The Study Of The Surface Area Change Of Lake Al-Razzaza Using Geographic Information System (GIS) And Using Remote Sensing Technology

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Abstract

Al-Razzaza, the second largest lake in Iraq and wider lower lakes being created at estimated surface area of 1810 km^2 and is one of the important sources of wealth of fish, also; It described as being a blue dot surrounded by desert. Started the water level in the lake to decline starting from the eighties and became this decline accelerated since 1990 due to climate change and rising atmospheric temperature and evaporation process continuing and inadequate water contained the lake to compensate for the shortfall and also because of low water levels in the Euphrates River, which is one of the most important source the waters of the lake, all this led to a decrease in the water level and the surface area and increasing salinity of soil that threatened a real disaster for the lake. This study employed both remote sensing and geographic information systems to estimate the change in the ratio of the surface area to Al-Razzaza lake, starting from 1990 up to the year 2012. In addition, chromatic classified maps show the changes during that period of time based on satellite scenes of the Landsat ETM+, and Google Earth scene after registration process was made based on Landsat ETM+ image. Also, we present a table that clarifies the percentage of change of surface areas for above period of time that followed in 1990. Then we represent such a change through a graph gives an idea of the great loss suffered by this lake. Also, this graph gives an impression about what the lake shape will be in subsequent years. The results showed that the percentage change was significant during this period, such that the decreased surface area was from 1621 km^2 in 1990 to 270 km^2 in 2012.

دراسة تغير المساحة السطحية لبحيرة الرزازة باستخدام نظم المعلومات الجغرافية وتقنية الاستشعار عن بعد

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الخلاصة

الرزازة ثاني اكبر بحيرة في العراق ومن أوسع بحيرات الدنيا كونها أنشأت بمساحة سطحية تقدر ب 1810 كم^2 كما وتعد احد المصادر المهمة للثروة السمكية وتوصف بكونها نقطة زرقاء محاطة بصحراء. بدأ منسوب المياه في البحيرة بالانخفاض ابتدءا من ثمانينات القرن الماضي وأصبح هذا الانخفاض متسارع منذ عام 1990 وذلك بسبب التغيرات المناخية وارتفاع درجة حرارة الجو وعملية التبخر المستمرة وعدم كفاية الماء الوارد للبحيرة لتعويض النقص الحاصل وكذلك بسبب انخفاض منسوب المياه في نهر الفرات الذي يعد احد أهم

مصدر لمياه البحيرة ، كل ذلك أدى إلى نقصان منسوب الماء والمساحة السطحية وزيادة نسبة الملوحة فيها بشكل متزايد والذي يهدد بحلول كارثة حقيقية للبحيرة.

هذه الدراسة وظفت كل من تقنية الاستشعار عن بعد ونظم المعلومات الجغرافية لأجل بيان التغير الحاصل في نسبة المساحة السطحية لبحيرة الرزازة ابتداءا من عام 1990 وصولا إلى عام 2012، حيث تم رسم خرائط مصنفة لونيا تبين نسبة التغير خلال تلك الفترة وبالاستناد على صور فضائية للساتل Landsat ETM+، والصور الفضائية Google Earth بعد تسجيلها وفق الإحداثيات الجغرافية المعتمدة صورة الساتل Landsat ETM+. كما وتم إيضاح النسبة المئوية لتغير المساحات السطحية للفترات الزمنية التي تلت عام 1990, حيث مثل هذا التغير من خلال رسم بياني يعطي فكرة عن الخسارة الكبيرة التي تتعرض لها هذه البحيرة كما يعطي هذا الرسم انطباع عن ما ستؤول إليه البحيرة في الأعوام اللاحقة. وبينت النتائج بأن نسبة التغير كانت كبيرة خلال هذه الفترة حيث تناقصت المساحة السطحية من 1621 كم^2 في عام 1990 إلى 270 كم^2 في عام 2012.

Introduction:

Al-Razzaza was created in 1969 when a Spanish contractor built a drainage canal to divert the annual floodwaters of the Euphrates river into the desert to prevent flooding across southern Iraq.

