Change Detection Study Of Al Razaza Lake Region Utilizing Remote Sensing And GIS Technique

Nawal K. Ghazal[1*]l, Auday H. Shaban[2], Fouad K. Mashi[3], Abdulhadi M. Raihan[1]
[1]Department of Physics, College of Science, University of Baghdad. [2]Department of Physics, College of Education Ibn Alhaitham, University of Baghdad, [3]Remote sensing unit, Collage of Science, University of Baghdad, Baghdad, Iraq.
audayhattem@yahoo.com

Abstract
Remote sensing techniques are now widely used for environment studies, surveys and monitoring. It became a need to study Razaza lake and the surrounding areas especially when the Antiquities Authority of the Ministry of Tourism announced, that the discovery of the effects under the waters of Lake Razzaza in Karbala province. The aim procedures carried out in this study, the first classified the study area by using unsupervised classification method to produce the land cover and land use ,deriving the elevations as a vector layer using TIN for the whole surrounding region of lake, the second part, the output is a continuous surface to be created by applying Kriging interpolation, the third step, obtaining maps of contour lines also used to show lines of constant density or brightness by implementations the contour lines , converting the result of interpolation method to a vector values that can be calculated, then the implementation of the classified process and calculating the area around the lake, all these steps are done by using ArcGIS. Finally a classification process for the same scene on a different date is applied and then compare it with the first scene using ERDAS.
Keywords: Digital Topographic Map, Contour Line, DTM, remote sensing, Disaster Environment

دراسة بكشف التغيرات لمنطقة بحيرة الرزازة باستخدام تقنيات الاستشعار عن بعد و نظم المعلومات الجغرافية

نوال خلف غزال[1*]، عدي حاتم شعبان[2]، فؤاد كاظم ماشي[3]، عبد الهادي محمد ريحان[1]
[1] قسم الفيزياء، كلية العلوم، جامعة بغداد، [2]قسم الفيزياء، كلية التربية ابن الهيثم، جامعة بغداد، [3]وحدة الاستشعار عن بعد، كلية العلوم، جامعة بغداد، بغداد، العراق.

الخلاصة
يتم الآن استخدام تقنيات الاستشعار عن بعد على نطاق واسع لمسوحات ودراسات البيئة والرصد.اصبح هناك حاجة لدراسة بحيرة الرزازة المناطق المحيطة بها خصوصا عندما أعلنت هيئة الآثار التابعة لوزارة السياحة عن اكتشاف آثار تحت مياه بحيرة الرزازة في محافظة كربلاء، مشيرا إلى أن المستويات المنخفضة من البحيرة بسبب الجفاف هو الذي ساعد على كشف أسرار البحيرة. الهدف من العمليات التي اجريت في هذه الدراسة, اولا اجريت عملية التصنيف لمعرفة الاراضي المستخدمة من غيرها, الحصول على الارتفاعات الرقمية كطبقة المتجه باستخدام (TIN) للمنطقة المحيطة بالبحيرة، الجزء الثاني، فقد تم تحويل طبقة المتجه الى سطح بالاعتماد على احد طرق الاستكمال(Kriging) والخطوة الثالثة, ممثلة برسم الخطوط الكنتورية والتي تستخدم الاظهار القيم الثابتة لكل خط (ارتفاع الارض), تحويل نتائج طريقة الاستكمال الى متجه يمكن حساب قيمه, وبعد ذلك نفذت عملية التصنيف على قيم التجه وبعدها تم حساب المساحة المحيطة بالبحيرة, جميع هذه الخطوات نفذت بواسطة (ArcGIS) و اخيرا عملية تصنيف اجريت على صورة فضائية لنفس المشهد ولاكن بتاريخ مختلف (2008) ومن ثم مقارنة تها مع الصورة الفضائية (2002) باستخدام برنامج(ERDAS).

Introduction

Digital Terrain Model (DTM) are originally used to represent the terrain surface for highway engineering purposes. But nowadays, DTM applications have been diversified in many fields, namely, route engineering, landscaping, land surveying and mapping, military-purpose mapping, remote sensing, land and geographical information system, etc. The rapid growth and fast emerging of DTM usage in vast fields is largely due to the advancement of recent computer technology both information computing power and graphics visualization capability. Due to this advancement, DTM processing e.g. data capture, further processing's such as interpolation, and display can be handled by less expensive but powerful personal computer ( ).DTM can be generated using different data sources and formats, such as grid, profile, random, or digitized contours. And these can also be collected by using various techniques. The data may be captured manually using simple vector digitizing or automatically e.g. raster scanning. It is obvious that the quality of the generated DTM depends on the quality of the contour lines (1,2).

