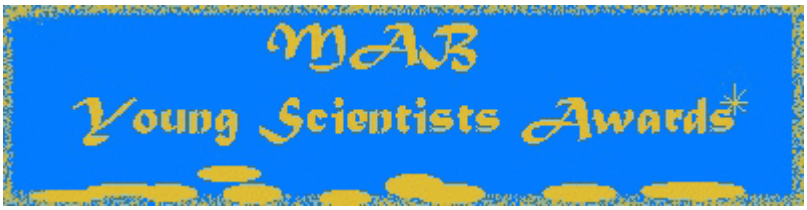

MAB Young Scientists Awards 1990

Ms Boshra SALEM

Botany Department, Faculty of Science, University of Alexandria, Moharram Bey, Alexandria
Egypt

Award research title
Detection of temporal environmental changes in arid lands by remote sensing. Case study: North coastal desert of Egypt, 18 pp, 9 pls. (1991).

Original text
English

Country & region
Egypt, the western Mediterranean coastal zone (a belt extended in an E-W direction about 500 km between Amria (20 km W of Alexandria) and Salloum (near the borders of Libya), and in a N-S direction for an average distance of about 20 km from the coast.

Objectives
i) to improve the knowledge of the environmental changes through time of the western coastal desert of Egypt, and the effect of these changes on land cover;
ii) to estimate of the rate of desertification in the area due to the temporal changes, and predicting its rate in the following decades.

Research and methods
Two representative transects were selected covering an area of about 15 x 15 km, and extends N-S from the sea shore to the inland plateau. They pass by two of the most important settlements in the coastal desert of Egypt: Burg EL Arab and Omayed (45 and 90 km west of Alexandria respectively).

The temporal changes were studied from: i) Landsat-MSS imageries of February 1978, with an spatial resolution of 80 x 80 m in 4 wavelength bands, ii) SPOT=HRV imageries covering the same area as the Landsat-MSS, but in two frames, with an spatial resolution of 20 x 20 m in 3 wavelength bands, and iii) Landsat-TM imageries,in the form of 15 x 15 km with an spatial resolution of 30 x 30 m in 6 of its 7 spectral bands.

Digital image processing work was carried out at the remote sensing unit of the Ecology laboratory in the Botany

Department

The temporal changes were analyzed comparing the available imageries of different dates. Techniques used for assessing change are: i) principal component analysis differencing, whereby information contained with the spectral data is reduced in dimensionality and then compared for two or more dates; ii) post-classification change detection whereby two or more classifications are compared and the differences noted.

Previous and further reconnaissance field visits aided by visual interpretation from aerial photographs were made to recognize visually soil configuration, land cover types and verification of classification results.

Major results

Most of the changes that have taken place in the study area are anthropogenic, those effects are very well demonstrated (e.g. the quarries which are distributed all over the coastal area, the extension of the new canal for irrigation, the new touristic villages on dunes).

There are also other changes which are seasonal, and are due to the different timing of the two imageries (e.g the amount of natural vegetation cover). This effect of the different timing of the images has caused a misclassification between classes 2 (the rain-fed system on slopes of ridges) and 7 (the inland plateau and eroded areas) in the case of the April image.

The difference between the percent cover of class 2 (rain-fed system on slopes of ridges) as-interpreted by Landsat and that as interpreted by this means that the actual cover of eroded areas as interpreted by simulated Landsat should be 51.07%-18.06% = 33.01%.

The difference between the cover of the eroded area in February 1978 recorded by Landsat-MSS (26.12%) and the corrected cover of that area in April 1987 recorded by simulated Landsat (33.01%) is 6.9%.

This difference could be attributed mainly to the process of desertification due to the impact of human activities, such as clearing of vegetation for cultivation, wood-cutting for fuel consumption and overgrazing. This percent amounts to 10 920 ha out of the 158 494 ha of the total area of land under study.

Relative to areas that are usually utilized for grazing and dry farming (classes 2, 7, 8 and 9), and excluding the salt marsh vegetation and dunes (139 649 ha), this desertified areas forms about a year, with different sun angles, the three bands of the Landsat-MSS were normalized to have the same mean, and were stretched to have the same standard deviation as the corresponding three bands of the simulated Landsat.

The resultant three normalized Landsat bands and the corresponding three bands of the simulated Landsat were then used to produce three different images for each band by

applying principal component analysis. This application was satisfactory, where the image in each of the three cases represented three difference images. The three images show almost all the differences where the temporal changes appear bright in colour and can easily be identified. However, some differences appear more clear in one particular image than in the other.

For example, the difference in the irrigated fields between 1978 and 1987 in the area between Burg El-Arab and Hammam transects show as clear while patches more in the red band difference image than in the other two difference images. Also the difference in the salt marsh in the area between Burg El-Arab and Hammam transects show more clearly in the near-infrared difference image than in the other two difference images.

If desertification proceeds at the same rate (1 213 ha/year), this would lead to the degradation of rangelands and dry farming areas in about 15 years.

In the Burg El-Arab transect the salt marshes and their associated salt marsh vegetation occupy about 37% of the total area, the ridges and their slopes occupy 25% of the total area, ploughed fields for rain-fed cultivation, and irrigated cultivations occupy 15.63% and 10.63% of the total area respectively, while dunes occupy only 4.12%. Excluding the salt marsh habitats and their associated vegetation, the disturbed areas due to human impact (7.57% of the total area) constitute about 16.9% of the areas normally used for cultivation either rainfed or cultivated, and areas used as rangelands. This percent amount for about 40 km2 of the transect. The disturbed areas are mainly caused by quarrying, leveling of the soil for building touristic villages, and other anthropogenic effect mentioned before.

Comparing these results with those of Omayed transect, the salt marsh habitats and their associated vegetation occupy about 8% of the total area, the saline depression and areas used for rain-fed farming crops and olive orchards occupy about 39% of the total area, dunes occupy about 2.4% while the background desert with sparse vegetation which is normally used as rangeland occupy about 30% of the total area. The disturbed areas due to human impact (about 19% of the total area) constitute about 34% out of the productive areas which are normally used for cultivation and rangelands. This percent amounts for about 81 km2 of the transect.

Combining both estimates of disturbed areas in Burg El-Arab and Omayed transects, one would say that about 121 km2 out of the total area of the two transects added together are considered to be non productive due to human impact (about 25% of both transects).

The corresponding estimate of 1987 done using SPOT-HRV is 7.8%, with 18% more about of the land disturbed in 4 years. This would amount for about 4.5 % of the land degraded each

year. If this amount is expressed in area, it corresponds to about 21 km2/year, converted to non productive areas.

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