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A GIS-BASED TOOL FOR MAPPING A COASTAL HIGHWAY'S SENSITIVITY INDEX : A CASE STUDY OF THE MEDITERRANEAN COASTAL HIGHWAY IN EGYPT

H. A. EFFAT and M. N. HEGAZY
National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt

Abstract. The objective of this study is to assess in a qualitative and quantitative approach the mutual environmental impacts between a coastal highway and its landscape. The study aims at highlighting the efficiency of using remotely sensed data and GIS in environmental management of highways.

The construction of the International Coastal Highway that extends parallel to the Mediterranean shore of Egypt east to west, from Rafah in the East to El Salloum. The highway has its positive and negative influences on the environment. Passing through various land features such as wetlands, lagoons, sand dunes, towns, national parks and ports, the road is under pressure from rapid growth of touristic villages especially in the north-western coastal area. The existence of the highway has environmental impacts on the natural coastal environment. The coastal environment in its turn, affects the performance and functionality of the road.

A land use/land cover map (LU/LC) was produced from the Landsat ETM+data and used to provide an inventory of the sensitive areas that are liable to affected and, in need of a management plan. Buffering function was applied to detect the zones of the land cover classes that are subject to undesirable changes along a sector of the coastal highway. Those land cover zones are weighted according to their relative importance. A simple relation was developed by multiplying the land class distance-from highway and the LU/LC class relative importance. The relation quantifies the impacts of the highway on its surrounding lands, in terms of an impact index. The terrain characteristics of the landscape were studied, elevation zones, slope and aspect maps were used to produce the highway's sensitivity map. The resulting impact index is an indicator that points out the priorities for a required management plan while the highway's sensitivity map defines the zones in need of an adequate management plan.

The results indicated that the wetlands have an index of management priority of 60 in the 100 meters and an index of 50 in the 200 meters buffer zones. Water bodies score a priority index of 60 in the 100 meters buffer zone, suggesting a first priority in any control plan. Cultivated lands score a management priority index of 45 in the 100 meters buffer zone, indicating a second order priority in control plans. Environmental impact indices for any planned extensions to the existing roads that may intersect the highway have an index of 45 suggesting a high priority index necessitating urgent control actions. The limestone quarries activities surrounding the highway would certainly constitute a threat to the highway construction unless thoroughly controlled.

The elevation map shows that in the studied sector, with only some exceptions, most of the highway is located on a relatively higher elevation than its surroundings. The elevation of the highway and its neighboring landscapes range from -3 meters to 33 meters above sea level. The slope of the highway is gentle ranging from zero to 6 degrees. The result of the aspect model (slope direction) shows that most of the lands surrounding the highway and falling in the vicinity of the northern part are oriented in the northwest direction between 315 and 360 degrees in El Hammam and El Omayed sectors. This trend changes making a northeastern direction in El Alamein sector. The sensitivity map is produced to show the highway sectors of high, medium and low sensitivity.

The present study shows that the establishment of sensitivity maps with adequately chosen criteria and the estimation of management priority indices for different areas provide an indispensable guideline for highway management plans to insure sustainable development. Utilizing the potentials of remote sensing and GIS techniques in the analysis provided a wider vision for land use management and control.

Keywords: Coastal Highway, Sensitivity Index, Slope, Aspect, Land Use/Land Cover, Management Plans, Environmental Impact Assessment, Sensitivity Map, Egypt.

INTRODUCTION

Egyptian coastal areas extend more than 2500 km along the Mediterranean, Red Sea and the Gulfs of Suez and Aqaba. There are impressive land cover changes along the coastal lines and these changes are a consequence of the growth of urbanization and land reclamation activities.

The study area is located along the northern coast of Egypt between 30º 00’ and 31º 00’N and between 28º 45’ and 29º 00’ E and is bordered by the Mediterranean Sea (Fig. 1).The area is 930.8 sq.km covering El Hammam, El Omayed and El Alamein zones. The construction of the International Coastal Highway which is located parallel to the Mediterranean shoreline, is expected to cause changes in land use /land cover in the study area. A remarkable set of wetlands is located near the coast, which, include wet Sabkhas, dry Sabkhas, and Lake Maryiout splinters. Land use in the hinterland has different trends. The local people (Bedouin) living in this region utilize natural vegetation for pasturing within some scattered cultivation in the terrestrial inland (*Mohammed et al,* 2000). Some urban growth takes place around Lake Maryiout shorelines, mostly at the expense of the wetlands. A trend to future expansion and land use changes due to tourist sites and summer resorts along the coast (*Kaffas et al, 2000*) is also obvious from the imageries.