Contour is one of the standard products of any DTM or mapping package. The produced contours have the purpose to represent the variation of the terrain surface, and to provide a visual interpretation and the outcome is largely depend on how good the contours were produced and depicted. In order to produce good contours, several things need to be considered such as, the accuracy of the capture data, the interpolation method, and other processing factors. Contour interval also plays a role. Smaller interval affects the storage, interpolation speed, and producing touching lines in steep slopes.

A digital elevation model (DEM) is a spatial referenced, continuous gridded surface where each cell in the grid represents a ground elevation above an established datum. More commonly; DEMs have been generated using Triangular Irregular Network (TINs) from contour data within a commercial GIS (3,4).

Study Area

The Razaza Lake and the surrounding area lying 15 km west of Karbala.

Table 1- Location of study area

	Northing	Esting
Upper Left	33.421	42.834
Lower Right	32.033	44.623

Data Used

1- Administrative map of Iraq as paper,with scale(1:100,000).

2- Software used such as ERDAS, ArcGIS.

Methodology

During the studding the Razaza Lake and the area surrounding it, using some methods such as Triangulated Irregular Network (TIN), Kriging interpolation, contour lines, slope and aspect .

Triangulated Irregular Network (TIN)

TIN surface is that it does not interpolate between points, but creates a set of triangular surfaces, connecting the existing points. By this, a 3D surface is created, from which a slope map can be easily derived. Slope classes with inclinations less than 12° are isolated, because the flatter surfaces have less control points and therefore cause the interpolation problems. These areas were supplied with new control points, assuming linear evolution from one contour line to the other. The main difficulties encountered in classical interpolations are variations in anisotropy (5).

***Kriging* Interpolation**

It is a statistical technique that posits a certain statistical model for the data, which trying to produces an estimate of the surface by a weighted average of the data, with weights declining with distance between the point at which the surface is being estimated and the locations of the data points. The exact nature of the decline is based on modeling the conversation between data at various spatial locations. Data points, and the associated surface, at nearby locations are assumed to be more similar to each other than data points at locations that are distant from each other. There are many ways to estimate the covariance structure in spatial data and to use this information to create a kriging surface. All kriging estimators are but variants of the basic linear regression estimator Z (u) defined as

$$\mathbf{Z^*(u) - m(u)} = \sum_{\alpha=1}^{n(u)} \lambda\alpha \, [Z(u\alpha) - m(u\alpha)]$$

With location vectors for estimation point and one of the neighbouring data points, indexed by α U,Uα :

Number of data points in local neighbourhood used for estimation **Z*(u)** : n(u)

$\lambda\alpha$:Kriging weight assigned to datum $Z(u\alpha)$ for estimation location u: same datum will receive different weight for different estimation location (6).

Contour Line

A **contour line** of a function of two variables is a curve along which the function has a constant value. In cartography, a contour line (often just called a "contour") joins points of equal elevation (height) above a given level, such as mean sea level. A **contour map** is a map illustrated with contour lines, for example a topographic map, which thus shows valleys and hills, and the steepness of slopes. The **contour interval** of a contour map is the difference in elevation between successive contour lines (7).

