overcome the hazards of the consequence that the region suffers. The study also attempts to provide solutions that maintain the ecological balance.

Analysis and Discussion

This section focuses on the contributions of the study. It is divided into six parts: (a) geographical distribution of the SCLR longitudinal dunes, (b) morphometric characteristics of the SCLR longitudinal dunes, (c) movement of the SCLR longitudinal dunes, (d) factors affecting the SCLR longitudinal dunes movement, (e) hazards of longitudinal dunes movement on agricultural development in the SCLR, and (f) protection from the environmental hazards related to the longitudinal dunes movement. Each part fathoms out a particular aspect of the research in terms of the data, the procedures of analysis, and the results. As elaborated below, significant elements of each part, if any, are introduced and thoroughly explained.

The Study Area astronomically extends between latitudes °30 ′10 and °30 ′36 north, and longitudes °32 ′15 and °32 ′35 east. The region geographically extends from the north of Al - Timsah Lake to the South of the Lesser Al-Murrah Lakes. It is bordered to the east by the 100 m contour line, and to the west by 15′ 32º east longitude (see Figure 1). The study area includes three lakes: (a) Lake Al -Timsah, (b) the Great Al-Murrah Lakes, and (C) the Lesser Al-Murrah Lakes, north to south respectively. The area of the region is about 1482 km^2.



Source: the researcher’s findings are based on the” Land Sat ETM” Satellite images, in 2018.

Figure 1: Geographical Location of the Study Area

The present study has relied on the following sources:

- **Field study:** related to the main sources of data collection (i.e., morphometric properties and samples of mechanical analysis), and of photographing;

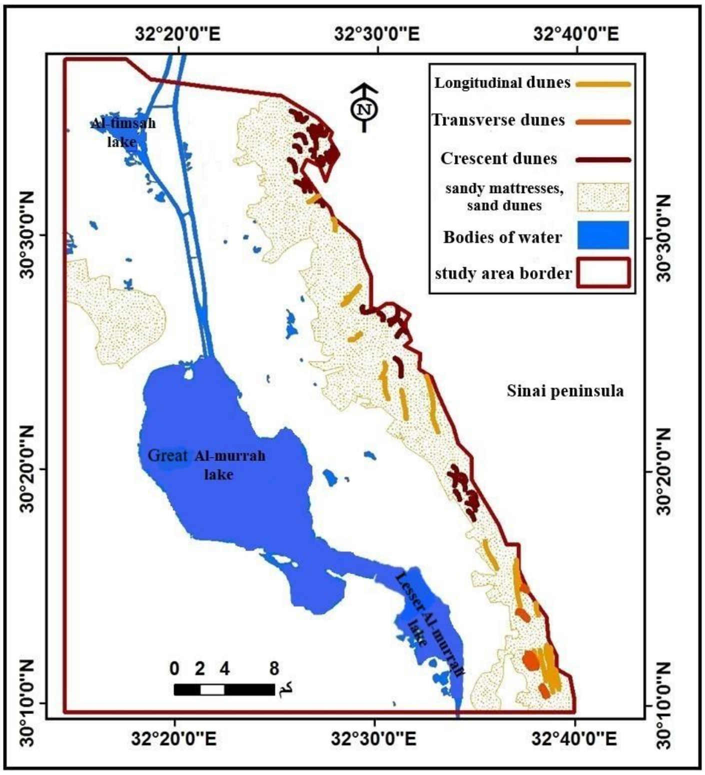
- **Satellite visuals:** related to Landsat ETM in 1995 and 2018; and

- **Topographic maps:** represented by Scale 1: 50000 in 1996 and 2006, which is issued by The Egyptian Survey Authority (ESA).

I. Geographical Distribution of the SCLR Longitudinal Dunes:

Longitudinal dunes are among the significant geomorphological Features in the SCLR, as they are formed by winds. The researcher finds that when sand grains reach a low basin region, the coarse grains are deposited on the bottom of the basin, forming the first layer (Cornish, 1900, p. 30). That formation represents an environmental threat to the center of population settlement, road infrastructure, agricultural reclamation areas, and all development projects.

The density of the longitudinal dunes increases in the Northeast direction of the wind to Al-Timsah Lake and in the Southeast direction of the Lesser Al-Murrah lakes, while it decreases in the east of the Great Al-Murrah Lakes and Northeast of the Lesser Al-Murrah Lakes (see Figure 2). The flatness of surface in the direction of the wind and the absence of topographic obstacles, which impede the movement of the dunes, are the main reasons for that density. Al-Murrah and Al-Timsah Lakes help to raise the ratio of the underground water to the surface. Thus, they stabilize the surface layer and inhibit the source of sand that feeds the dunes, except in the southern part of the region from moving.



Source: Topographic maps are at a 50.000:1 scale, adapted from Land Sat ETM, in 2018.

Figure 2: Geographical Distribution of the SCLR Longitudinal Dunes

The human factor plays an important role in the changes that have occurred in the SCLR longitudinal dunes through resurfacing some of them to take advantage in the processes of urban expansion or in agricultural reclamation operations, and in road infrastructure. The following is an account of these ranges.