The lake, with a surface area of 1810sqkm, is 40 meters above sea level and can hold some 26 billion cubic meters of water with length 70km form north to the south and 40km width from the east to the west. Al-Razzaza Lake is located 15 km north west of Karbala. It is part of a wide valley that includes al-Tharthar, al-Habbaniya, al-Razzaza and Bahr Najaf (Najaf Sea). The lake is supplied by eight sources, including the River Euphrates; Lake Habaniya, east of Ramadi; Rashidiya, north of Karbala; groundwater springs in Ayn al-Tamr, 80km west of Karbala; rainwater and seasonal flows. Located to the west of the Iraqi holy city of Karbala with Coordinates 32°45'35"N 43°39'22"E, as shown in Figure (1). Our research uses the geographic information systems and remote sensing techniques in order to study the decreasing surface area ratio of Al-Razzaza lake for the period time 1990 up to 2012, then guess the date on which it will dry completely. [1, 2]

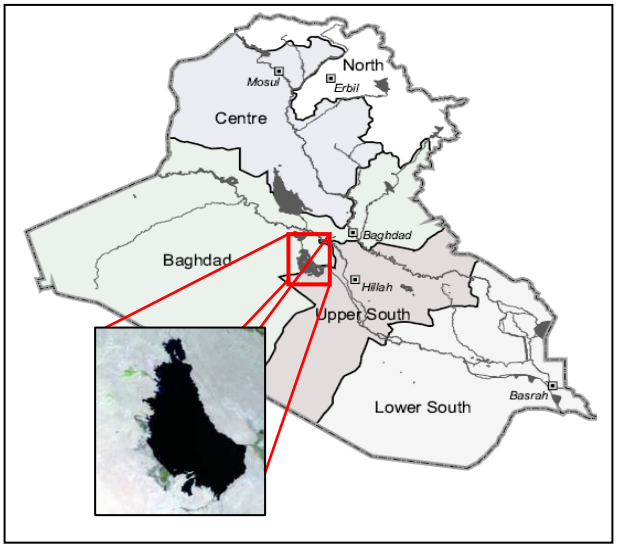


Figure 1- The Area of Study (Al-Razzaza lake 1990).

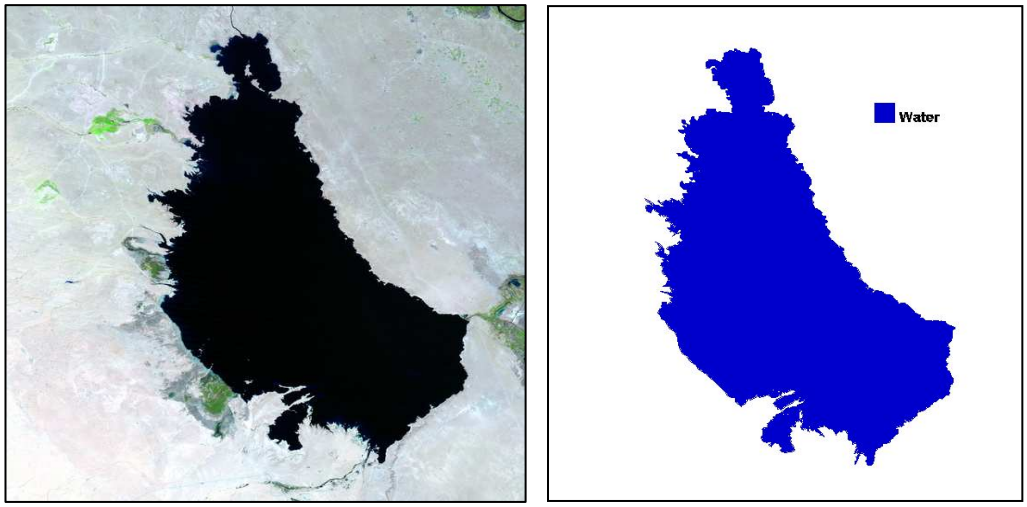
Objective Of The Research:

In this paper we used satellite images to estimate the surface areas during a period of time of Al-Razzaza lake located at a distance of 15 Km north Karbala. Because of the great importance of the lakes which reflected manifestations in each of the environmental reality, agricultural, tourism, fisheries, water storage and other life aspects, it is sure to lake such as Al-Razzaza having significance ability storage and wide features on all aspects mentioned made us focus our attention around it. So we want through this

research to roll considering what ails the lake from the danger of disappearing over the next few years through the actions stop this disaster risk.

Work Steps:

By using the picture space form in Fig(2-a) of the satellite Lansat-MSS, which represents a picture of Al-Razzaza in 1990, we calculate the surface area and extracting a vector layer for the purpose of making it as a base map in all our comparison and area calculations purpose (estimating the proportion of drought that threatens the lake). Extracted vector layer shown in Fig(2-b) using ENVI and ERDAS programs has a surface area about 1621.106 km^2 in 1990 .