Input Data

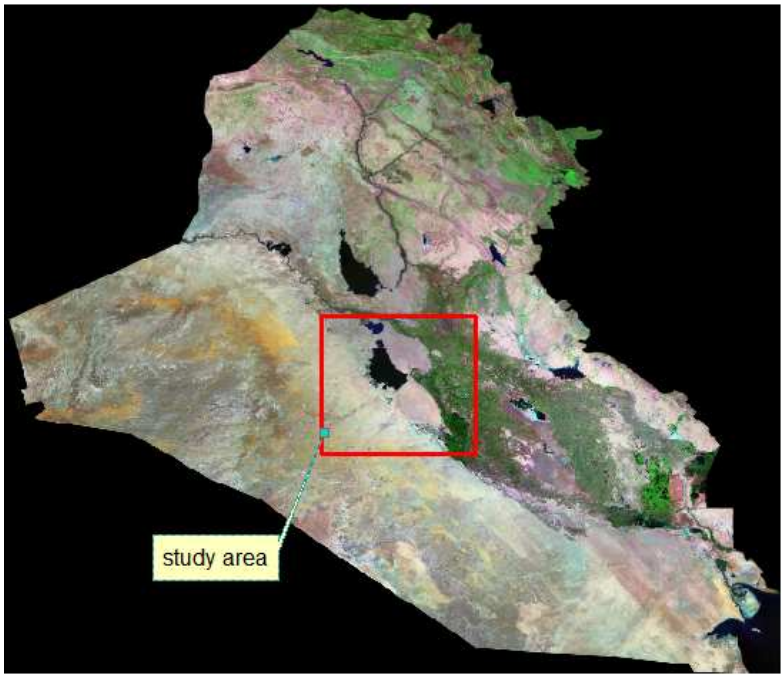

Figure 1- Map Of Iraq And Study Area

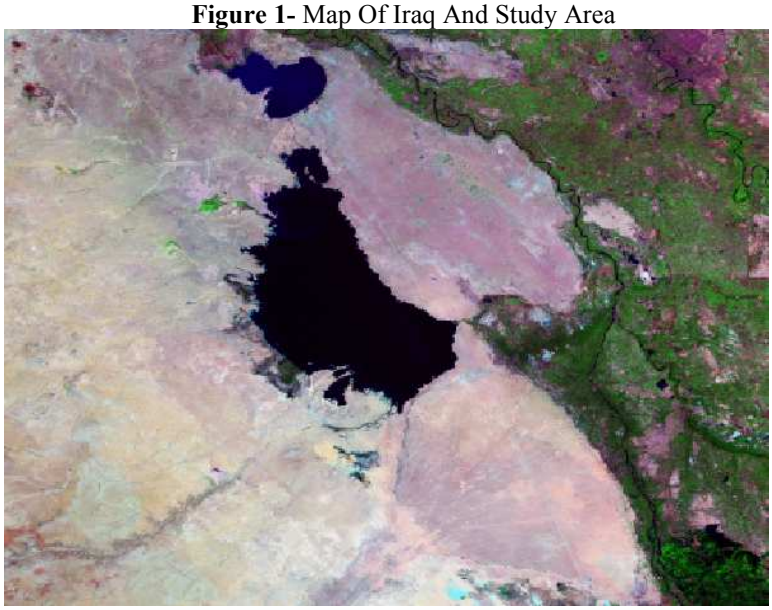

Figure 2- Landsat Satellite Image For Razaza Lake Producted In 2002 And Surrounding Area.

A Description Of The Study Area

The study area is located, which includes Razaz Lake and the area surrounding it to the south of Baghdad, is located west of the city of Karbala. Razaza linked from the north by Habbaniyah Lake by Nazim al-warawr Canal, and surrounded by the other three sides of the land of desert interspersed with some hills and there are some villages,urbans sawmills in the area and the roads linking areas with each other. There are some tourist houses and a very specific number of casinos in the eastern side of the lake is supplied. The Euphrates River is located on the eastern side of the lake a few

kilometers from and resides on its banks, farms, orchards, villages and poultry farms.

Classification of the study area

Unsupervised classifications can be performed on the imagery (ETM+). Six initial land use and land cover classes producing from this method (Water bodies, Rural areas, grass land, vegetable-field, bar land, and Plateaus) .successful land use and land cover classification allowed to identify relationship between land use and land cover change and urban expansion.

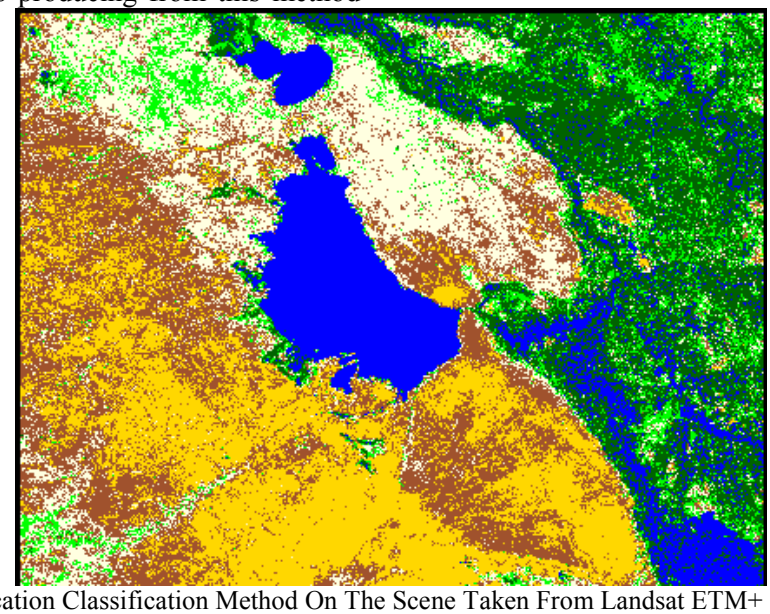

Figure 3- Application Classification Method On The Scene Taken From Landsat ETM+ Satellite Image At 2002.