A. East of the SCLR:

This range extends from the Northeast of Al-Timsah Lake to the South of the SCLR, and is bounded to the east by the contour line 100 m. Most of the dunes of this range are of the longitudinal type, along with some crescent-shaped and transverse dunes. Thus, the east range is smaller than the western range. The number of dunes in this range is about (850)[1], in an area of 310 km^2. Hence, this is the largest section of the western range that gathers most dunes.

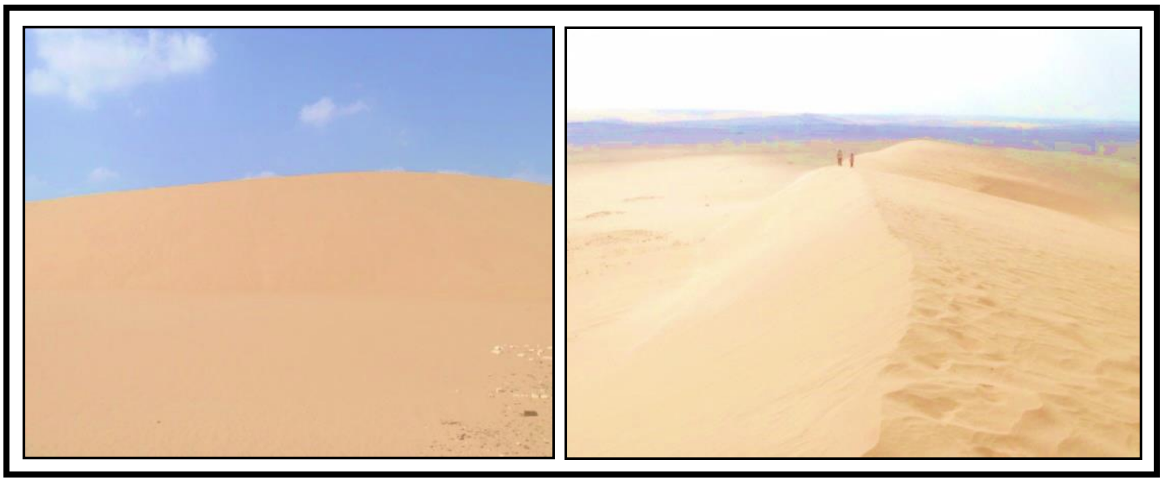
[1] The number of longitudinal dunes was calculated from" Land Sat ETM" Satellite images, in 2018.

B. West of the SCLR:

This range extends North and South of Wadi Tumilat to the west of the SCLR. The dunes of this range are of a simple longitudinal type. They are 50 dunes, spread over an area of 12 km^2. Due to its small area and the large number of population activity there, this range is considered the least assembling of longitudinal sand dunes.

II. Morphometric Characteristics of the SCLR Longitudinal Dunes:

The longitudinal dunes are the most widespread in the SCLR. They occupy a large area, and their surfaces are distinctive in form. The length of the longitudinal dunes is much more than its width, so it takes a longitudinal shape. Moreover, their sides slope in opposite directions, and meet at a sharp apex, which looks like a zigzag along the longitudinal axis of the dunes. Sometimes this type is known as the Al-Seif or Ghorod dunes. Example of these dunes are (a) the Abyssinian dune, located east of Al-Murrah Lakes, and (b) the group of longitudinal dunes, spread east of the SCLR in Al-Qatawiya area (see Picture 1).



Source: This is adapted from the Field Study.

Picture 1: Longitudinal Dunes, East of the SCLR

The lengths of the longitudinal dunes in SCLR range between 250 m and 8 km; the width, between 20 m and 200 m; and the height, between 5 m and 45 m. (Aql, 2002, pp. 7-8). The longitudinal sand dunes take the form of semi-parallel sand chains, with approximately equal distances of about 1 km between them. This type of dunes is known as regular longitudinal dunes.

Longitudinal dunes are formed in the SCLR because of the availability of several factors, such as a permanent source of the availability of large quantities of sand, a flat surface devoid of erosion, and a continuous wind in the region. First, the source of the sand here is that from the valley sediments and that from the eastern coasts of Al-Timsah Lake and Al-Murrah Lakes, where the winds transport and deposit them in different regions of the surface. Second, the nature of the surface in the SCLR is characterized by flatness, low-lying land, and lack of topography. Third, the prevailing northwest, northern and northeastern winds blow over the region, as they are in line with the axes of the dunes. Longitudinal dunes may form when spiral air currents occur with strong winds, blowing permanently from a specific and prevailing direction with their axes, generally extending parallel to these winds (Bagnold, 1941, pp. 224-299). They may form because of the encounter of winds from two different directions.

It seems that the local topography and the influence of local winds are among the most important factors affecting the union or bifurcation of longitudinal dunes. Therefore, if the slope of the surface is in the same direction of the wind, the dunes unite with each other and the opening is in the direction of the wind direction. On the contrary, when the surface level rises, the wind diverges. Thus, this leads to branching a secondary dune from the main dune body (. Desouki, 2000, p. 254). There are three types of longitudinal dunes in the SCLR.