-a- -b-

Figure 2- AL-Razzaza Lake 1990.

1- In the years that followed in 1990 Al-Razzaza significantly suffered from reduced in its water levels and large wide dry areas were appeared because of a huge water fields turned to the territory of land, as shown in figure (3-a), represented by Landsat ETM+ image with resolution 15m. In 2005, water area of framework aqueous Al-Razzaza almost was calculated which amounted to 1126.89 Km^2, as well as calculate the area of the islands that formed within the lake which reach to about 228.89Km^2. Thus, the net water area reaching an about 898 Km^2, as shown in figure (3-b).

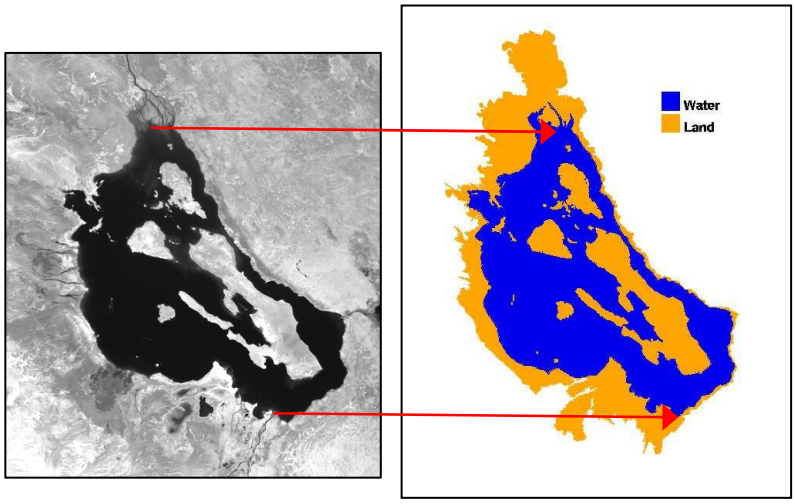


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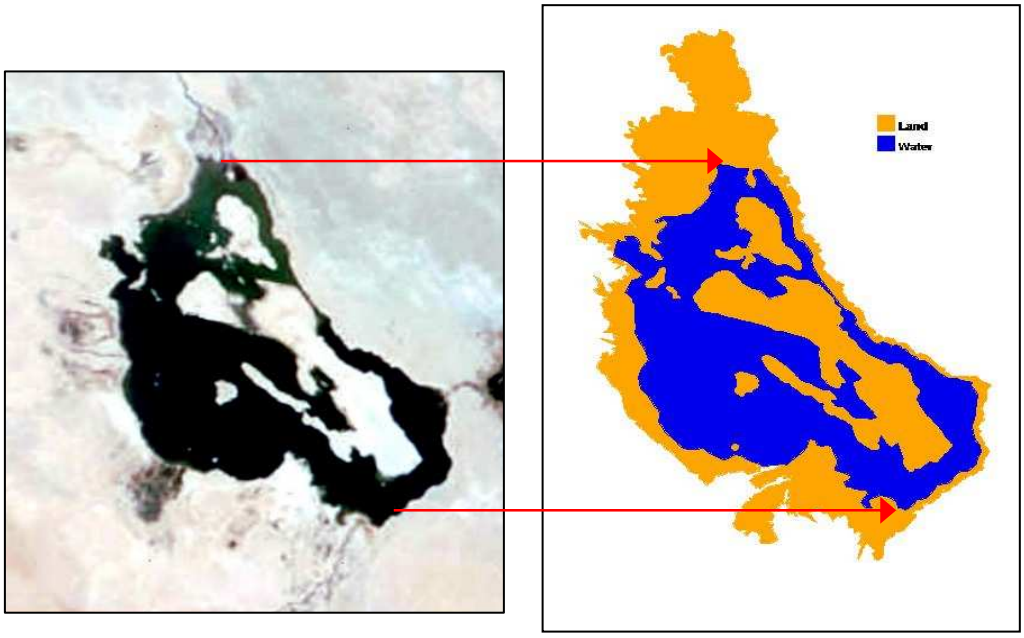
Figure 3- AL-Razzaza Lake 2005.

2- In the same way and using the ENVI and ERDAS programs we calculate area borders the lake for the year 2007 amounted to almost 1047.377 Km^2 including the lake dotted with islands, While the area of these islands amounted to 280.654 Km^2, almost thus a water surface area of Al-Razzaza in 2007 reach about 766.7237 km^2, shown in figure (4-b). The figure (4-a) represents the satellite image used in drawing vector layer by which we identified areas in an image. This scene taken using Google Earth image after registration to the Landsat ETM + image with resolution 28m.