Discuses And Results

In this studding can be obtained some results such as, Fig (4):TIN are usually used to represent terrain surface in engineering applications, as the spot heights can be irregularly distributed to accommodate areas of high variability in the surface.

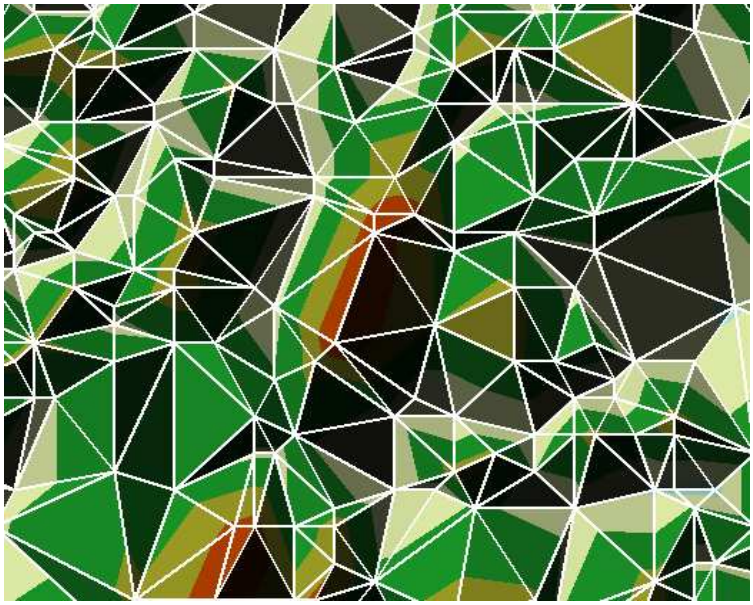

Figure 4- TIN Producing The Elevation Of Study Area Which Obtaining From DEM Satellite Image

Fig(5): Implementation Kriging interpolation method on the heights values, that obtained from TIN method to create a continuous surface.

Figure (6): shows map of contour lines with the value of each line.

