Land Cover Change Detection and Land Evaluation of Bur Arab Region, North West Coast, Egypt

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ABSTRACT

The identification of land use/land cover (LULC) classes and their changes over time as well as land evalua
the decision makers in agricultural development planning. Burg El Arab area represents one of potential loca
future development in the north-western coast of Egypt. Supervised classification of remote sensing imagery
calculation of Normalized difference vegetation index (NDVI) as effective tools were applied to monitor th
changes in this area. Data showed that the area was subjected to significant changes in the last three decades d
increase of reclamation projects as well as industrial activities. From 1984 to 2014 the agriculture land, urban
water bodies increased by about 10%, 17.6%, and 3.6 %, respectively. This increase took place on the expense
land.

Land evaluation serves as an essential tool for land use planning. The application of MicroLEIS system to d
land capability and suitability classes in a representative area at Burg El Arab region indicate that most of the are
60%) lies in class 3 (fair capability) with minor areas (21% and 19%) in class 2 (good capability) and class N1 (
not capable), respectively. Data of land suitability classes exhibited that major area (61%) is not suitable for whea
melon, sunflower, cotton, and sugar beet. The marginally suitable area include (S3) represents 23.6% except f
where it represents only about 3.5%, while the rest of the area is conditionally suitable (S4) for all the tested cr
limiting factors which affect the land capability and suitability include erosion risk, bioclimatic deficit, slope
properties which comprise salinity, sodium saturation, texture and calcium carbonate content.

Key words: land use/land cover, change detection, Land evaluation, Burg El Arab.

INTRODUCTION

The Egyptian government has advocated development policies aimed at extending cultivated land and maximizing production of the existing agricultural land. Thus, there is an urgent need to determine the trend and rate of land cover change as well as the land capability and suitability for the developing sustainable land use planning. Using the know- how of multi-temporal satellite images and remote sensing techniques, the change in land use/ land cover (LULC) classes over a long period of time can be detected. Timely and precise information about LULC change detection of earth's surface is extremely important for better management.

The northwestern coast (NWC) region is exposed to significant spatial and temporal change in LULC, urban agriculture areas, and water bodies which essentially affect the development and management of this area.Burg El Arab area represents one of potential location for future developments in the northwestern coast of Egypt. It is subjected to regional development projects including land reclamation, establishing new factories and many economic, scientific and recreation centers.

Change detection is the process of ide
differences in the state of an object by obse
at different times (Singh, 1989). Time
accurate change detection of Earth's surface
provides a better understanding of the inte
between human and natural phenomena t
manage and use resources. Remotely sensed
imagery is the most appropriate sou
information to determine LULC change
2005), as it offers the opportunity to ass
effects of reclamation processes and prov
data needed for the development of
agricultural strategies (Pax Lenney, et al.,
In Egypt, several researcher applied d
change detection techniques to study the ch
LULC.

Bahnassy et al., (2001) assessed the ch
the vegetated cover of wadi el Natroun, we
fringe, Egypt using RS/GIS techniques
reported that the cultivated land increase
3.5% of the studied area in 1984 to 11.47%
Suliman, (2001) used the integration of
sensing and GIS technique to moni
environmental change in the west Nile delt
Egypt. He reported that some changes in coa
and the vegetated areas as well as the
Burullus Lake took place in the period from
1999. Abd El Kawy et al., (2011) ap

supervised classification to four Landsat images collected over time (1984 – 2009) for the western Nile delta. They found that approximately 28%, 14%, and 9% of barren land were changed to agricultural land in the periods 1984-1999, 1999-2005, and 2005-2009, respectively. In addition to these LULC changes, evidence of land degradation processes was observed, which were mainly due to human activities. Bakr et al. (2010) monitored land cover changes in the Bustan 3 newly reclaimed area, Egypt. The authors used multi-temporal Landsat images captured in 1984, 1990, 2004, and 2008. Temporal changes were determined using both a hybrid classification approach and NDVI in that time series. The hybrid classification results showed that this area involves four land cover classes: urban or built-up land, agricultural land, water, and barren land. Assessment carried out on the produced thematic images indicates accuracies of 94.5%–100% were achieved. From 1999 to 2004, around 62% of the area experienced land cover change. Generally, from 1984 to 2008, the area has experienced a transformation from 100% barren land to 79% agricultural land, as a result of successful land reclamation efforts. The NDVI results indicated less accuracy than hybrid classification. Hegazy and Kaloop (2015) studied the increasing rate of urbanization in Mansoura and Talkha cities in Daqahlia governorate, Egypt. The results showed that between 1985 and 2010 the built-up area has been increased by more than 30% and agricultural land reduced by 33%.

Land evaluation is a process of appraising and grouping specific types of lands in terms of their absolute or relative suitability for specific kinds of use. It is an assessment of land performance when used for specific purposes. The basic feature of land evaluation is the comparison of the requirements of land use with the resources offered by the land (FAO, 1976). The definition of land evaluation is the fitness of a given tract of land for a defined use (Sys, 1985). Generally the aim of land evaluation is to provide information on the opportunities and constrains for the use of land as a basis for making decisions on its use and management (FAO, 1993). Land evaluation is an essential tool in land use planning and any agriculture development programs. Land capability defined as "The potential of the land for use in specified ways, or with specified management practices" (Dent and Young, 1981). It is the assessment of land for using in the most widely major kind of land use. Capability classes are groups of land units that have the same degree of limitations and the risks of soil damage. Land suitability is the assessment of how suitable a particular site is for a particular use. De La Rosa, (2005) showed that suitability can be scored based on factor rating or degree of limitation of land use requirements when matched with the land qualities.