-a- **-b-**

Figure 4- AL-Razzaza Lake 2007.

Figure (5), shows the difference between the surface areas of the lake between 2005 -2007, it appears e quickly increased dry land territory

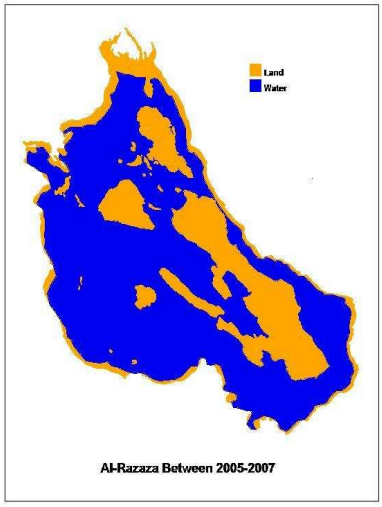
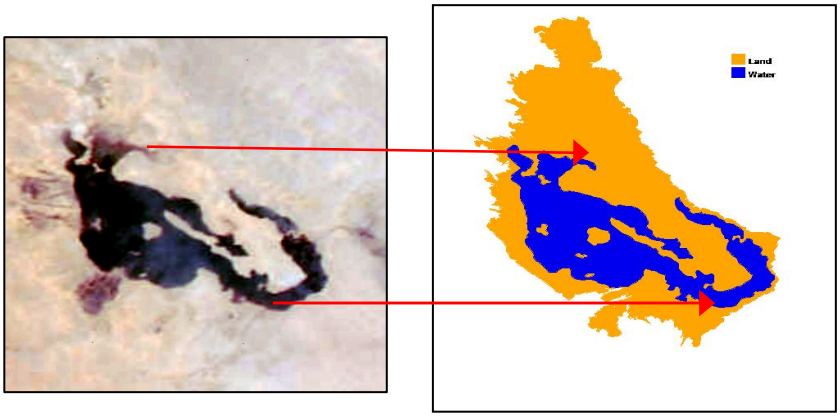


Figure 5- Al-Razzaza Between 2005 -2007

3-Figure (6-a) shows the satellite image taken from Google Earth in 2009, it was registered as preceding procedure in scene 2007. The water surface area including dry islands reached about 529.558538 Km^2 as the area borders the lake. While the space islands about 157.17 Km^2, thus the nut water surface area is about 513.84 Km^2 as shown in figure (6-b); these spaces ratio for the year 1990.



-a- -b-

Figure 6- AL-Razzaza Lake 2009.

Figure (7) see rapid dehydration of the lake between 2007 and 2009 alone.

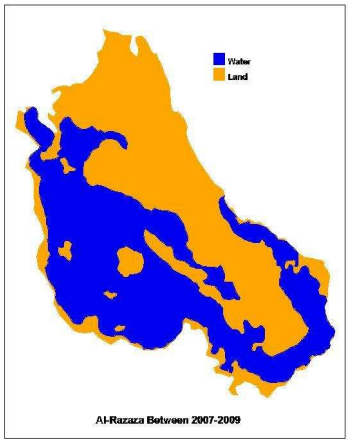


Figure 7- Al-Razzaza Between 2007-2009

1- In 2012 the lake faced a real danger drought where an estimated area of about (270.578 Km^2), almost reaching space limits the lake including dry islands (285.012 Km^2), while the almost dry land area reach (14.434 Km^2) as shown in Figure (8-b). The satellite image adopted figure (8-a) is taken from the satellite Landsat ETM+ with resolution 28.5.