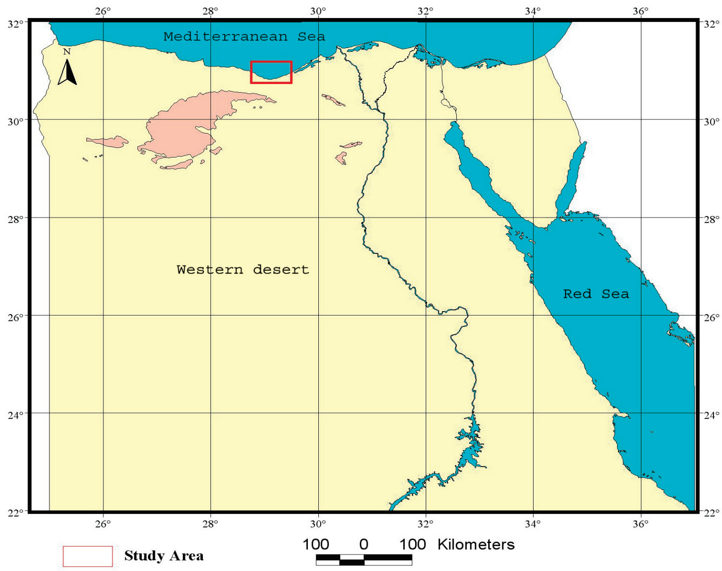

Figure 1: Location Map of the Study Area

MATERIALS AND METHODS

Data used for the present study are Landsat ETM+ Satellite image acquired in 2001 of path 178 and row 39 together with the topographic map of the study area. The topographic maps that were obtained from the Egyptian Military Survey are dated 1993 scale 1:50,000. The satellite image was geometrically rectified. The eight image covering the study area included bands. A multi-band image was layer stacked using bands 2, 4 and 7 rendered in RGB 3, 2, 1 respectively. A subset function was applied by using ERDAS imagine 8.5 software to extract the study area. The satellite image was used to capture the new International Coastal Highway in a new separate layer. Data used in this study are extracted from subsets included in a GIS database prepared in 2005 by NARSS as result of a project on: Environmental Evaluation of Land Resources in the North Western Coast of Egypt. The following map layers were used in the analysis: Contour, spot heights, roads, urban settlements, shoreline and lagoons.

1. Production of the Land Use/ Land Cover Map

The Landsat ETM+ image was processed using the unsupervised classification algorithm and given the parameters of 40 classes and 12 iterations to produce the land use/land cover (LU/LC) maps. Topographic maps, literature review and field trips were used to check and improve the classification results.

2. Quantifying and Ranking the LU/LC Classes Liable to the Highway Impacts

An attempt to quantify the current status around the highway where the road has its influence on the area is performed. The highway's influence zone was depicted in three buffer zones dimensioned as 100, 200 and 600 meters respectively. The impact of the highway is studied on the various LU/LC classes existing within those three buffer zones. The areas of each LU/LC class were calculated within each buffer zone. Each LU/LC was assigned a weight according to its relative land cover sensitivity in the study area (W). The areas enclosed in buffer 100m is subtracted from the areas enclosed in buffer 200m to get the areas enclosed in between the two buffers (areas more than 100m and less than 200m). Also the class areas enclosed in buffer 200 is subtracted from the class areas in buffer 600m to get the class areas enclosed in the area in between (more than 200 meters and less than 600 meters).

The relative importance weight assigned to each LU/LC class together with its location relative to the highway (location grade) therefore indicates the priority for a monitoring system. The highest index score indicates a high possibility for change due to the road impact. The impact index therefore points out the priorities of a needed monitoring system or management plan. The importance weights were set according to the need to preserve the current LU/LC status. This means that a change in the class will lead to an environmental deterioration relative to the current situation. On the contrary, some LU/LC classes will change to the better such as the semi-developed or the undeveloped desert areas which may change to urban or vegetated lands. In such case no importance weight was given to the impact of its change. Accordingly, relative importance weights or percentages of 25 and 20 were assigned to the wetlands and the lagoons respectively. The high values assigned are due to their importance in preserving the ecological environment in the coastal zones. The vegetated lands were given the weight of 15 as they are protected by the Egyptian law. The quarries in the area are given a value of 10 as the road will facilitate transportation of their products from a place to another. Desert areas with low density vegetation are given a weight of 10 as it is the national strategy to reclaim those lands. The urban class is given a weight of 5 as the road will increase the land prices but will also attract more urban activities which may add economic value to the area. The road terminals existing within the three buffer zones were given the weights of 15. This is due to the fact that road

terminals lying within the highway buffers are expected to extend to reach the highway causing traffic disturbance unless an efficient plan is maintained. The location grade is classified relative to the three buffers and is assigned a scale of 3, 2 and 1 respectively according to its distance from the main highway (Fig 2).
A simple relation based on the location grade and the relative importance of each LU/LC class is used to calculate the impact index. The impact index is a pointer to a needed management plan or monitoring system and is calculated as follows:

$$I = W \times L$$

Where:

I = Impact Index of highway on the LU/LC surrounding it.
W = Relative Importance Weight of the LU/LC class in percentage.
L = Location grade of the LU/LC in relation to the highway's buffer zones.

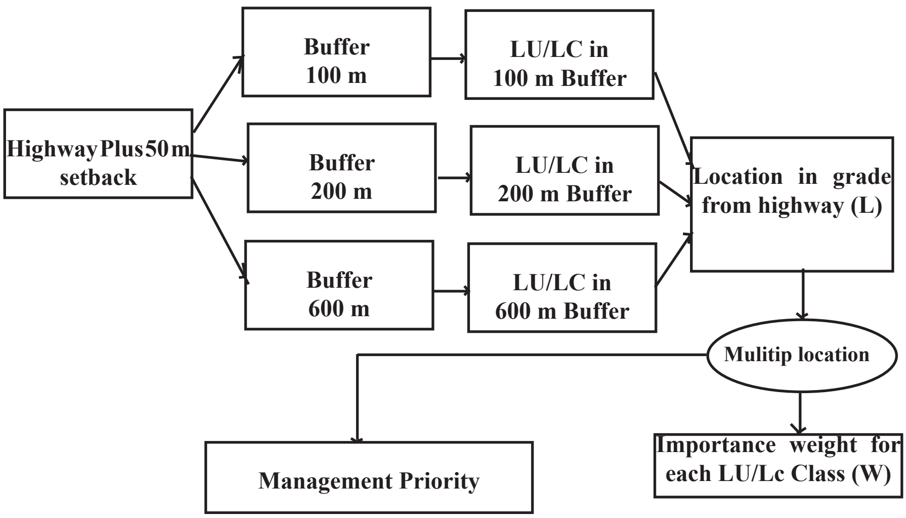

Figure 2: The model applied to calculate the management priority index for the highway's impacts on surrounding land cover categories.