A. Simple Longitudinal Dunes:

These dunes consist of one small straight or wavy sandy edge with two asymmetrical slopes. They are almost parallel, and their height ranges between 8 m: 18 m, while their length varies between 200 m: 2 km. Their width ranges between 20 m: 80 m. They are located at the South and East of the Great Al-Murrah Lake.

B. Composite Longitudinal Dunes:

Composite longitudinal dunes consist of two or more overlapping edges, forming regular vertical peaks. They are longer, wider, and higher than simple longitudinal dunes. Yet, their width is comparatively less than that of simple longitudinal dunes. Their height ranges between 40: 20 m, while their width is between 150: 40 m, and their length is between 300 m: 5 km. They spread Northeast of Timsah Lake and of Al-Murrah Lakes.

C. Complex Longitudinal Dunes:

They unite in a single main longitudinal dune, on which other types of dunes are found or joined together (khedr, 2005, p. 99). This type is characterized by the steep and sinuous peak line. Its height ranges between 45:30 m, and its length is about 8 km.

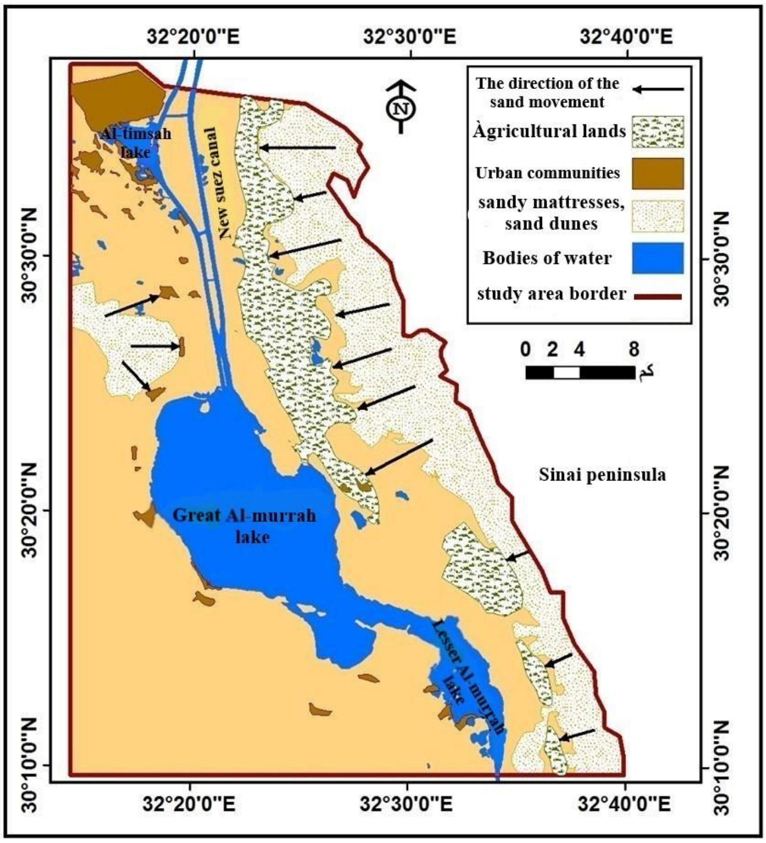
III. Movement of the SCLR Longitudinal Dunes:

The analysis of satellite visuals and the field study provide the following:

- From 1995 to 2018, the rates of sand dune movement range between 0.5 m/year and 80 m/year, with an average of 20 m/year.

- Due to the increase of wind speed and its ability to transport sand, the average movement of sand dunes in the east of the region is 12.6 m/year, which gradually increases towards the south to reach 15 m/year North of Wadi Capri.

-Due to the northwest wind blowing during Spring at a rate of up to 18.6 m/year, movement rates vary during the year from one dune to another and from one season to another. As a result, Spring is the highest season in rates of sand movement. On the other hand, due to the rainfall that works to bind sand grains together, the sand movement rates decrease in Winter.



Source: Topographic maps are at a 50.000:1 scale, adapted from Land Sat ETM in 2018.

Figure 3: Directions of Sand Movement over the SCLR

IV. Factors Affecting the SCLR Longitudinal Dunes Movement:

A. Size of Longitudinal Dunes:

There is an inverse relationship between the size of the sand dune and the distances that the dune moves. In addition to the height of the dune as one of the most important dimensions that can represent the size of the dune, small dunes move faster than large dunes (Imbabi, Ashour, 1985, p. 156). As the height of the dune increases, its size increases, and thus results in a decrease in the distance it moves at a greater rate than the increase in its height. The increase of the dune height, therefore, leads to an increase of the dune dimensions (Imbabi, Ashour, 1985, p. 161). The average movement of small-sized dunes in the east of the region is 18 m/year, while large-sized dunes have an average movement of 9 m/year.