Morsy (1994) used the system which was su
by El-Fayoumy (1989) to study the land ca
at El-Bangar area and showed that the stu
was classified as class3 (Fair) and class4 (Po
MicroLEIS software has been used by Yehia
to evaluate the soil of Banagr EL-Sokk
(Egypt). He found that the dominant ca
subclasses are S2I, S2TI and S3I with soil pr
(I) and topographic conditions (T) as
limitation factors.

Khalifa (2004) studied the land suitabilit
Bostan Sector, West Nubaria using ALI
program and indicated that the field
vegetables, forage crops, and fruit tree
belonged to class S1 (highly suitable) ar
marginally suitable. Massoud (2008)
MicroLEIS program to evaluate the land
Hagger farm, West Nubaria, Egypt and fou
the land capability classes were S2
capability). She also found that the domina
suitability classes for wheat, sunflower, cor
bean, potato, melon, citrus, and peach were
and S4while it was S2 and S3 for cotton
alfalfa, and sugar beet.

Abd El-Maguid (2006) display land su
at Abis region for six crops using Mic
program and found that the most of the stu
belonged to classes 2 and 3, with very small
class 4 for wheat, cotton, corn, alfalfa, cit
sunflower.

Bakr (2003) applied MicroLEIS to e
land capability and suitability in Wadi Nagl
Garawla watersheds at Northwest coast. Sh
that suitability classes for wheat were domin
class S2, S3, and S4, while the land su
classes for olive were S2, S3, and N. Abde
and Ramadan (1995) used the FAO system
evaluation to evaluate the lands of Dabaa-Fu
at north western coast for different lan
namely, wheat, barley, and fig plantatio
concluded that the prevailing land use clas
S2, S3, and N.

Ali (2000) evaluated the soils of east M
He found that these soils belongs to S1 c
Wheat and Barely, S2 class for Wheat, Barl
Grazing, S3 class for Grazing, and N class w
not suitable. Abdel Kawy et al., 2011 fou
land capability classes in the western Nil
resulting from the developed model of ASE
El Kawy et al., 2010) were 3.96% of the
classified as Fair (C3), 68.46% is Poor (C
27.58% is Very Poor (C5). The main reason
low levels of land capability is very po
fertility. According to the suitability resu
most suitable crops to grow in the study a
alfalfa, barley, wheat, sugar beet, onion, and

Atta (2010) applied both MicroLEIS and
to evaluate soils of Abis agriculture research
at Alexandria, Egypt. She reported that highe

of capability and suitability were obtained from MicroLEIS.

This research aims to study changes in land use/land cover and its impact on the agriculture situation during different periods (1984 – 2014) in some areas of Burg El-Arab, as well as evaluating and determining the land capability and suitability for some cultivated crops in a selected area in this region.

The study area

The area under investigation is located at Burg El Arab district between latitudes 30° 50` and 30° 57` N and longitude 29° 25` and 29° 38` E. It is geographically bounded by the Mediterranean Sea to the north, the tableland to the south, El Amerya area to the east, and El Hammam area to the west (Fig.1). The study area is occupying around 482 km^2; this area was subjected to change detection studies.

The climate of studied area belongs to Mediterranean climate. It characterizes by short rainy season, long hot summer, high relative humidity, small diurnal temperature variations. Summary of the agro-meteorological data of Burg El Arab area is illustrated in table 1 (FAO, Climwat 2). The surface of the area is created mainly of various Tertiary and Quaternary sedimentary deposits (Said, 1962, Gindi and Abd-Alla, 2000). The study area is characterized by a series of three parallel Pleistocene limestone ridges ranging in elevation up to 35 m separated by shallow depressions. The Quaternary deposits constitute the main groundwater source in the area. Ridges and depressions in the Burg El Arab area control the groundwater flow pattern (Gindi, 1989). The agricultural land is mainly cultivated by barley, beans, cabbage and melon. The irrigation water source is either El Hamman canal or ground water. However considerable area is bare with few scattered natural vegetation or built up land heavy industrial activities in Burg El Arab d

MATERIALS AND METHODS

1 - Data Sources

A- Satellite images

Landsat 5, 7, and 8 satellites were used study. Six images were selected to supp selected time series analysis in this research 1987, 2000, 2005, 2011 and 2014 (U.S. Ge Survey, 2015). All data scenes were acquire clear atmospheric conditions when the we generally cloud free. Landsat 8 image acqu Dec. 2014 was selected to extract the study the change detection studies (Figure.1).

B- Topographic maps

The entire study area for change d analysis is covered by three topographic map at scale 1: 50000. The paper sheet topograph were digitized to be converted from paper digital format. The IDRISI Selva software w to convert the geographic coordinates sys Universal Transverse Mercator (UTM) coo system (zone 35).

C- Field Work and Sampling

For performing a detailed and a compre field study, a smaller area was subset from th study area for land evaluation studies According to the variations among the mapping units in the classified image, the lo of the representative soil profiles were ide Fourteen soil profiles were dug and de morphologically in the field according t (2006) and classified according Soil Surve (2010). Soil samples were collected for chemical, physical, and fertility laboratory a Five irrigation water samples from different wells and three water table samples we collected for laboratory analysis.