3.Terrain Characteristics of the Study Area

The coastal highway is located in a coastal zone and backed by a desert environment. The study area is well known to experience the relatively highest rate of precipitation in Egypt during winter. Sand beaches and remains of sand dunes neighbor the road that runs in parallel to the shoreline. This creates environmental problems such as rain water accumulation and sand encroachment on the highway. In order to set up effective guidelines for the highway's management plan, the study's first objective was to create the highway's sensitivity map. The terrain characteristics of the study area were used to model the sensitivity.

The Elevation Factor

The contour layer derived from the topographic map was used to derive the digital maps elevation model (DEM). The elevation is a factor in the environmental management of the highway as it controls the run-off of water from the surrounding landscape. In low elevation zones, the road is subjected to precipitation problems from heavy rain. If the road is located higher than its surrounding landscape it should be more subjected to sand storms.

The Slope Factor

The slope is an important factor in road management as it affects the run-off on the highway and therefore the accumulation of rain water. The slope layer was derived from the digital elevation model.

The Aspect Factor

The aspect is an important factor in studying the prevailing wind effect on the highway and especially in sand storms.

To produce the highway's sensitivity map, the following parameters were defined:

The 600-meters buffer was used to clip the elevation, slope and aspect images in order to extract the highway's landscape in the study area. The elevation, slope and aspect were used to model the highway's sensitivity to the environmental problems due to its specific location. To subdivide the highway according to its sensitivity and the subsequent need for an environmental management plan, each of the terrain characteristic images was reclassified as shown in Fig (3).

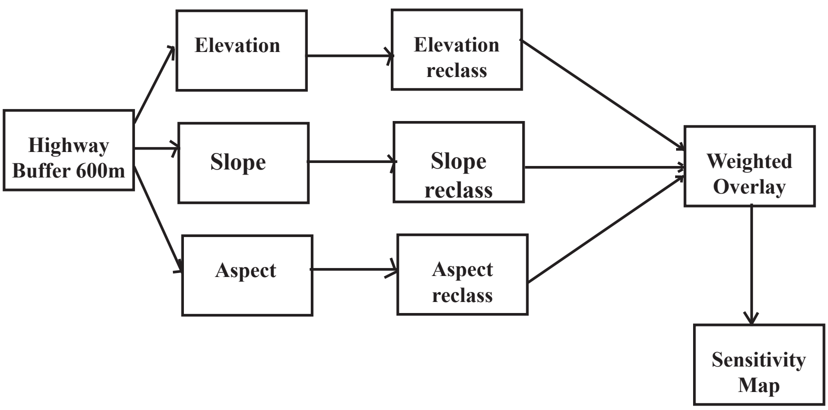

Figure 3: The model used to produce the highway's sensitivity map

The reclassified elevation, slope and aspect maps were then overlaid to produce the sensitivity map of the 600 meters buffer zone around the highway (Table 1). As the highway is located in that zone, the highway and its set back buffer was overlaid on the sensitivity map to discriminate sectors that need management against precipitation and storm sand accumulation.

Table 1: Parameters for reclassifying and ranking the terrain characteristics around the highway.

Parameter	High	Medium	Low	Rank
Elevation	-3 to 10 meters	10 -25 meters	25-33meters (asl)	30
Slope	4-7 degrees	2-4 degrees	0-2 degrees	30
Aspect	0-45 and 315-360	45-90 and 270-315	90-180 and 180-270	40

RESULTS

Production of the LU/LC Map

The classification of the Landsat ETM + image resulted in eight LU/LC classes. Those classes are mainly water bodies, wetlands, vegetated lands, urban areas, limestone quarries, desert with low density vegetation, semi developed desert areas and undeveloped desert areas. The major land cover class in the study area is composed of the undeveloped desert class covering 438.04 sq. km representing around 47% of the total area. The semi developed desert and the desert with low density vegetation were almost similar in areas ranging about 13.5% each. The vegetated land is 63.33 sq. km mostly cultivated with barely, olive and fig fields. Water bodies were 31.34 sq. km equivalent to 3.36 % of the study area mainly consisting of lagoons located south of the coastal highway. Wetlands are found in an area 15.01 sq.km equivalent to 1.61% of the study area. Those are found around the water bodies south of the coastal highway. Limestone quarries were found to be 26.16 sq. km equivalent to 2.81% most of which were in close proximity to the coastal highway. Urban areas, roads and urban bare land constituted 103.76 sq. km equivalent to 11.1% of the study area.

The classification of LU/LC shows the existence of the relatively fragile land cover classes presented mainly by water bodies, wetlands and limestone quarry concentrated around the coastal highway. (Table 2 and Figure 4).

Table 2: U/LC classes in the north -west coastal zone study area.