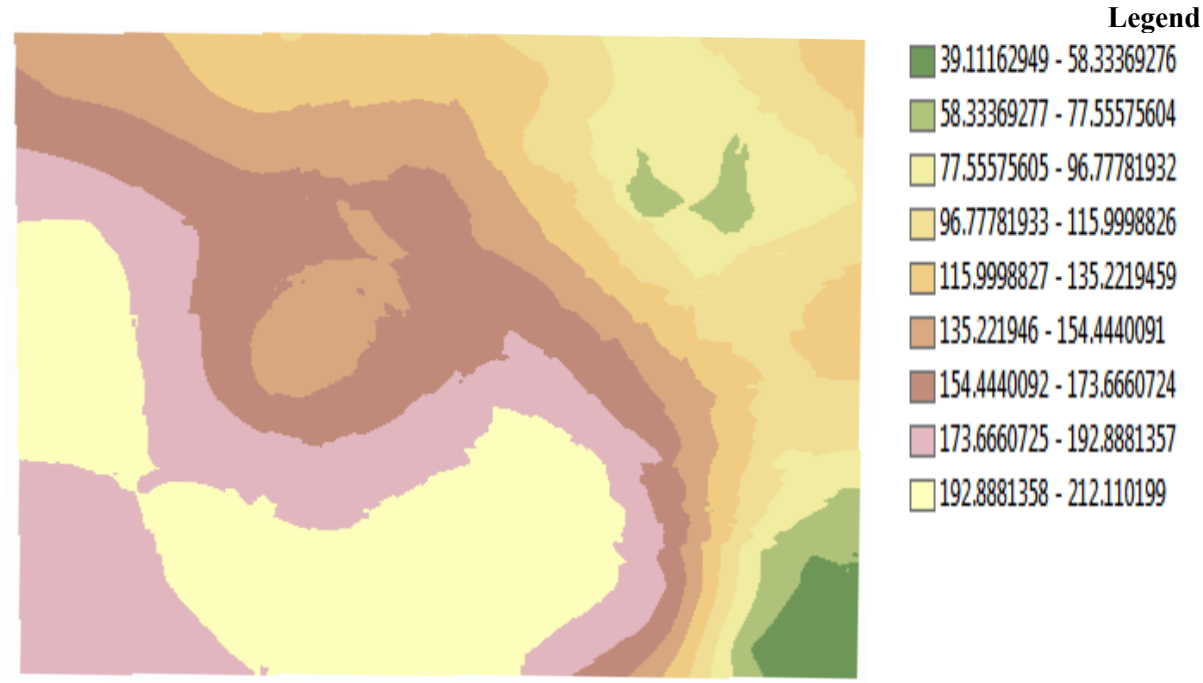

Figure 5- Illustrated The Kriging Surface And Elevation Of The Scene For Study Area

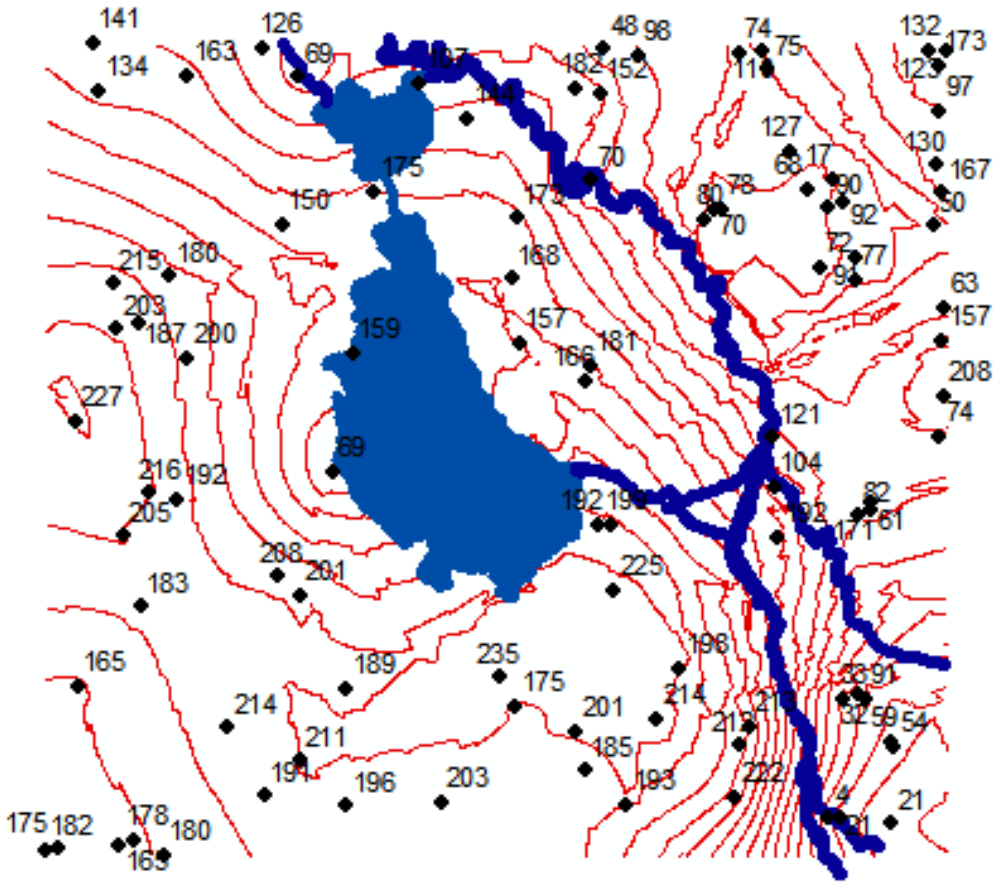

Figure 6- Producing Map Of Contour Lines.