Table 1: Average of Meteorological data for study area region

Months	Rain mm	Min. Temp	Max. Temp	Humidity %
January	33	6.3	16.6	81
February	9	8	17.6	68
March	17	8.7	19	63
April	0	10.7	24.5	59
May	0	15	26	64
June	0	18	28.8	61
July	0	19.8	29.2	71
August	0	19.3	30.3	70
September	0	18.5	27.2	66
October	1	14.8	27.2	64
November	28	12	23	66
December	16	8.7	19.5	61
Total annual average	104	13.3	24.1	66

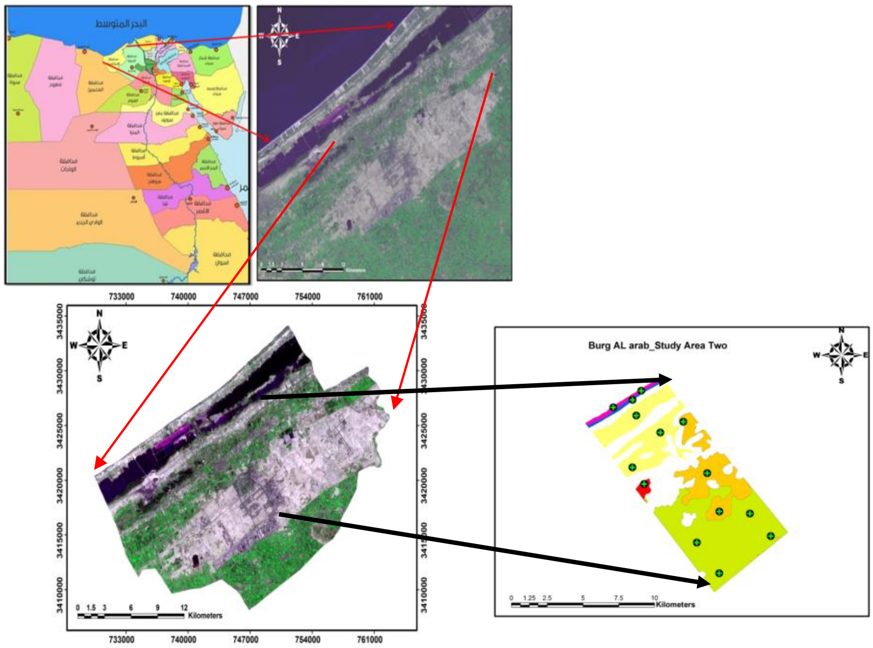

Fig. 1: Location of the study area(extracted from landsat 8 image)

2 - Image analyses

A- Image Pre-processing

All images dataset were geometrically corrected using both digitized topographic map and ground control points (GCP) using image-to-map procedure in IDRISI Selva software (IDRISI, 2012). The root mean square error (RMSE) obtained for this process was 0.35, which means that the positional error is 7.0 m deviated from the location on earth. This is a satisfactory accuracy since it is less than the assigned value of 0.5 pixel which was reported by (Lunetta and Elvidge, 1998). A combination of bands 4 (NIR), 5 (MIR), and 3 (Red) was used in this study for Landsat 5 and 7 images since it is the most useful band combinations for discrimination of land cover categories (Scepan et al., 1999). For Landsat 8, a combination of bands 7-4-2 gives the same tone colours of the 4-5-3 band combination of Landsat 5 and 7 images.

B - Image Processing

i - Satellite image classification

IDRISI image analyst extension and ArcGIS 10.1 software (ESRI, 2011) were used to carry out the image classification. The following steps were carried out to perform supervised classification for each satellite image in each chosen year separately:

Subset of study area: The area of interest was cut out (clip) from the entire image scene into a smaller more manageable file.

Identifying land cover classes*:* The land cover of study area was classified into four main classes include; water, urban area, bare lan agriculture.

Developing the training sites*:* The first supervised classification is to delineate traini in order to develop spectral signature for ea cover class. This is done by using “si development” and “MAKESIG” modules in software. A considerable number of trainii were assigned for each land cover class and through a digital topographic map, groun points, and the visual interpretation of d images.

Classification model: The Maximum Like Classification method was used for the sup classification using “hard classification” mo image processing under IDRISI Selva enviro

Calculating the area coverage*:* For eac cover class in each subset image for each y “calculating area” module was used to prod area coverage by Hectares and percentage.

Display the final classified images*:* Si classified images were exported as shape fi import to ArcGIS 10.1 for better display outputs.

ii- Normalized Difference Vegetation (NDVI) calculation:

The NDVI is a widely index that i commonly in the processing of satellit especially in agriculture development area defined by Rouse et al., (1973) as the followi

NDVI= (NIR-R) / (NIR+R)

Where, NIR is near infrared (NIR) band and R is red (R) band. They stated that, values 0 represent water and non-vegetated areas, while values >0 represent vegetation. The NDVI was calculated for each image at each date using band 3 (R) and band 4 (NIR) in each image. However, for Landsat 8 image band 4 (R) and band 5 (NIR) were used.