Class	Area, Sq. Km	Percentage
Water bodies	31.34	3.36
Wetland, vegetated	15.01	1.61
Vegetated land, fields	63.33	6.80
Urban , roads and urban bare land	103.76	11.10
Limestone quarries	26.16	2.81
Desert with low density vegetation	126.58	13.59
Desert, semi developed	126.54	13.57
Desert, undeveloped	438.04	47.06
Total	930.80	100.0

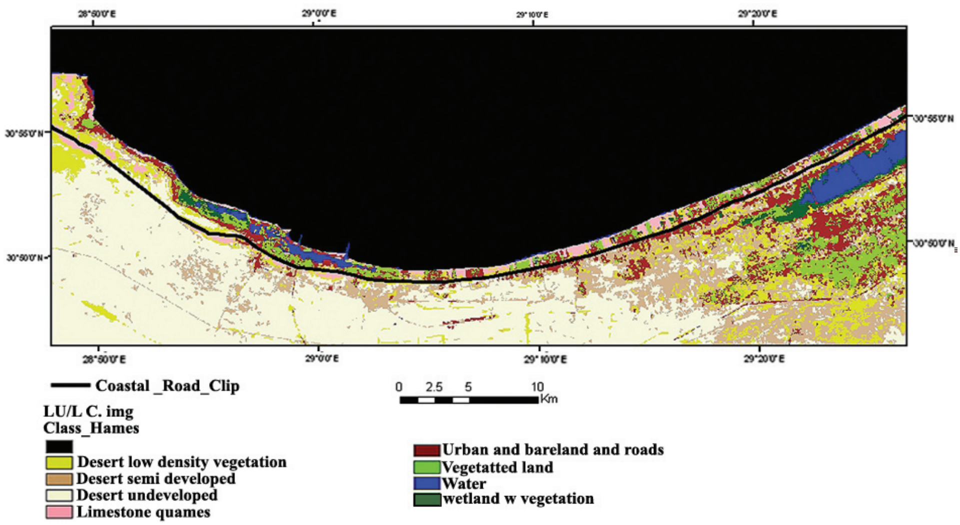

Figure 4: A map composite showing the distribution of the LU/LC classes for the study area and the portion of the International Coastal Highway passing through it.

Ranking LU/LC Classes Liable to the Highway Impacts

Applying the three consecutive buffers around the coastal highway (Figure 5), the areas of each LU/LC class were defined (Tables 3). A relative importance weight (percentage) is given to each class relative to the other classes. The results show that the water and the wetland classes have a relatively significance existence in buffer 600 amounting to 0.402 sq km and 0.517 sq km in buffer 600. Those two classes do not exist in buffer 100. The vegetated land class has a relatively strong existence in the three buffers. Vegetated areas existing in buffer 100 amounts to 1.377 sq. km, 2.745 sq. km in buffer 200 while it exists in 9.985 sq. km in buffer zone 600. The limestone quarries amounted to 1.755 sq. km in buffer 100 which is significant compared to the other classes (Figure 5). Also the limestone quarries exist in buffer 200 and Buffer 600 with areas 4.560 and 14.22 respectively. The relationship of the highway and the existing road terminals is shown in (Table 4). It is found that a number of 50 road terminals cross the three buffers reaching buffer 100. These roads (or some of them) are expected to extend to the coastal highway causing negative impacts on the road traffic flow unless efficiently designed and managed. In the study area, four roads intersect the highway. A number of 52 road terminals reach buffer 200 while 63 road terminals reach the buffer 600. Those roads are also expected to extend towards the highway. The study of the existing main roads and the coastal highway's relationship is crucial for sustainable planning and monitoring.

Table 3: The relative importance of LU/LC and their inventory in each buffer zone.

Environmental Parameter – (Land cover classes)	Importance weight of LU/LC in Percentage	Areas lying within the 100 m buffer (sq km)	Overall Areas lying within the 200 m buffer (sq km)	Overall Areas lying within the 600 m buffer (sq km)	Area lying at Distance 100-200m (sq km)	Area lying at Distance 200-600 m (sq km)
Water	20	Nil	0.025	0.402	0.025	0.377
Wetland	25	Nil	0.142	0.517	0.142	0.375
Vegetated Land	15	1.377	2.745	9.895	1.368	7.150
Urban , roads and urban bare land	Nil	8.440	13.055	28.755	4.615	15.7
Limestone quarries	15	1.755	4.560	14.220	2.805	9.66
Desert, low density vegetation.	5	3.103	7.192	20.00	4.089	12.808
Desert, semi developed	Nil	0.145	0.877	7.535	0.732	6.658
Desert, undeveloped	Nil	1.283	3.440	14.563	2.157	11.123

Table 4: Inventory, relative importance weights and location grades of the road intersections and terminals reaching or crossing the Coastal Highway.

Buffer Zone	Location Grade	Importance (Weight in Percentage)	Number of main roads intersecting the buffer zone	Number of main roads terminals reaching the buffer zone	Priority Index
Buffer 100	3	20	4	50	45
Buffer 200	2		4	52	30
Buffer 600	1		4	63	15