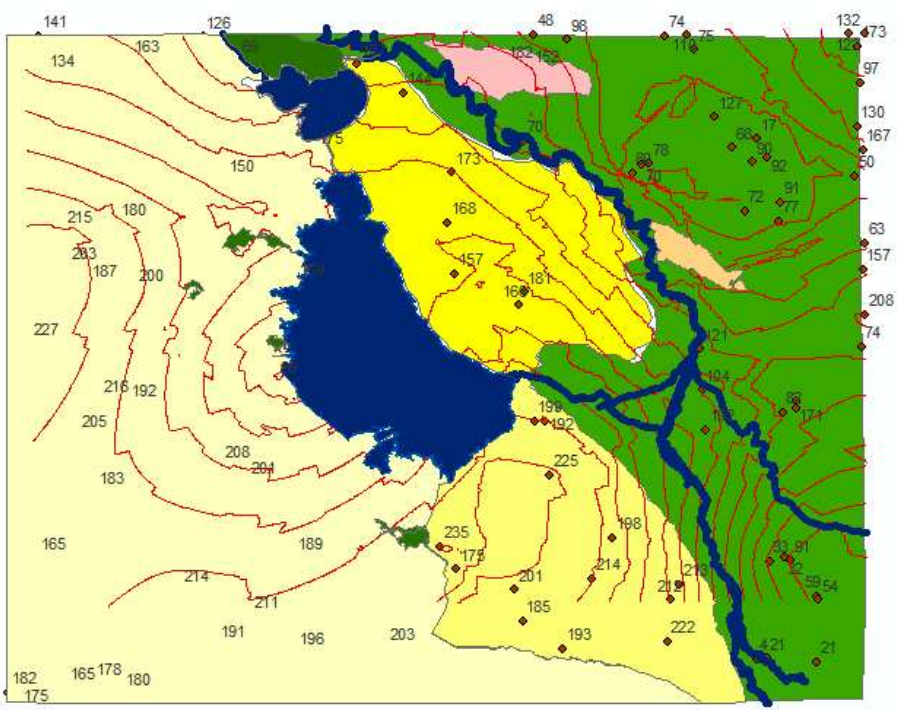

Figure 7- Illustrated The Layers Of The Studding Area.

After dealing with kriging interpolation method, has been applied the geostatistical analysis to convert the output results to vector that can be able to calculate these values. The output vector map was classified to isolate the proper regions that refer to catchment area for Razzaza Lake. The catchment area had been calculated by applying certain condition which is the region heights.