Six NDVI continuous images, for all dates, resulted from this step. Each image at each date was recorded to only two values: 0 and 1. Zero for the non-vegetated land and one for vegetated land. The “VEGINDEX” module in image processing was used to calculate NDVI. After producing of NDVI images for each date, the “RECLASS” module was used and the area of vegetated versus non-vegetated were calculated and represented by Hectares and percentage.

iii - Change Detection

The change detection techniques was used to monitor the changes in the land cover classes in the area over 30 years based on different time series from 1984 to 2014. The land change modeler under IDRISI Selva software was used for change analysis through differencing of image pairs. The change detection between each pairs of the selected dates (1984-1987, 1987-2000, 2000-2005, 2005-2011, and 2011-2014) was achieved to produce different change maps.

3- Laboratory Analysis: The collected soil samples were analysed for physical, chemical and fertility properties ccording to the methods described by Page et al., (1982).Chemical analyses of the collected water samples were also determined.

4 - Land Evaluation

Microcomputer land Evaluation Information System (MicroLEIS) which introduced by (De la Rosa, 2000) was used to determine the land capability and the suitability classes for wheat, melon, maize, sugar beet, sunflower, and cotton under Mediterranean climate. Maps for spatial distribution of the capability and suitability classes and the area which occupied by each clas created and displaying using Arc GIS 10.1 sc The capability and suitability classes ratin were identified according to Storie (1978) ar (1976 and 1985). The crop requirement ba the data introduced by Sys et al. (1991). C Thiessen polygons under ArcGIS 10.1 softw used to display the land capability a suitability maps.

RESULTS AND DISCUSSION

Supervised Classification

For each selected date, four land cover were determined in the study area: (water, u built-up land, bare land and agricultural land (2) represents area for each land cover clas several dates.

The results show that in 1984 the bare la agricultural land cover an area of 61% an respectively. Water and built-up land t covered around 14% only. By 1987, the bu land increased by around 8% which gained fr bare land and agriculture land as the area co by these classes decreased to about 57% an respectively. In 2000, the area covera agriculture land clearly increased by around cover about 33% (15857 ha) of the study ar bare land area coverage decreased to 42.5% the built-up land was kept almost the proportion compared to 1987 classification re

As a result of urban progress in the stu between 2000 to 2014, a substantial increas built-up land and considerable decrease in b were observed. The urban land covered an 28% in 2014 compared to 17% in 2000, w area of bare soil decreased from 42.5% to the same period. Additionally, agricultur slightly increased from about 33% to 35% o period. Between 2011 and 2014, no consi change in the land cover was observed as sh Table 2.

Table 2: The Area coverage by hectares and percentage of each land cover class at different date on supervised classified images in the studied area.

Year	Unit	Land cover classes				Total
		Water	Urban or built-up land	Bare land	Agricultural land	
1984	Hectares	1536.48	5065.65	29506.23	12088.26	48196.62
	%	3.18	10.51	61.22	25.08	100
1987	Hectares	1741.77	8801.82	27439.74	10213.29	48196.62
	%	3.61	18.26	56.93	21.19	100
2000	Hectares	3656.07	8302.32	20489.31	15748.92	48196.62
	%	7.58	17.22	42.51	32.67	100
2005	Hectares	3471.3	10442.07	18426.24	15857.01	48196.62
	%	7.20	21.66	38.23	32.90	100
2011	Hectares	3866.58	12848.49	13793.13	17688.42	48196.62
	%	8.02	26.65	28.61	36.70	100
2014	Hectares	3284.37	13554	14417.1	16941.15	48196.62

%	6.81	28.12	29.91	35.15	100

Normalized difference vegetation index NDVI

According to the NDVI values, the land cover was divided into two main classes: non-vegetated and vegetated lands. The NDVI negative values or zero represents non-vegetated land, while the values greater than zero up to one represents vegetated land (agricultural land). Figure (2) shows the area for each land class across the different studied dates.

The results showed that in 1984, 1987, and 2000; the non-vegetated land covered around 85%, 84, and 82%, respectively. In contrast, higher decrease was observed in the non-vegetated land coverage in 2005, 2011, and 2014 as it covered 73%, 70%, and 64.26%, respectively. Comparing the NDVI results with the supervised classification results, the data indicated that the vegetated land in NDVI analyses (which represents the agricultural land in the supervised classified images) was under estimation by an average of 7% for all dates. These results are consistent with the literature as many researchers proved that NDVI values for bare fields are indistinguishable from vegetated fields whenever the vegetation density is low or the fields are temporarily fallow (eg. Maselli, 2004). However, Bakr et al., (2010) reported that even though the land is vegetated, the NDVI analysis
may be classified the land as non-vegetat
data exhibited also that NDVI values obtain
Landsat 8 (2014) was in full agreement wit
obtained from supervised classification as ill
in Table 2 and Figure 2.

Land Cover Change Detection

According to the results of sup
classification and NDVI, monitoring the cha
land cover between each two dates was ac
Pairs of images from two different dates we
to produce land cover change images. F
shows the changes in the area between ea
dates for each land cover class based on sup
classified images.

Taking the whole period (1984-201
consideration, results show that the studi
exposed to wide range of gain or loss in the
different land cover classes as shown in Fi
The area of urban land, agriculture land an
bodies increased by about 17.6%, 10%, an
respectively on the expense of decreasing t
land where it loosed 31.3% as shown in T
Actually, these changes reflect the changes
farming, reclamation, demographic and urba
activities.