B. Wind Speed and Direction:

In spring and summer, the north and northwest winds blow, while in winter and autumn, the south and southwest winds blow. Wind is one of the most crucial factors that directly affect the movement of sand dunes. The higher the wind speed is, the greater its ability to carry large amounts of sand for longer distances proves. The study shows that north and northwest winds are the prevailing winds, and that they are responsible for carrying sand to other areas. So, the study area is one of the most exposed areas to sand drift, this is due to the average wind speed of about 13.9 km/hour in year.

C. Humidity and Rain:

Moisture works to saturate the surfaces of sand dunes with water; therefore, it reduces the movement of the transported sand. In addition, water seeps between the sand grains as the rain falls, resulting in the cohesion of those grains in the dunes. This makes them need strong winds with high speeds to be able to carry and transport these grains. As a result, both the humidity and the amount of rain affect the movement of sand dunes in the SCLR. Besides, rainfall affects the growth of plants on the surfaces of the dunes, which also work to bind the sand grains to the dunes and reduce the ability of the wind to carry that sand. Consequently, it reduces the movement of sand dunes, as seen in the sand dunes east of the SCLR, where both moisture and vegetation cover reduce the movement of sand dunes.

D. Relative Positions of the Longitudinal Dunes:

Relative locations are the distances and directions between the longitudinal dunes. The shorter the distances between the sand dunes are, the greater the change in wind speed and direction is. This helps the sand dunes to merge close to each other, which in turn reduces their movement rates. On the contrary, the larger the distances between the sand dunes are, the smaller the change in wind speed and direction is. Here, the dune movement rates increases, and the size of the sand grains that make up the dune affects the dune movement rates. Greater size of the grains requires strong winds with high speeds to transport them; for the smaller the size of the grains is, the easier they are transmitted by the prevailing winds in the region.

E. Local Topography:

Local topography, on which dunes move, affects the rates of longitudinal dunes movement in the region; the flatter the surface is, the higher the longitudinal dunes movement rates are. On the contrary, the more severe the topography is, the lesser the longitudinal dunes movement rates are. The SCLR is somewhat flat, and it has a slight slope, except for the Southwestern part thereof; so, the longitudinal dunes movement rates are high on that region. Topography shape clearly and directly affects the regions, where sand accumulates. Coarse sand accumulates in the bottom of the low-level basin regions, forming the first mattress; then the fine grains of sand accumulate, forming the shape of a sand dune (Cornish, 1900, p

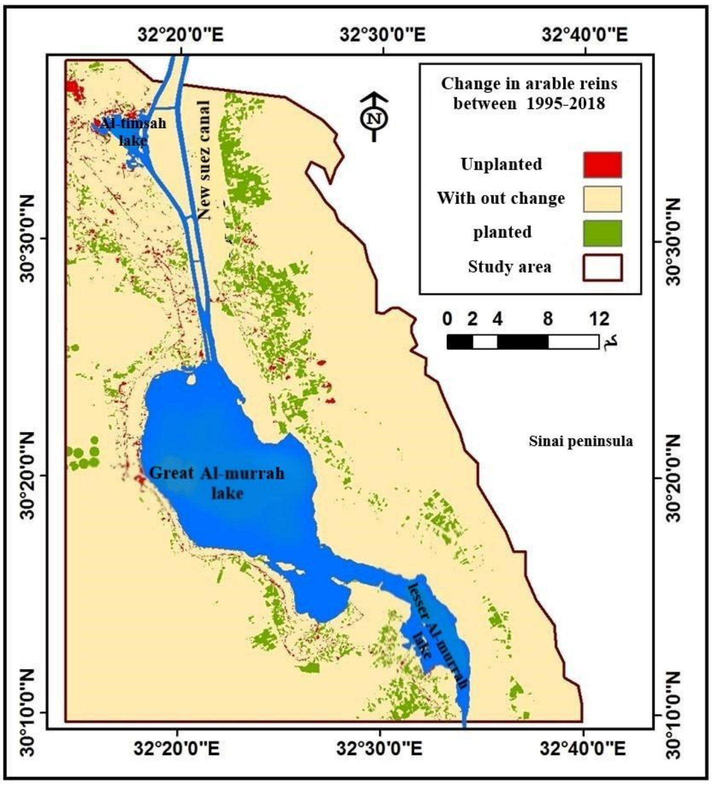
.30).

F. Human Interventions:

Human intervention is evident in the agricultural and urban expansion, and settlement of dunes for roads and irrigation infrastructure. It is also there in the sand dunes regions of the SCLR. It has caused the region to be exposed to environmental hazards. Sand drifts accumulate in projects, such as those in the East of the SCLR (e.g., Technology Valley Project & Lands Reclamation Projects).

V. Planted Reins in the SCLR:

The total area of the planted lands in the SCLR is 302,465.9 feddans[2]. The largest planted region is located in the Western of the SCLR, North of Ismailia, and the Northwest and West of Al-Murrah Lakes due to the reclamation of a large area of Wadi Tumilat for purposes of cultivation. Besides, there are reclaimed lands in the East of the SCLR, where agriculture is based on groundwater and drip irrigation system. The region is known of the cultivation of many types of grains, vegetables, and fruits. Based on the field study, it turns out that 60% of this planted region is exposed to sand drift hazards.