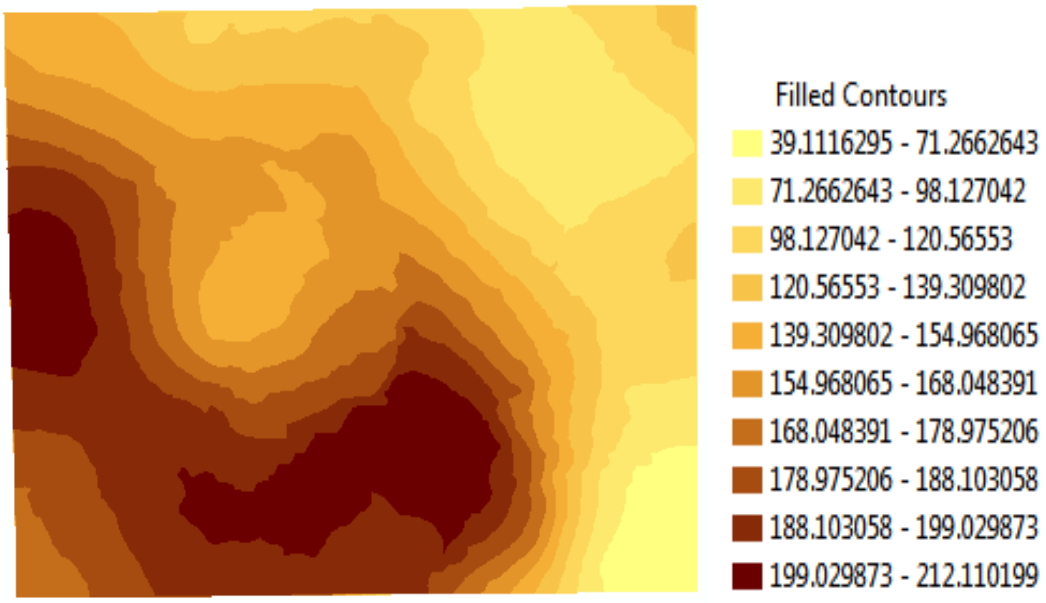

Figure 8- Output Vector For Kriging Interpolation

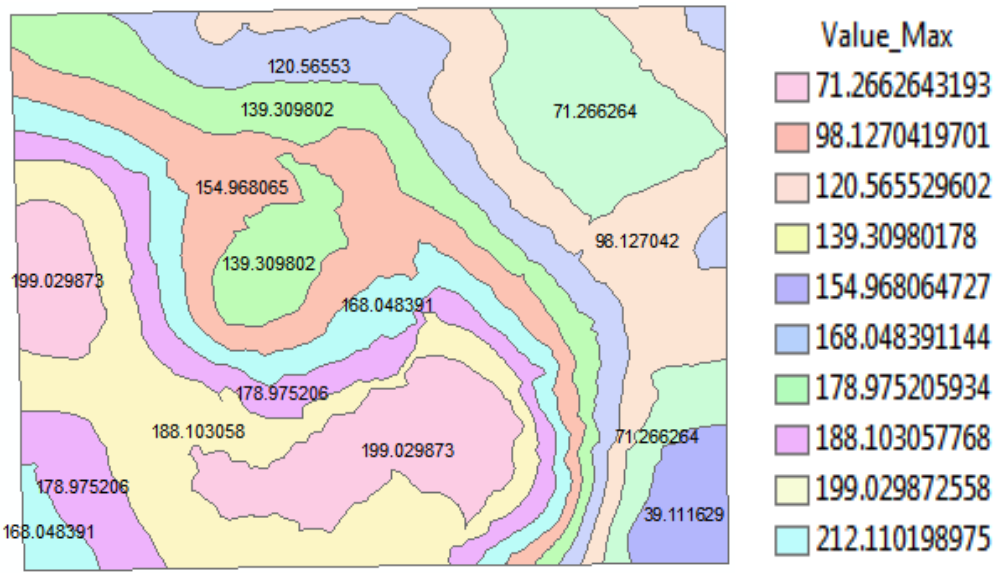

Figure 9- Classified For Figure 8

Total catchment area = 11209867853 m^2

Water Resources Directorate in Karbala confirmed that retread in the rate of lake water is supplied to 5% of the amount of water in few years ago, warning of loss of Iraq an important resource of the fisher resources in the event of drought the lake,as we see in figures(**10,11).**

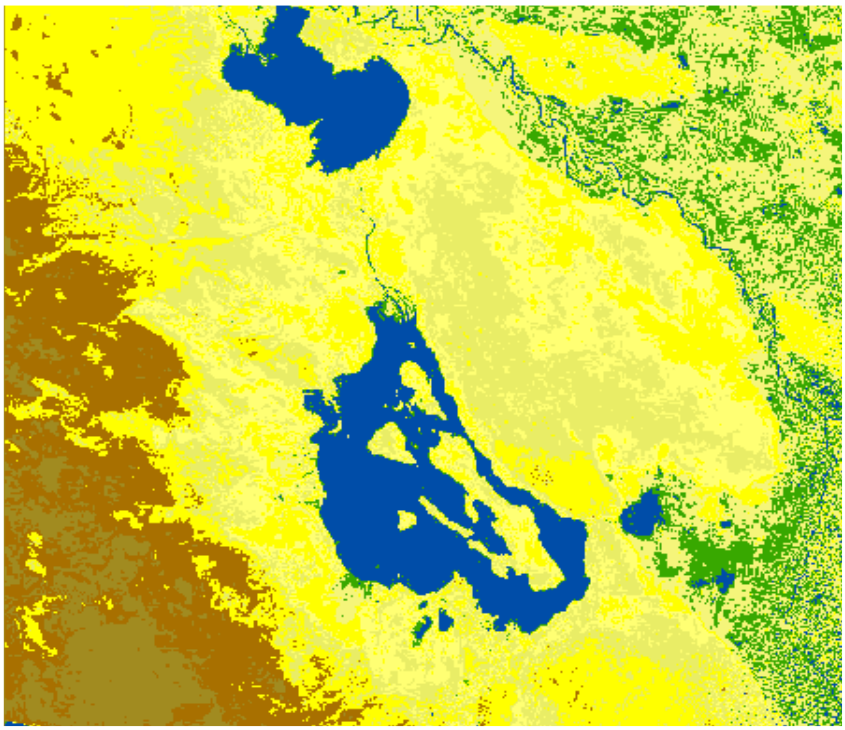

Figure 10- Applied Classification Method On The Scene Taken From Landsat+ Satellite Image At 2008.