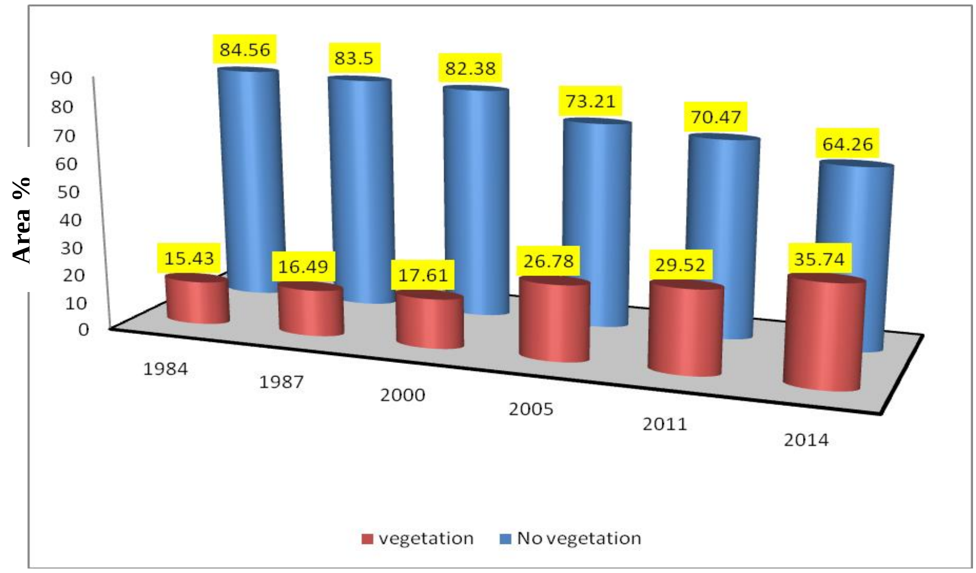

Figure 2: Area percentage of non-vegetated and vegetated land at different dates in the studied

Table 3: Loss or gain in different land use / land cover (LULC) classes from 1984 to 2014

LULC class	Gain %	Loss %	Net change %
Agriculture	22.88	12.81	+ 10.07
Urban	22.54	4.92	+ 17.62
Bare land	3.97	35.28	- 31.31
Water	4.39	0.77	+ 3.62