Source: This is adapted from Land Sat ETM, 1995-2018

Figure 4: Development of the Planted Rein from 1995 to 2018

[2] Areas have been calculated from Land Sat ETM, 1995,2018.

A. The Development of the Planted Rein:

The planted area has increased from 118,645 feddans in 1995 to 363.435 feddans in 2018. The increase rate is 244.79 feddans, so the area of the agricultural frontier and the calculated area are constantly increasing. This increase occurs because of the development projects, land reclamation and irrigation projects in particular, and the settlement of agricultural villages.

B. Large-Reclaimed Lands in the SCLR:

A total of 141,414 feddans have been reclaimed (see Picture 2). An area of 514,665 of feddans isalso planned to reclaim.[3]

Picture 2: Some Crops in the SCLR

El-Sheikh Zayed Canal, one of Al-Salam Canal's branches, is a source for irrigation water in the East of the region (see Picture 3). It is 72 km in length insofar as some sub-canals branch out therefrom to irrigate 30 thousand feddans east of Al-Murrah Lakes, and to reclaim and cultivate 40 thousand feddans east of the SC. Ismailia Canal provides it with water through Sarabium Siphon, which consists of four lined pipes. There are also two lift pump stations.

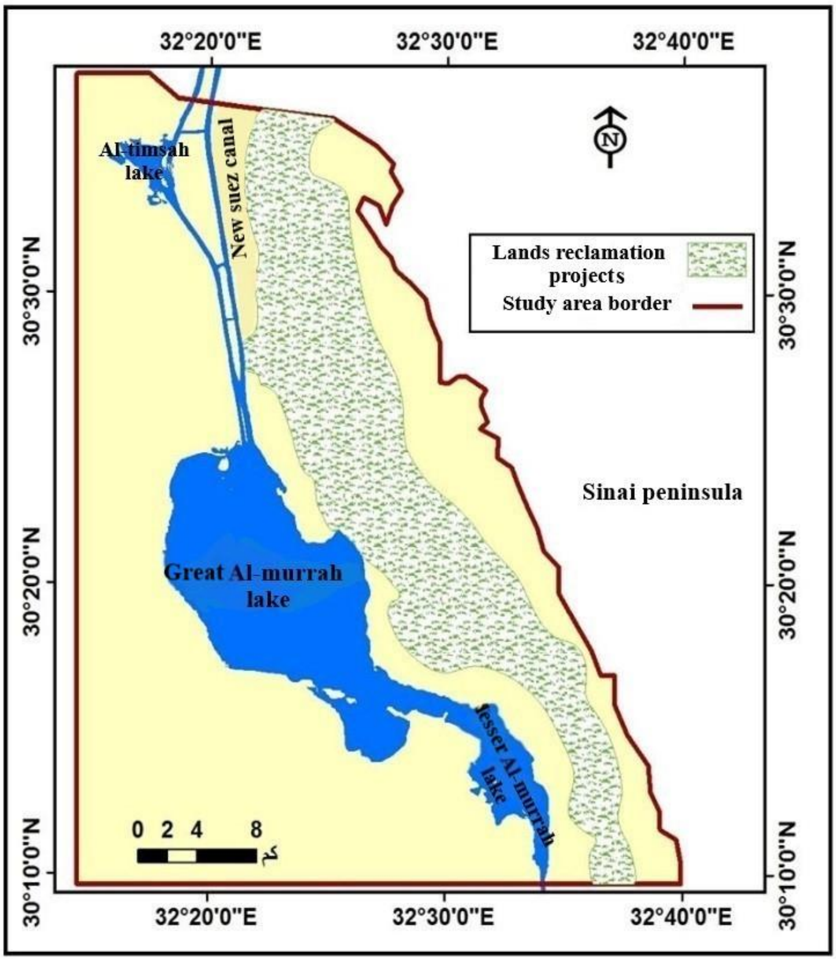
Picture 3: Sheikh Zayed Canal, East of the SCLR

[3] This is ascribed to Ministry of Agriculture and Land Reclamation in separate reports on reclaimed lands in Ismailia Governorate, 2012.

This canal has caused the SCLR to become a significant land reclamation region. It has increased the farmland and the agricultural production of vegetables and fruits. It has also changed the shape of sand dunes regions, and turned them into agricultural and urban regions in the East of the SCLR.

C. Reclaimed Regions:

a. East of Al-Murrah Lakes and Al-Timsah Lake: This region is located East of Ismailia and Al-Murrah Lakes. It is used to reclaim 30 thousand feddans in order to cultivate citrus and peanuts. It relies on Ismailia Canal and Sheikh Zayed Canal in land irrigation, as shown in Figure 5.



Source: This is ascribed to General Authority for Reconstruction Projects & Agricultural Development, Cairo, 2012.