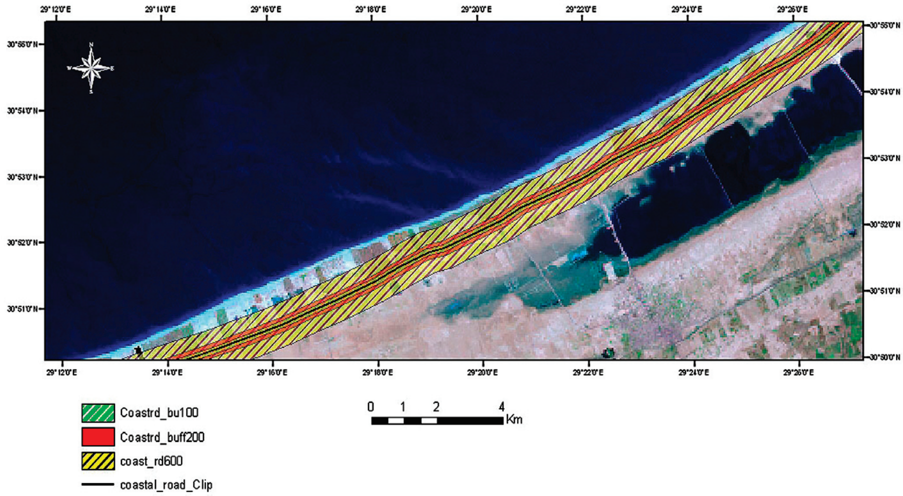

Figure 5 : A map composite showing the three buffers 100, 200 and 600 meters around the coastal road.

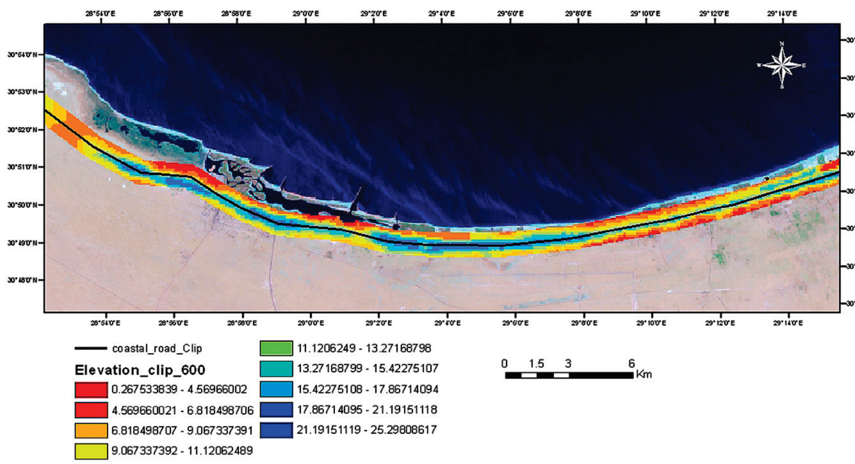

Figure 6: A map composite demonstrating a sector of the coastal highway and the LU/LC categories lying within the 600 meter buffer.

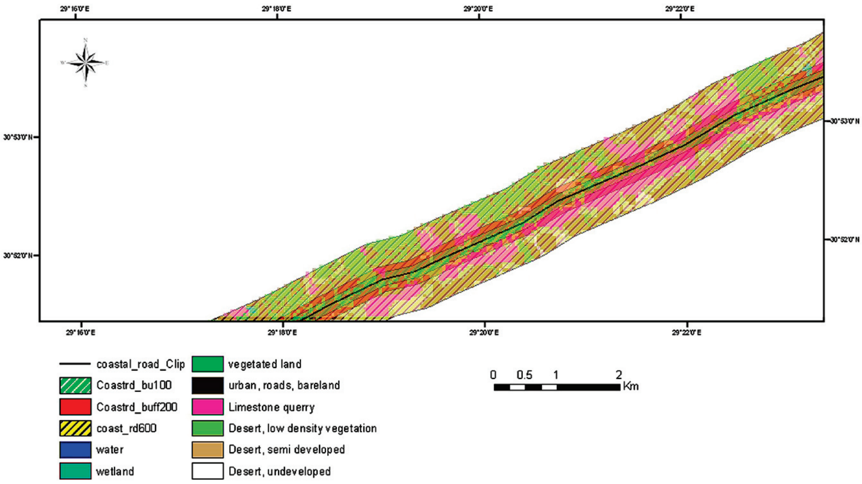

Figure 7: A map composite demonstrating a sector of the coastal highway and the LU/LC categories existing in the 600 meters buffer zone.

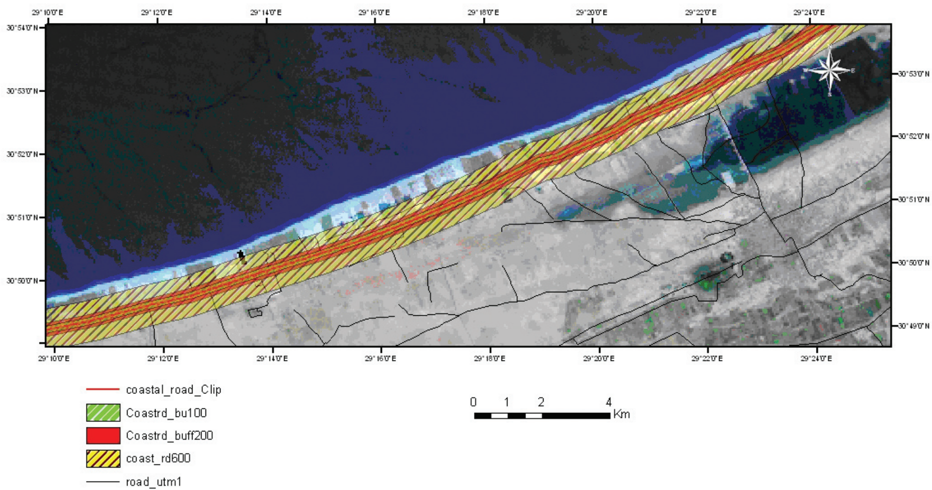

Figure 8: A map composite demonstrating a sector of the coastal road, the three buffer and the existing road terminals reaching the road buffer zone.