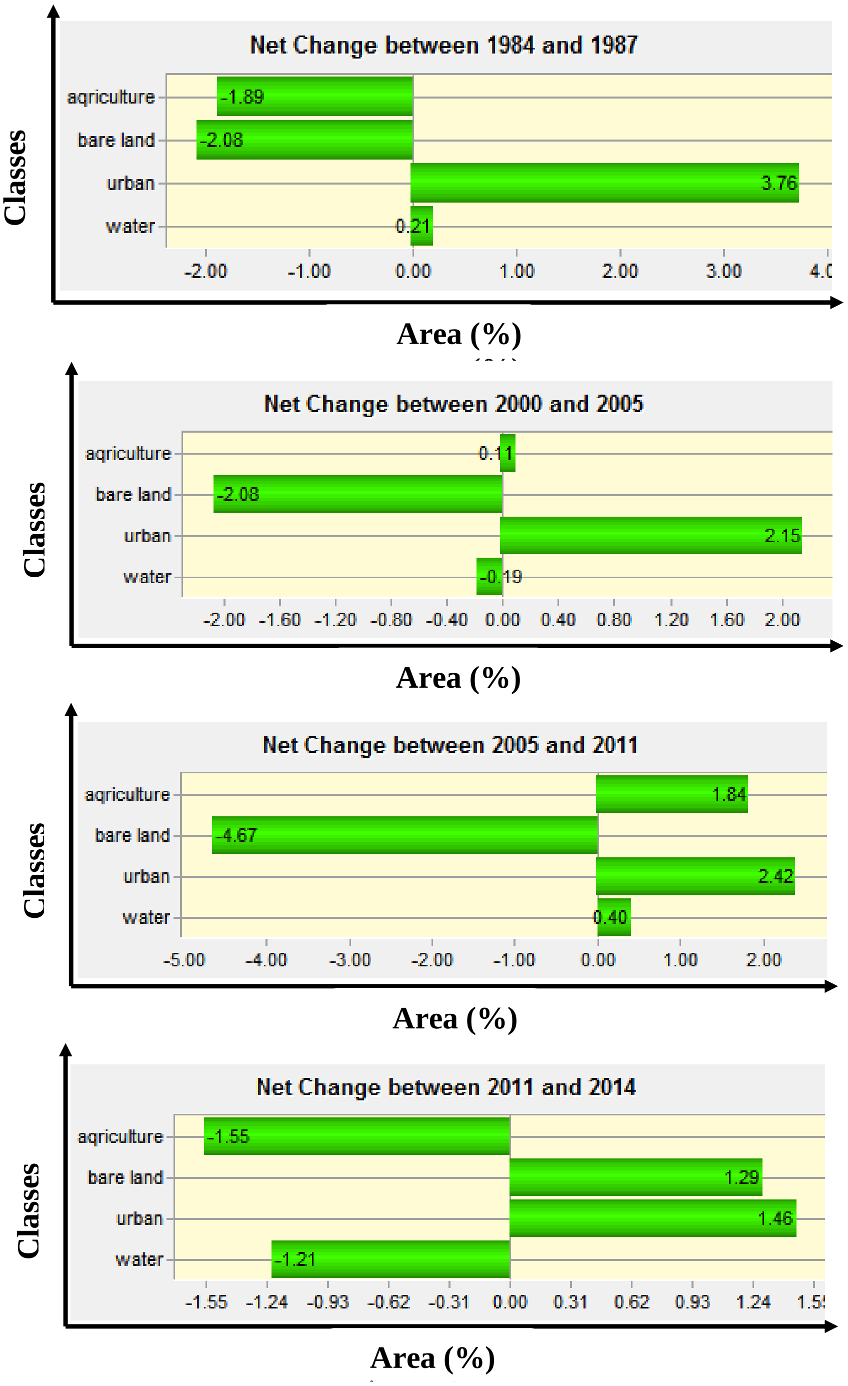

Figure 3: Net change detection (Gain or loss) in the different land cover classes between each tw

Land Evaluation

Land capability

The application of Cervatana model in MicroLEIS system using weighted average to determine the land capability of the studied area revealed that most of the studied area (59.83%) belonged to C3 (moderate capability) as illustrated in Table (4) and Fig. (5), while Class2 (Good) comprised about 21.08%. However, the area of currently not capable (N) occupied 19.08%. Data exhibited also that erosion risk, soil properties, bioclimatic deficit, slop are the dominant limiting factors. From the practical point of view, these areas are under cultivation and the growth is relatively moderate and in agreement with the data that obtained from MicroLEIS.

Land suitability

Land suitability classes were obtained for 6 field crops (Wheat, Maize, Melon, sunflower, Cotton, and Sugar beet), using Almagra m MicroLEIS software (De La Rosa, 20 determine suitability classes and the lim Data (Table 5) exhibited that major areas (6 unsuitable (NS) for the tested crops. Th revealed also that the marginally suitabl represent 23.61% except for maize w represents only 3.49%. The rest of the conditionally suitable (S4) and represents and 15.29% for maize and the other tested respectively. Figures (6 and 7) illustrate the distribution of suitability classes for whe maize, respectively. The distribution of su classes for other tested crops is almost si wheat. Regarding the limitation parameter indicate that EC, sodium saturation, textu $CaCO_3$ content are the main limiting fac shown in Fig 6 and 7.

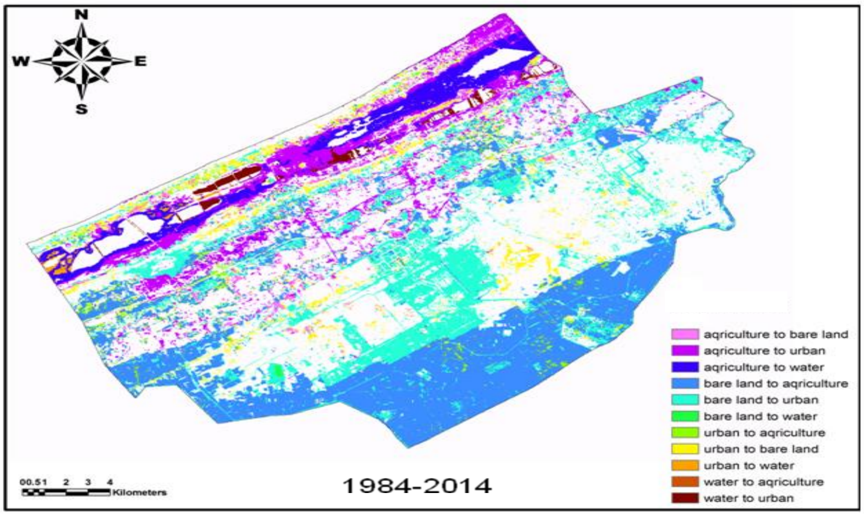

Figure 4: Change detection in land cover classes between 1984 -2014 based on supervised classifi

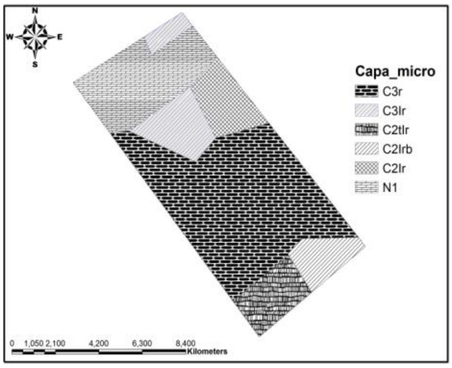

Fig. 5: Geospatial distribution of land capability classes
r: erosion risk, b: bioclimatic deficit, t: slop, I: soil properties

Table 4: Area percentage of capability classes and their limitations

Classes	Description and limitations	Area %
C3r	Fair Erosion risks	49.86
C3Ir	Fair Soil, Erosion risks	9.97
C2tIr	Good Slope, Soil, Erosion risks	7.50
C2Irb	Good Soil, Erosion risks, Bioclimatic deficit	5.79
C2Ir	Good Soil, Erosion risks	7.79
N1	Very poor (currently not capable)	19.08