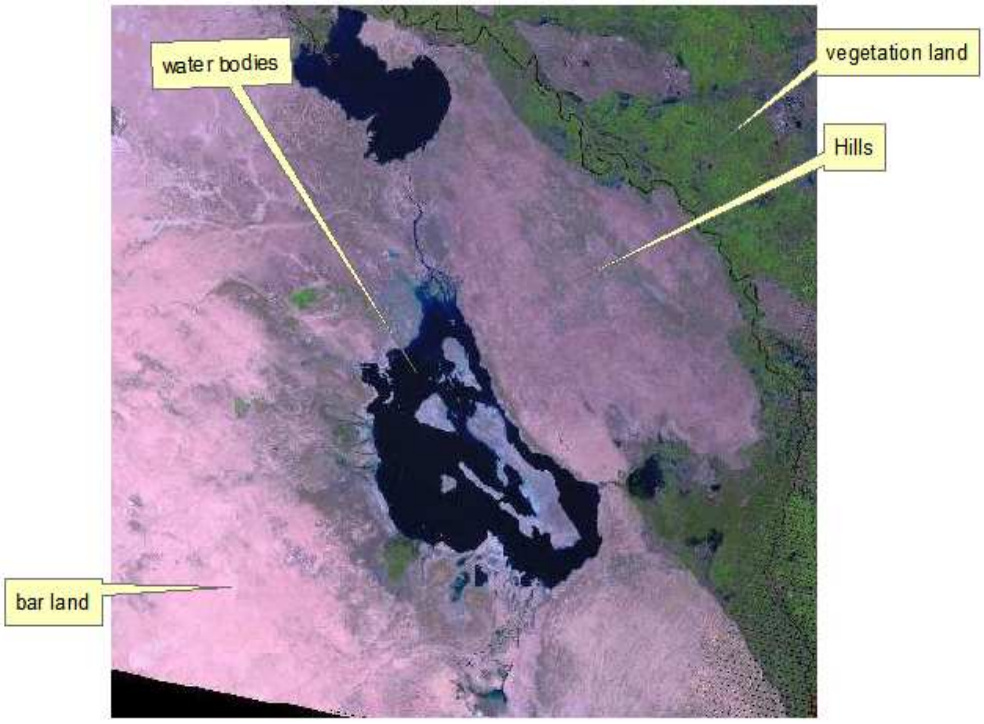

Figure 11- Landsat+ Satellite Image For Razaza Lake Producted In 2008.

Conclusion

1-Studing the topography of the area around Alrazaza Lake to conclusion, decline water in the lake.

2- Catchment area around the lake supplied it quantity from rainfall that cannot be overlooked, but because of the low rainfall led to low water levels which is influential.

3 -.Because of the scarcity of water and causing water to recede significantly in Razaza Lake. Therefore, fish and many animals that lived in the lake have become almost non-existent, and this has affected many of those working in fishing and also those who work in the grazing

Reference

[1] AKOV A.S., **2000**, "DTM Generation from Russian TK-350 Space Imagery in the PC-Based Photogrammetric System Z-Space", State Research Institute of aviation Systems (GosNIIAS),Mosco,Russia.

[2] Baltsavias E.P., Stallmann D., **1993**, "SPOT stereo matching for Digital Terrain Model generation", Institute of Geodesy and Photogrammetry, Swiss Federal Institute of Technology,ETH-Hoenggerberg-CH-8093 Zurich, Switzerland.

[3] Subramanian k.S., Singh S., Sudhakar A. M., **2003**,"Evaluation of Digital Wlevation Models created from different satellite images", Map India Conference,RMSI Private Limited,A-7 Sector 16-NOIDA 201 301,India.

[4] Abdul Rahman A.,**2005**,"Desing and Evaluation of TIN Interpolation Algorithms", Department of Geoinformatics Faculty of Surveying and Real Estate ,University Technologi Malysia,.

[5] Lacey A.J., Thacker N.A.,P.Courtney and Crossley S., **2001**,"The Evolution of the TINA Stereo Vision Sub-System",Imaging Science and Biomedical Engineering Division, Medical School, University of Manchester,Stopford Building, Oxfrd Road, MANCHESTER,m13 9pt.

[6] C&PE940,19 October, **2005**, "Kriging", Assistant Scientist Kansas Geological Survey,Geoff@kgs.ku.edu 864-2093.

[7] Gousie M.B., "Converting Elevation Contours to a Grid", Dept. of Computer Science, Rensselaer Institute, Troy, NY, 12180-3590, Electric, Computer, and Systems Engineering Dept., 6026JEC, Rensselaer Polytechnic Institute, Troy, New York.