Figure 5: Geographical Distribution of Reclaimed Lands, East of the SCLR

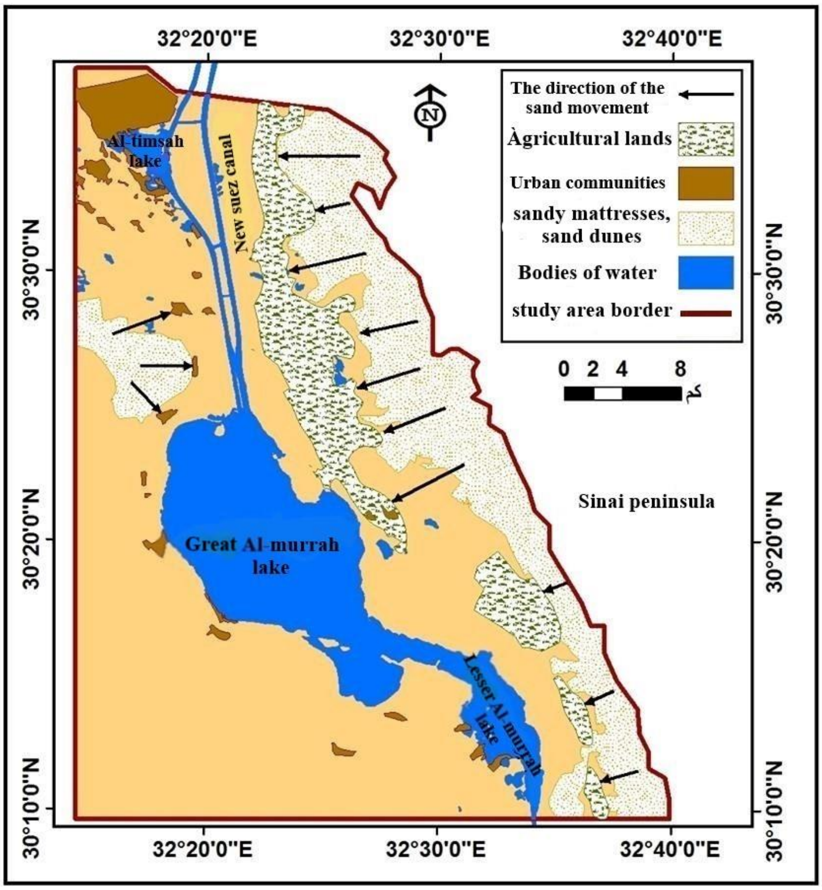
b. West Al-Murrah Lakes: This region is located West Al-Murrah Lakes. It relies on Ismailia Canal in land irrigation.

C. Al-Manayef: This region is located 20 km from the city of Ismailia and east of the Ismailia Desert Road. It relies on Al-Manayef Canal in land irrigation.

d. South Ismailia Desert Road: This region is located to the west of the region and South of Ismailia. It relies on Ismailia Canal and its branches in land irrigation.

VI. Hazards of Longitudinal Dunes Movement on Agricultural Development in the SCLR:

Based on the above analysis, it is obvious that the SCLR longitudinal dunes are moving towards the west, east, southwest, and southeast. This occurs as result of the different directions of wind blowing. Wind carries, transports, and leaves sand towards agricultural lands and urban constructions. Therefore, it threatens various human activities in the region (see Figure 6).



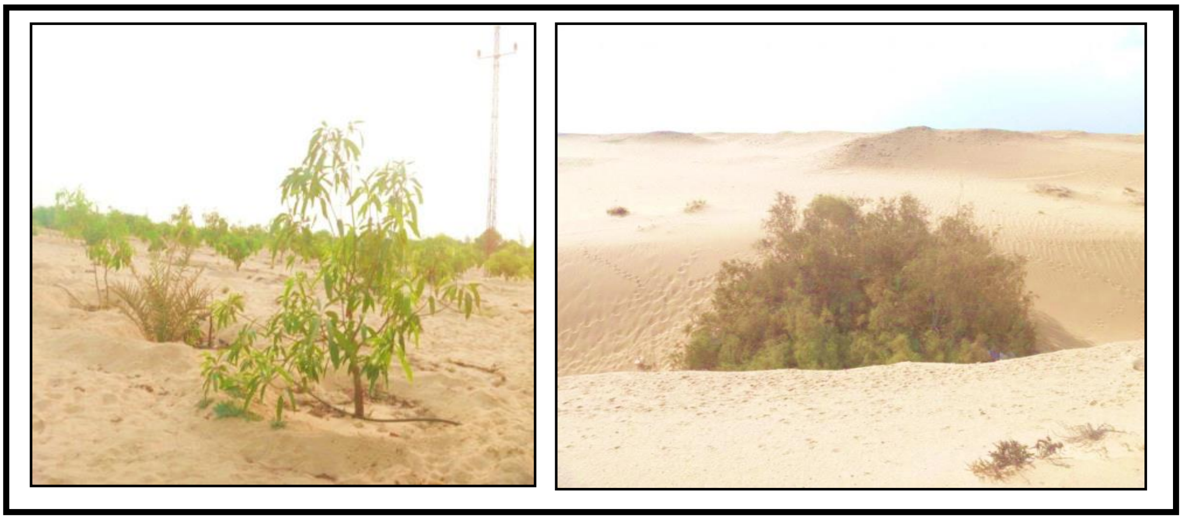
Source: This is a 1:50,000 Scale Topographic Map, adapted from Land Sat ETM, 2018.