Applying the equation resulted in an approximate scale of priority factor for controlling the LU/LC against undesirable changes due to the highway impact on the surrounding land cover. The result is a priority index which is an indicator to the monitoring system shown in Tables (5,6,7,8) and Figure (9).

Table 5: Calculation of the Management Plan Priority Index in Buffer 100.

LU/LC	Area	Parameters		Priority Index	Expected qualitative change(due to road impact)
		Location grade	Importance		
Water bodies	Nil	3	20	Nil	Nil
Wetlands	Nil	3	25	Nil	Nil
Vegetated land	1.377	3	15	45	To urban
Urban, bare land	8.440	3	Nil	Nil	To dense urbanization
Limestone Quarry	1.755	3	15	45	High consumption
Desert (low density veget.)	3.103	3	5	15	To urban
Desert semi developed	0.145	3	Nil	Nil	To developed
Desert undeveloped	1.283	3	Nil	Nil	To semi developed
Existing Main Road terminals		3	20	60	Traffic disturbance

Table 6: Calculation of the Management Plan Priority Index in Buffer 200.

LU/LC	Area	Parameters		Priority Index	Expected qualitative change (due to road impact)
		Location grade >100<=200	Importance Weight (%)		
Water bodies	0.025	2	20	40	Dried up
Wetlands	0.142	2	25	50	Dried up
Vegetated land	2.745	2	15	30	To urban
Urban, bare land	13.055	2	Nil	Nil	Dense urban
Limestone Quarry	4.560	2	15	30	High consumption
Desert with low density vegetation	7.192	2	5	10	To urban
Desert semi developed	0.877	2	-	-	More development
Desert undeveloped	3.440	2	-	-	More development
Main roads terminals		2	20	40	Extension to reach the highway.

Table 7: Calculation of the Management Priority Index in Buffer 600

LU/LC	Area	Parameters		Priority Index	Expected qualitative change (due to road impact)
		Location grade >200≤600	Importance		
Water bodies	0.402	1	20	20	Drying up
Wetlands	0.517	1	25	25	Drying up
Vegetated land	9.895	1	15	15	To urban projects
Urban, bare land	28.755	1	Nil	Nil	Dense urbanization
Limestone Quarry	14.220	1	15	15	High consumption
Desert with low density vegetation	20.00	1	5	5	Commercial projects
Desert semi developed	7.535	1	-	-	More development
Desert undeveloped	14.563	1	-	-	More development
Main roads terminals		1	20	20	Extension to reach the highway.

Table 8: The calculated Management Priority Index for the three Buffer zones.

Buffer	Management Priority Index for Highway Landscape							
	Water	Wetland	Vegetation	Urban Roads	Quarry	Desert (low density veget.	Desert Semi developed	Desert Undeveloped
Buffer 100	-	-	45	60	45	15	N/A	N/A
Buffer 200	40	50	30	40	30	10	N/A	N/A
Buffer 600	20	25	15	20	15	5	N/A	N/A

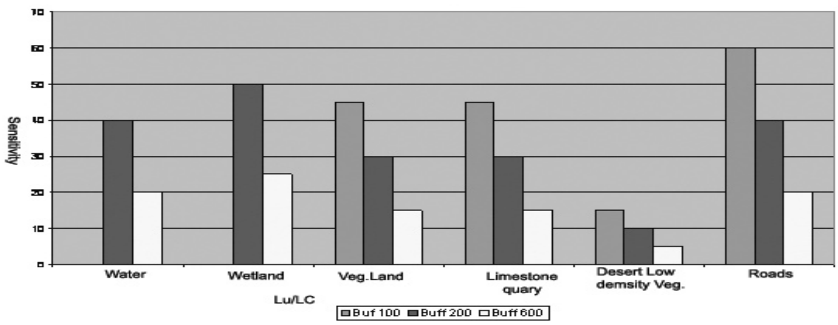

Figure 9: Management Priority Index for land use/ land cover.

Producing the Highway's Sensitivity Map

The elevation map for the studied sector indicates that the highway is located on relatively higher elevation than its surrounding landscapes with some exceptional zones. The elevation of the highway and its neighboring landscapes ranged from -3 meters to +33 meters. The slope ranges from zero to 6 degrees. This indicates a gentle slope for the highway in the study area. The aspect map indicates 8 classes. The result of the aspect model shows that most of the lands surrounding the highway and falling in the northern part are facing the north-west direction (azimuth 315° -360°) in El Hammam and El Omayed sectors. This trend changes to 0°-45° making a north-eastern trend in El Alamein sector. Most of the lands lying south of the highway have an aspect between 180° and 270° facing south to south-east. The study of the aspect of the highway and its landscape is crucial for determining areas that need protection from sand storms. The highway sensitivity based on its surrounding topography is produced by overlaying both slope and aspect sensitivity (reclassified) maps.