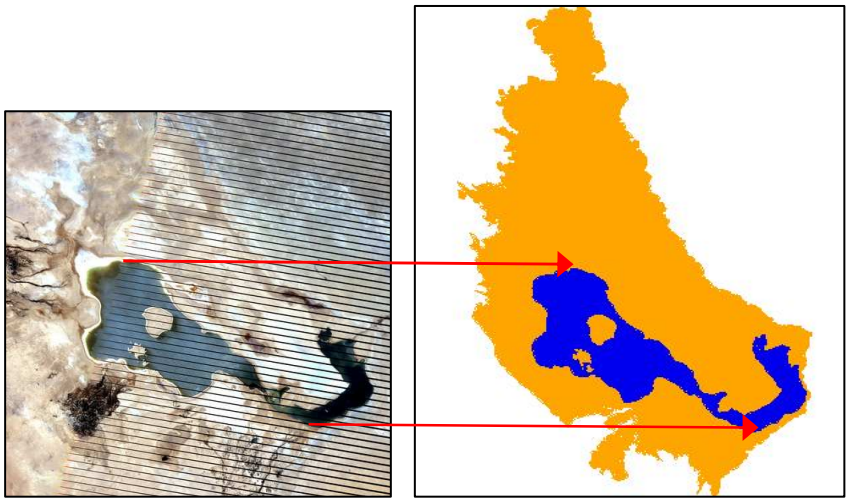


Figure 8- AL-Razzaza Lake 2012.

-a- -b-

In Table1, it could be show the increasingly severe drought areas ratio for the dry areas as the period of time between 1990 up to 2012. Figure (9), shows all Al-Razzaza changing water surface area from 1990 to 2012, we collected them in one figure in order to see them in obvious way and making the comparison between those years more easy.

Table 1- Al-Razzaza drought areas percentage

Date	Surface Area (Km^2)	Drought Ratio
1990	**1621.106**	**0%**
2005	**898**	**44.6%**
2007	**766.723**	**52.7%**
2009	**513.841**	**68.3%**
2012	**270.578**	**83.3%**