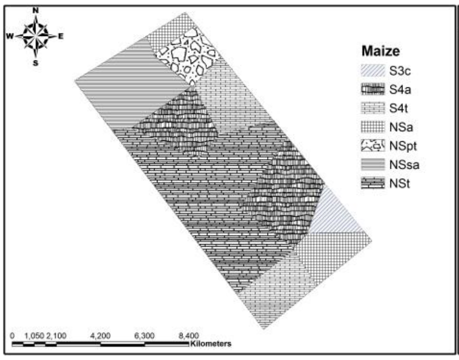

Fig. 6: Geospatial distribution of suitability classes for Maize

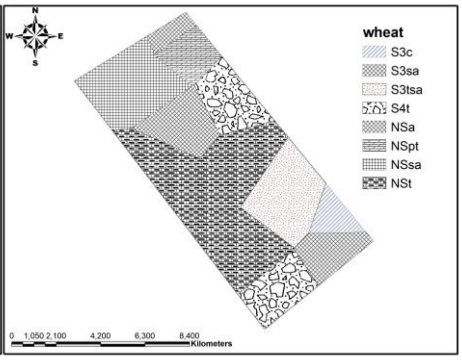

Fig. 7: Geospatial distribution of suitability classes for Wheat

c: CaCO$_3$ a: alkalinity t: texture s: salinity p: slope

Table 5: Areas percentage of suitability classes for the studied crops

crop	S3	S4	NS
Wheat	23.61	15.29	61.1
Melon	23.61	15.28	61.1
Maize	3.49	35.42	61.0
Cotton	23.61	15.29	61.1
Sunflower	23.61	15.29	61.1
Sugar beet	23.61	15.29	61.1

~~**1- Yield/ vine:**~~

~~Data in Table (1) clearly show that spraying clusters of Early sweet grapevines with GA$_3$ at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm was significantly effective in improving the yield relative to the check treatment. The promotion on the yield was accompanied with increasing concentrations of each plant growth regulator. Using GA$_3$ at 10 to 40 was significantly preferable than using Sitofex at 2.5 to 10 ppm in improving the yield. A slight and unsignificant promotion on the yield was attributed to increasing concentrations of GA$_3$ from 20 to 40 ppm and Sitofex from 5 to 10 ppm. The ma~~
~~yield was produced on the vines that recei~~
~~spray of GA$_3$ at 40 ppm but the best treatme~~
~~economical point of view was the applica~~
~~GA$_3$ at 20 ppm (since no measurable promo~~
~~the yield was recorded between 20 and 40~~
~~GA$_3$). Under such promised treatment, yiel~~
~~reached 13.6 and 14.0 kg during both~~
~~respectively. The control vines produced 9.1~~
~~kg during 2013 and 2014 seasons, respective~~
~~percentage of increase on the yield~~
~~application of GA$_3$ at 20 ppm over the~~

~~treatment reached 49.5 and 45.8 % during both seasons, respectively. The beneficial effects of GA$_3$ on the yield might be attributed to their positive action on increasing cluster weight. The promoting effects of GA$_3$ on the yield was supported by the results of Dimovska *et al*., (2011) and Abu- Zahra and Salameh (2012) on different grapevine cvs.~~

~~The results regarding the beneficial effects of Sitofex on enhancing the yield are in harmony with those obtained by Juan *et al*. (2009); Abdel- Fattah *et al*., (2010) and Al- Obeed (2011).~~

~~2- Harvesting date:~~

~~It is clear from the data in Table (1) that all GA$_3$ and Sitofex treatments had significantly delayed on the harvesting date of Early Sweet grapevines rather than the control treatment. The degree of delayness on harvesting date was correlated to the increase of the concentrations of both GA$_3$ and Sitofex. Using GA$_3$ significantly delayed harvesting date comparing with using Sitofex. Increasing concentrations of GA$_3$ from 20 to 40 ppm and Sitofex form 5 to 10 ppm failed to show significant delay on harvesting date. A considerable advancement on harvesting date was observed on untreated vines the great delay on harvesting date was observed on the vines that received GA$_3$ at 40 ppm during both seasons. GA$_3$ and Sitofex were shown by many authors to retard the release of ethylene and the disappearance of pigments such as chlorophylls and carotenoids and onest of maturity start. Also they were responsible for prolonging pre-maturity stages Nickell (1985). These results regarding the delaying effect of GA$_3$ and Sitofex on harvesting date were in harmony with those obtained by Wassel *et al*., (2007), Kassem *et al*. (2011), Abu- Zahra and Salameh (2012) and Refaat *et al*. (2012).~~

~~3- Cluster weight and dimensions:~~

~~It is evident from the data in Table (1) that treating clusters with GA$_3$ at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm was significantly accompanied with enhancing weight, length and width of cluster relative to the control treatment.~~

~~The promotion was significantly associated with increasing concentrations of GA_3 and Sitofex. Using GA_3 was significantly favourable than using Sitofex in this respect. The maximum values were recorded on the vines that received one spray of GA_3 at 40 ppm. Meaningless promotion was detected with increasing concentrations of GA_3 from 20 to 40 ppm and Sitofex from 5 to 10 ppm. The untreated vines produced the minimum values during both seasons. The positive action of GA_3 on cluster weight and dimensions might be attributed to its essential role on stimulating cell division and enlargement of cells, the water absorption and the biosynthesis of proteins which will lead to increase berry weight.~~

~~Dimovska *et al*., (2011); Abu- Zahra and S~~
~~(2012) and Dimovska *et al*., (2014).~~

~~The previous essential role of CPPU on~~
~~weight was attributed to its higher con~~
~~cytokinin when applied to plants (Nickell, 19~~