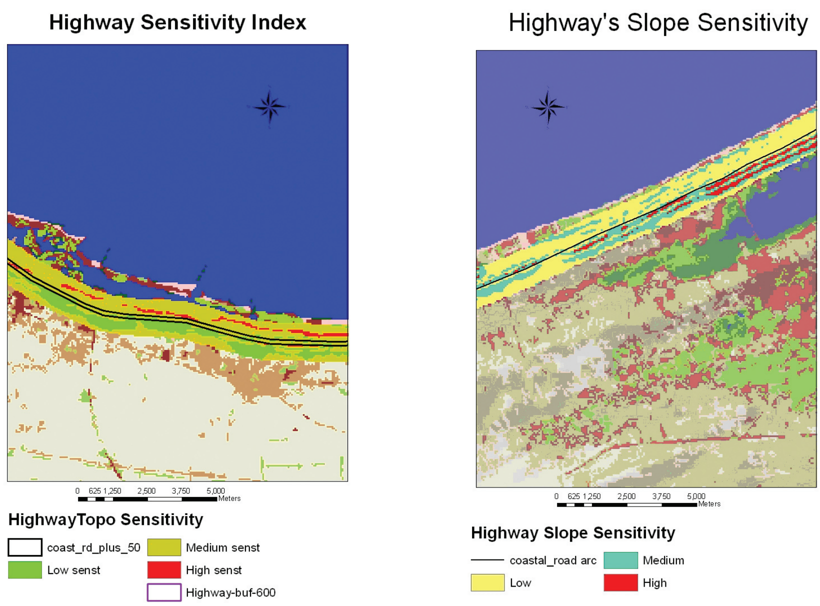

Figure 10: Left Highway's sensitivity to the surrounding topography.
Right : The Highway sensitivity Land use/ land cover

Overlaying the reclassified terrain characteristics maps of the highway's landscape within the 600 meters buffer produced the highway final sensitivity map (Figure 10). The highway and its 50 meters setback was overlaid on the sensitivity map allowing for the discrimination of sensitive sectors that need management actions against rain water precipitation and sand encroachment (Figure 11).

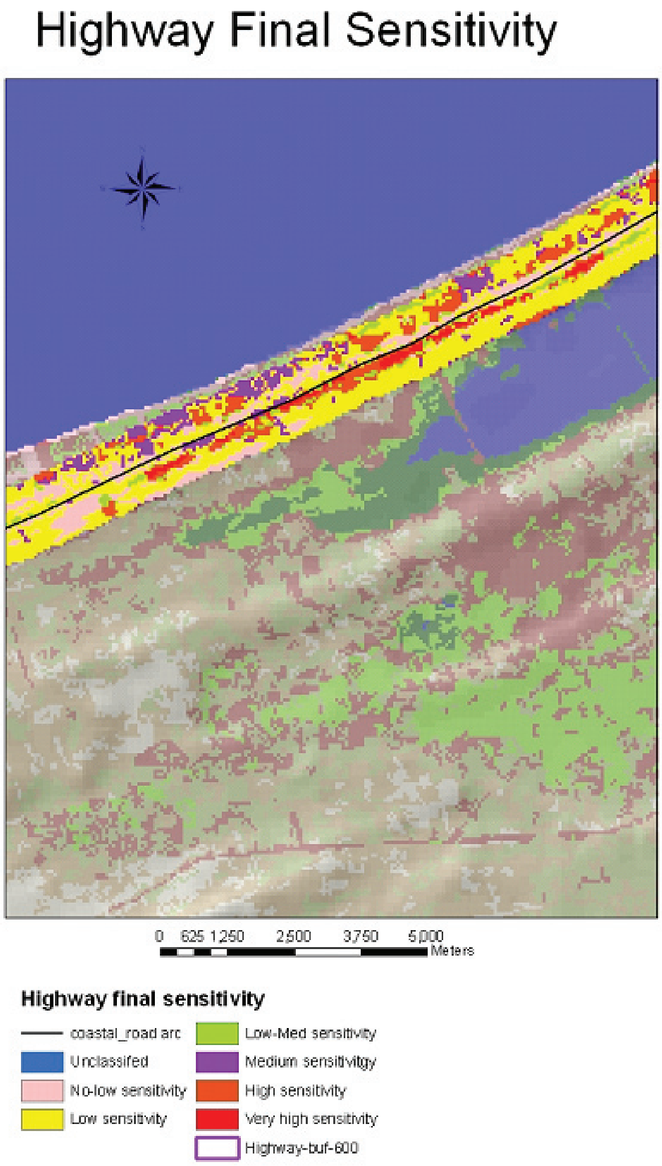

Figure 11: The final sensitivity map of the Coastal Highway in the study area

CONCLUSIONS AND RECOMMENDATIONS

This paper is concerned with the mutual impacts between a costal highway and its surrounding landscape. The change in land use/ land cover categories from one to another and the impacts of the topography and land cover on the highway were studied. The study results conclude the following:

1. The highway impact index shows a relatively high value for vegetated lands in the first 100 meters buffer zone scoring a value of 45. This is an indication that those lands are liable to change to other land use/land cover classes such as urban. A monitoring system is to be applied if those lands are to be preserved for agricultural use.
2. Limestone quarries exist in buffer 100 meters that is close to the highway in areas of 1.75 sq.km with a sensitivity (impact) index of 60. The highway promotes quarry activities. It is recommended to study and consider the limestone crop rate as excess excavation may resemble threats to the highway's structure. This issue needs some administrative control to protect the highway structure.
3. The lagoons (water bodies) and wetlands are found in the 200 meters buffer zone scoring a 40 and 50 respectively. The area for water bodies existing in the buffer is 0.025 sq.km and 0.142 sq.km for wetlands. Those zones need an environmental control plan. The water bodies and wetlands exist in buffer 600 with an index score of 20 and 25 and existing in areas of 0.402 and 0.517 sq.km respectively. Those areas need some environmental protection due to their ecological importance and to prevent their transformation to urban or vegetated classes.
4. The impacts of the surrounding landscape on the coastal highway are also studied. Using geographic information system, both the highway's sensitivity indices to topography and land cover are estimated. The final highway's overall sensitivity index map has been produced.
5. The need for environmental management of the highway's various sections is determined according to the sensitivity map that was produced for the highway and its 600 meter buffer zone.
6. Sectors liable to possible impact of rain water accumulation and sand encroachment can be defined from the slope and aspect sensitivity map.
7. Sectors liable to be harmed by water or limestone quarry have been defined from the land use/ land cover map.