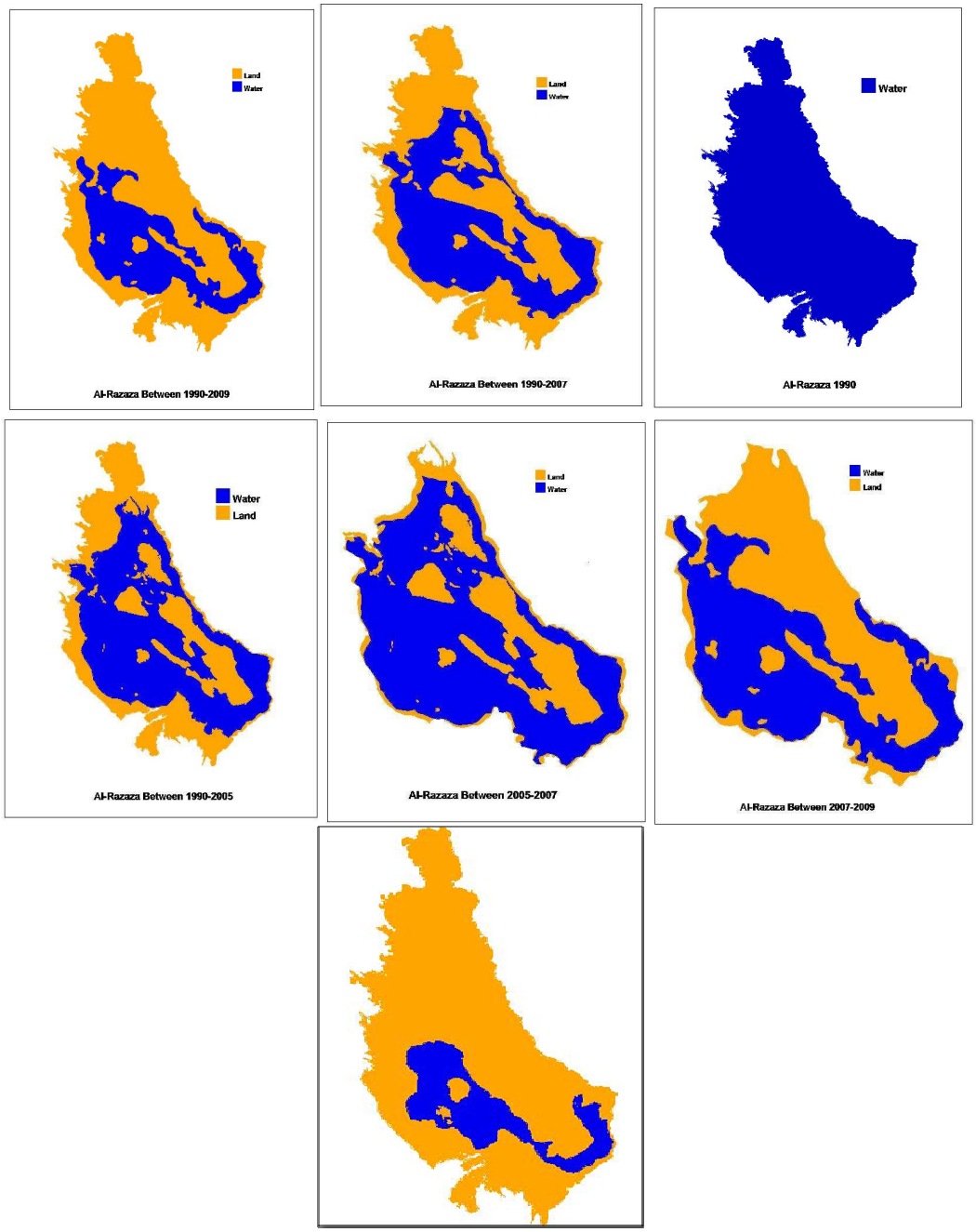


Figure 9- Al-Razzaza Surface Water Area Changing From 1990 To 2012.

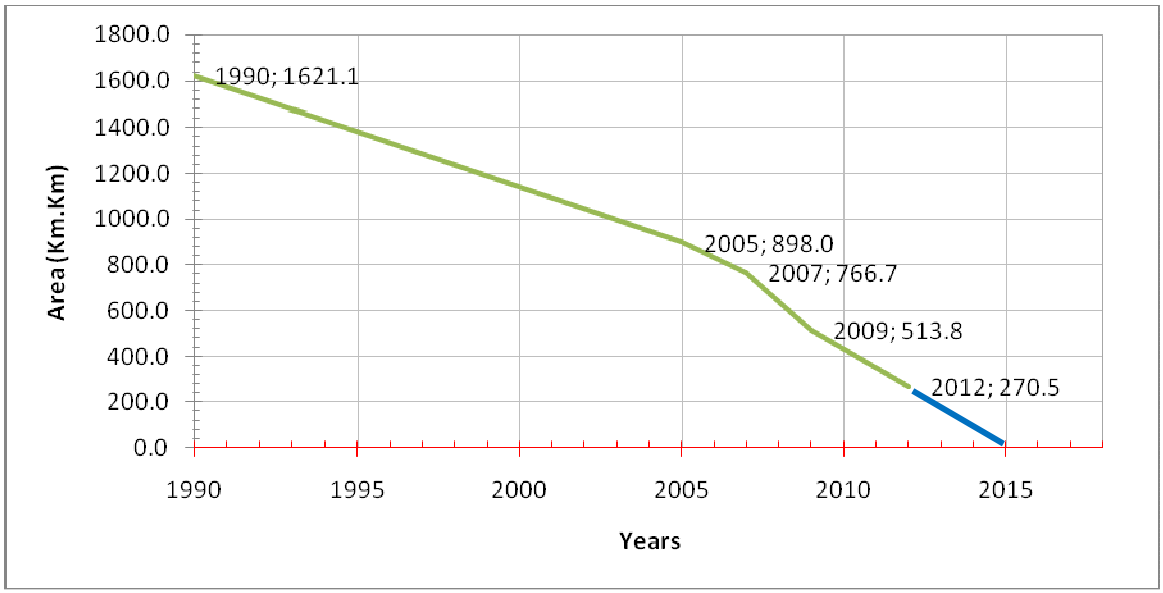


Figure 10- Al-Razzaza Water Area Decay.

Discussion of Results

1- The surface area of Razaza since 1990 and until 2012 in the case of diminishing very scary, as the area of the lake in 1990 was almost (1621.106 Km^2) was judged to base to estimate the proportion of drought years later in 2005 amounted to surface area Almost (Km^2 898) i.e. they say by 44.6% rate for the year 1990, but in 2007 the surface area became about 766.723 Km^2 (Percentage 52.7% for the year 1990), then in 2009 water area almost became 513.841 Km^2 and sequentially decrease water area with increasing the percentage of drought to reach 68.3%, and this space became in 2012, 270.578 Km^2 and thus became the percentage of this year's 83.3% from the proportion of 1990 water area.

2- The research shows to us that the surface area in 2012 is less than a quarter in 1990.

3- When you take the surface area of Razaza in 2005 it shows approximately twenty-five island within a body of water while in 2007, the number of these islands has increased to merge with each other then became fewer than six islands then five islands in 2009.

4- Chart represents the relationship between changing of the surface area of Al-Razzaza from 1990 to 2012, it shows a decrease in surface area from 1990 down to the year 2012 as the percentage decrease 83.3% based on the surface area of 1990. Also, in the light of this decline we can be painted along the graph as shown in Figure with blue line who gives us the predicted drought stage which will be full as to be expected in 2015.

References

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