~~4- Shot berries %:~~

~~Data in Table (2) obviously reve~~
~~percentage of shot berries in the clusters c~~
~~Sweet grapevines was significantly controll~~
~~spraying GA_3 at 10 to 40 ppm or Sitofex at 2~~
~~ppm relative to the check treatment. Using G~~
~~preferable than using Sitofex in reduci~~
~~percentages of shot berries. There was a~~
~~reduction on the percentage of shot berri~~
~~increasing concentrations of GA_3 and Sitofex~~
~~was a slight reduction on such unfav~~
~~phenomenon with increasing concentrations~~
~~form 20 to 40 ppm and Sitofex from 5 to 1~~
~~The minimum values of shot berries (7.3 and~~
~~during both seasons, respectively) were reco~~
~~the clusters harvested from vines treated wi~~
~~at 40 ppm. The maximum values of shot~~
~~(12.0 & 12.5 %) during both seasons were r~~
~~on the untreated vines during both seaso~~
~~reducing effect of GA_3 on shot berries m~~
~~attributed to its important role on enhanci~~
~~division and the biosynthesis of proteins~~
~~(1985). These results were supported by the~~
~~of wassel *et al*. (2007) and Abu-Zahra and S~~
~~(2012).~~

~~5- Fruit quality:~~

~~Data in Tables (2, 3 & 4) clearly sho~~
~~spraying clusters with GA3 at 10 to 40~~
~~Sitofex at 2.5 to 10 ppm significantl~~
~~accompanied with enhancing weight, long~~
~~and equatorial of berry, total acidity%, pro~~
~~and percentages of P, K and Mg and T.S~~
~~reducing sugars %, T.S.S. / acid and~~
~~carotenoids relative to the check treatme~~
~~effect either increase or decrease was ass~~
~~with increasing concentrations of each auxin~~
~~GA_3 significantly changed these paramete~~
~~using Sitofex. A slight effect was recorded o~~
~~quality parameters with increasing concentra~~
~~GA_3 from 20 to 40 ppm and Sitofex from~~
~~ppm. From economical point of view, th~~
~~results with regard to fruit quality were o~~
~~due to treating clusters with GA_3 at 20~~
~~Untreated vines produced unfavourable eff~~
~~fruit quality. These results were true durin~~
~~seasons. The effect of GA_3 on increasing~~
~~weight and dimensions might be attributed~~
~~effect in promoting cell division and enlarge~~
~~cells, water uptake and the biosynthesis of p~~
~~Nickell (1985). These results were in conc~~
~~with those obtained by Williams and Ayars~~
~~and Dimovska *et al*., (2014).~~

~~The higher content of Sitofex from cy~~
~~surly reflected on enhancing cell division~~

~~elongation of berries Nickell (1985). These results were in agreement with those obtained by Abu-Zahra (2013) and Retamales *et al.* (2015).~~

~~CONCLUSION~~

~~Treating Early Sweet grapevines once when the average berries reached 6mm with GA$_3$ at 20 ppm was responsible for promoting yield and fruit quality.~~

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الملخص العربى

التغيرات فى الغطاء الأرضى وتقييم الأراضى لمنطقة برج العرب الساحل الشمالى الغربى – مصر

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ودراسة مدى التغيرات مع الوقت فى الغطاء الأرضى والإستخدامات وكذلك تقييم الأراضى من حيث قدرتها ومدى ملائمتها للمحاصيل المختلفة أحد الركائز الهامة فى التخطيط لتنمية منطقة برج العرب والتى تعتبر أحد الواعدة بالساحل الشمالى الغربى. وتهدف هذه الدراسة إلى رصد التغيرات فى الغطاء الأرضى والإستخدامات من عام 1984حتى عام 2014 وذلك من خلال صور الأقمار الصناعية باجراء التقسيم الموجه وحساب

باتى NDVI بالإضافة إلى تقييم القدرة الإنتاجية ومدى ملائمة الأراضى لزراعة بعض المحاصيل المختلفة
برنامج MicroLEIS

حت النتائج أن منطقة الدراسة تعرضت لتغيرات واضحة فى الغطاء الأرضى حيث إرتفعت نسبة الأراضى
والمبانى والاراضى المغمورة بالمياه بنسب 10%، 17.6%، 6و3% على التوالى خلال فترة الدراسة وذلك
اب الأراضى البور (الجرداء).

. أوضحت دراسة القدرة الإنتاجية أن حوالى 60% من المساحة متوسطة الإنتاجية(C3) بينما الأراضى الجيدة
(C2) والتى ليس لها قدرة إنتاجية حاليا(N1) تمثل 21%، 19% على التوالى. وتبين من دراسة مدى ملائمة
دراسة لزراعة بعض المحاصيل أن 61% من المساحة غير ملائمة لمحاصيل القمح، الذره، عباد الشمس،
نجر السكر، البطيخ بينما المساحات المتوسطة الملائمة والمنخفضة جدا تمثل 23.6%، 15.3% على
محاصيل السابقة ماعدا الذره حيث أوضحت النتائج أن المساحات المتوسطة الملائمة منخفضة جدا (3.5
ا أوضحت الدراسة أيضا أن العوامل المحددة للقدرة الإنتاجية والملائمة لزراعة المحاصيل السابقة هى مخاطر
ميل السطح، العوامل الجوية، وخصائص التربة والتى تسمل الملوحة ونسبة الصوديوم والقوام ونسبة كربونات
،.

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