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REFERENCES

Effat, H. A. 2004. Environmental Assessment of the Plans of Urban Development on Coastal Zones using Remote Sensing and Geographic Information System. Ph.D. thesis, Institute of Environmental Studies and Research, Ain Shams University, Cairo, Egypt.

El-Kaffas, S. M ; El-Aref, S. A. and El Raey, M. 2000. Remote Sensing of Environmental Changes of New Burg El Arab, Egypt. Proceedings of the 2nd International Conference on Earth Observation and Environmental Information, 11-14 November, 2000, Cairo, Egypt.

El Raey, M. ; Nasr, S. and El Hattab, M. 2000. Assessment of Land Cover Changes Along the North-western Coastal Zone, Egypt. Proceedings of the 2nd International Conference on Earth Observation and Environmental Information, 11-14 November, 2000, Cairo, Egypt.

Frihy, O.; S. M., Nasr; M. M., El-Hattab and M. El Raey 1994. Remote sensing of beach erosion along the Rosetta promontory, North-western Nile Delta, Egypt. International Journal of Remote Sensing, 1994,Vol. 15,No. 8, pp. 1649-1660.

Mackenzie, S. A and Walker, A. M. 2004. Perimeter Highway Route Determination Using GIS in Hamilton, Ontario. Geography at Guelph , GEOG 4480 Applied GIS 2004.

McFadden, C. and Whitehead, S. 2003. Locating a Landfill Site Macoupin County, Illinois Using GIS. GEOG 4480 Applied GIS,GIS,Winter 2003.

Mohammed, W. E; Elkaffas, S. M. and El Raey, M. 2000. Development of a Classification Scheme for Land Cover / Land Use Mapping in a Semi Arid Coastal Area. Proceedings of the 2nd International Conference on Earth Observation and Environmental Information, 11-14 November, 2000, Cairo, Egypt.

Parpairi, K. and Parpairis, A. 2000. Environmental Considerations in Coastal Planning and Management : Case study Fauka Matrouh, Coastal Area, Egytp. Proceedings of the 2nd International Conference on Earth Observation and Environmental Information,11-14 November 2000, Cairo, Egypt.

Saied M. M. 2000. Development of Marine Aquaculture and Fishing Activities in the Egyptian Coastal Area, Utilizing Geographic Information System and Satellite Remote Sensing. Proceedings of the 2nd International Conference on Earth Observation and Environmental Information. Proceedings of the 2nd International Conference on Earth Observation and Environmental Information,11-14 November 2000,Cairo, Egypt.

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تحديد معامل الحساسية البيئية للمناطق المحيطة بالطريق الساحلي الدولي بمصربالاستعانة بنظم المعلومات الجغرافية

هاله عادل عفت و محمد نجيب حجازي
الهيئة القومية للاستشعار من البعد وعلوم الفضاء- القاهرة- مصر

تعني هذه الدراسة بتقييم وقياس الاثار البيئية المتبادلة بين طريق سريع ساحلي وبيئته المحيطة. فان انشاء الطريق الساحلي الدولي والذي يمتد من رفح شرقا وحتي شرق السلوم غربا موازيا لساحل البحر المتوسط في مصر قد أثر وتاثر بالاراضي المحيطة به. فمرور الطريق بالمناطق الرطبة والبحيرات والكثبان الرملية وكذا بعض المدن والقري السياحية أدي الي تغيرات للبيئة الساحلية الطبيعية والتي كان أيضا لها اثارها علي أداء الطريق وكفاءته.
وتهدف تلك الدراسة لوضع منهجية لدراسة وتقييم الاثار المتبادلة بين الطريق والبيئة المحيطة باستخدام تقنيات الاستشعار من البعد ونظم المعلومات الجغرافية.حيث تم استخدام البتانات الفضائية انتاج خريطة استخدامات الاراضي والاستعانة بها في تحديد المناطق ذات القابلية للتغير نتيجة لوجود الطريق. وقد أعطيت الاغطية و الاستخدامات المختلفة للاراضي حول الطريق درجات نسبية تبعا لحساسيتها للتغير كما تم اعطاؤها درجة مرتبطة ببعدها عن الطريق في حدود ثلاثة نطاقات محيطة بالطريق السريع. وباستنباط علاقة رياضية بسيطة تم حساب مقياس الاثر البيئي للطريق علي الاراضي المحيطة به. كما تم انتاج خريطة الحساسية البيئية للاراضي المحيطة بالطريق وذلك بانتاج خرائط الارتفاعات والميول الارضية واتجاهات ميول الاراضي المحيطة بالطريق السريع في منطقة الدراسة وباعادة تصنيف تلك الخرائط واستخدام نموذج كارتوجرافي أمكن انتاج خريطة المناطق التي تضم وتحيط بالطريق السريع والتي تحتاج الي خطة ادارة بيئية.