Figure 6: Agricultural Lands and Urban Communities exposed to Sand Drift

*It is noted that 80% of the reclaimed lands is exposed to sand drift hazards. This has deteriorated the green cover, as sand dunes movement results in filling up large regions of agricultural lands with earth and depriving some agricultural villages of its productivity. The annual average of sand drift in the SCLR is 20 m. This has reduced the productivity of the soil, and made it desertification vulnerable. This is typical of the East of the Suez Canal, West of Al-Fardan, and some regions to the West of the SCLR.

Sand crawls towards the reclaimed agricultural lands (see Figure 6) to the east and West of the SCLR, especially East Al-Murrah Lakes. Since the level of agricultural lands is lower than the surrounding regions, agricultural lands prove more vulnerable to sand blasting hazards. Furthermore, the soil pores are clogged with sand, and the region is vulnerable to erosion and desertification. The soil properties, therefore, have changed, and the soil becomes coarse-sandy, light-textured, poorly fertile, and non-cultivable. The area of the agricultural lands eventually decreases in the SCLR.

This is clear as some trees are exposed to sand blasting in the West of the SCLR. Some crops, which are near to Al-Ahrar village east of Al-Murrah Lakes, are exposed to sand drift (see Picture 4). This is because wind force increases going southwards. Therefore, agricultural lands should be protected from these hazards by building barriers and fences, and planting trees around crops.



Source: This is related to the Filed Study of the SCLR

Picture 4: Sand Drift in the Agricultural Lands, East of the SCLR

Sand creeps towards irrigation networks (viz., canal networks), and impedes the agricultural expansion in the SCLR. A network of sub-canals has been excavated. The largest of these sub-canals is Sheikh Zayed Canal, east of the Suez Canal. It is exposed to sand blasting along its full length (see Picture 5). All sub-canals, branched out of Sheikh Zayed Canal, are highly exposed to sand blasting. They require to be constantly cleared because they are a main source for land irrigation.

Picture 5: Sand Drift along Sheikh Zayed Canal, East of the SCLR

As a result, the State, in cooperation with the Egyptian Environmental Affairs Agency, carries out some projects. On the one hand, sand-drift-protected agriculture projects are among the agricultural expansion ways that create an environment, suitable for plant growth and capable of giving the highest productivity of crops. This is shown in Picture 6.

Picture 6: Protecting Mango Saplings from Sand Drift Hazards, West of Kisferet

On the other hand, afforestation projects stand as an example of trees protection. Casuarina trees can be used to protect fruit trees from sand storms and severe wind that carry sand towards the agricultural lands. This is shown in Picture 7.

Picture 7: Using Arundo Trees to Protect Mango Trees in Sarabium

VII. Protection from the Environmental Hazards Related to the Longitudinal Dunes Movement:

Several different chemical and mechanical methods are used to stabilize the longitudinal sand dunes, as follows.

A. Temporary Methods:

1. The first method is done through perpendicularly spraying some chemicals on the dunes to wind direction, such as asphalt, basalt, and bitumen. Although this method does not resist erosion for long periods, it stabilizes the sand, and makes it more resistant to wind movement.
2. The second method is to transport sand (by mechanical removal), using machinery from places near to roads, various urban constructions, and crops, to other distant places; or it is to use such sand to fill ponds and swamps. However, this method is very expensive.
3. The third is that of constructing roads in high-level regions in the SCLR, constantly maintaining roads by removing sand, and putting up sings to warn citizens of roads in the places exposed to the hazards of dunes.
4. The fourth method is by using a mixture of stones, gravel, and clay to cover and stabilize the dunes in order to reduce sand drift and its vulnerability to air erosion. Picture 8 refers to the stabilization of a longitudinal dunes region, upon which a village is constructed in the East of the SCLR.

Picture 8: Stabilization of Dunes for Purposes of Construction in the East of the SCLR

5. The fifth method is to utilize rice straw, which pollutes the environment when farmers burn it, by collecting and transporting the rice straw to the regions affected by sand movement. The surface of sand, required to be stabilized, shall be covered by this rice straw and also by gravel and boulders to make it stabile on sand surface, exploiting the weight of these materials. This method completely isolates the sand from the wind. Furthermore, rice straw retains rain water, which binds sand grains together in the SCLR (Aql, 2002, p. 69).
6. This sixth method is achieved by planting some trees and plants with deep roots in regions of dunes in order to make the dunes stabilize. The region that is intended to be stabilized shall be divided into squares of different size that shall be then cultivated with such trees and plants (see Picture 9). This method can be applied in the east of Al-Timsah Lake.

Picture 9: Cultivating some Trees in Dune Regions, East of Al-Timsah Lake

7. In the seventh method, the researcher suggests to build fences and walls to obstruct sand movement, or to make squares or rectangles windbreaks over dunes surfaces,

using Arundo trees, reeds or palm fronds. This is intended to prevent sand movement towards the regions, required to be protected. It aims to intercept sand movement by winnowing; hence, the dune stops moving. The life span of this process is about five years (Mahsoub, 2004, pp. 150-151).

B. Sustainable Methods:

Sustainable methods include the steps ahead.

1. This first method is designed to carry out afforestation projects (by creating plant barriers) around urban constructions and farms near the sand dunes regions east of the SCLR. Afforestation is one of the most used methods for permanent stabilization of sand movement in the SCLR. It can be carried out by cultivating tamarisk and Ziziphus spina-christi (sidr) trees, which are resistant to drought, salinity and high temperature. Acacia, Calligonum comosum, castor and aerva javanica plants spread on the surfaces of some sand dunes. They are so huge that they highly stabilize the dunes and reduce the wind force. Stabilizing the dunes by cultivating plants preserves moisture and nitrogen, which works to improve soil properties.
2. This second method aims to conduct the appropriate scientific studies in order to constantly specify the places of sand dunes movements and reduce their hazards by preventing sand drift.
3. This third method helps cultivating many saplings with deep roots, using modern irrigation methods and techniques, in order to stabilize the movement of sand.
4. This fourth method attempts to clear the sand on the shores of the Canal.

References

Aql, M. T. (2002). Sand Movement East of Suez Canal and its Impact on Human Activity “A Geomorphological Study”, Peer-reviewed Scientific Journal, Faculty of Arts, Damanhour Branch, Alexandria University. -in Arabic-

Bagnold, R.A. (1941). "The physics of Blown Sand and Desert Dunes", Methun, London. P 265.

Cornish, V. (1900)."On Sand Dunes Bordering the Nile Delta". *Geol. Journ*., Vol.15, London.

Desouki, S. A. (1992). Geomorphology of Sandy Forms in the Basin of Wadi Al-Hajj and Al-Jaddi in Sinai. *Arab Geographical Journal,* Issue 24. -in Arabic-

Desouki, S. A. (2000). Sand Dunes East of Suez Canal “A Geomorphological Analysis”. *Journal of the Faculty of Arts in Benha*, Volume VII, Issue 7, pp. 619-696. -in Arabic-

Hajjaj, A. B. S. (2012). Geomorphological Hazards in the Area between Al-Timsah Lake and Head of Suez Gulf, (Unpublished MA Thesis). Faculty of Arts, Cairo University. -in Arabic-

Imbabi, N. S., & Ashour, M. M. (1985). Sand Dunes in the Qatar Peninsula, Part II. Publications of the Humanitarian Research Center, Qatar University, Doha.- in Arabic-

Khedr, M. M. (2005). Geomorphology of Sand Forms West of Wadi Al-Arish, (Unpublished PhD Thesis). Faculty of Arts, Ain Shams University.-in Arabic-

Mahsoub, M. S. (2004). “Dry Lands”, their Natural Characteristics and their Environmental Problems). Al-Israa Press, Cairo. – in Arabic-

تطبيقات الجيوماتكس الراصدة للتغيرات الجيومورفولوجية للكثبان الطولية

وأخطارها على التنمية الزراعية بمنطقة بحيرات قناة السويس

مستخلص

تمتد منطقة الدراسة فلكيا بين دائرتي عرض 10′ 30°، 36′ 30° شمالاً، وبين خطي طول 15′ 32°، 35′ 32° شرقاً ، وتبلغ جملة مساحتها نحو 1482 كم2، وتهدف الدراسة إلى معرفة نشأة وتطور الكثبان الطولية، ومدى تأثيرها على الاستخدامات البشرية المختلفة خاصة الأراضي الزراعية بمنطقة بحيرات قناة السويس، بالإضافة إلى وضع حلول للمشكلات والأخطار الناجمة عنها، والتي تعاني منها المنطقة، للحفاظ على التوازن البيئي بها.

ويركز هذا البحث على مساهمات الدراسة، وهم مقسم إلى سبعة أجزاء: (1) التوزيع الجغرافي للكثبان الطولية بمنطقة الدراسة (2) الخصائص المورفومترية للكثبان الطولية (3) حركة الكثبان الطولية بالمنطقة (4) العوامل المؤثرة في حركة الكثبان الطولية (5) الزمام المنزرع بالمنطقة (6) أخطار حركة الكثبان الطولية على التنمية الزراعية (7) وسائل الحماية من الأخطار البيئية المرتبطة بحركة الكثبان الطولية ، كل من هذه الأجزاء يوضح جزء مهم من بيانات هذا البحث اللازمة لاجراءات التحليل وابراز النتائج ، كما هو موضح ادناه العناصر المهمة لكل جزء وشرحها بدقة.

الكلمات المفتاحية: الجيوماتكس، التغيرات الجيومورفولوجية، الكثبان الطولية، التنمية الزراعية، بحيرات قناة السويس.