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Monitoring Coastline Change Using Satellite Imagery (A case study of Zrewar Lake, IRAN)

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Abstract

One of the important uses of remote sensing science is management of water resources and one of these management is monitoring of changes in water resources. Recently, Zrewar lake is under consideration of different environmental organization and some alarms about future of it have been acclaimed which are based on the observed changes. In this study, the changes in Zrewar lake has been assessed by remote sensing techniques and doing of pre processing and estimated changes processing. And, for doing this study, we have used the datas and satellite images of Landsat. And we have used a period of time between 1985-2015 for estimated changes of surface changes and vegetation of zrewar lake. (Landsat 5,7,8) Lake position in row 35 and path is 168. And for the processing classification was used in software ENVI.

Keywords: Zrewar (Zrebar) lake, Surface changes, Images of satellite, Remote Sensing

INTRODUCTION

Zrewar lake (or Zrebar) is one of the most vulnerable lakes in the western part of kurdestan in Iran, due to its special status; And has undermined the effects for accident of 8 years of war between Iran & Iraq. The current trend of decrease of subsurface water and surface water, one of the future crises, is water shortage. On the other hand, Iran

has a low water source and faces major problems such as the drying of Uremia lake, Hamoon lake and the downfall of subsurface water and ... (1). Meanwhile, Zrewar lake is also facing some problems, including the entry of urban sewage into lake, and vegetation and the growth of the algae in its depths and the reeds on the lake surface. (2)

Zrewar lake is one of the big freshwater lakes, that its waters are coming from the fountains of floor of the lake and rainfall too. Zrewar is located on the northwest side of the city of Marivan. Height of the lake1280 meters, which in cold winters surface of lake be freezes. The length of the lake is about 6 km and its width is 3 km. Depth the lake does not exceed 6 meters and has about 30 million cubic meters of water (3). Average rainfall in the Marivan region is larger than near region of around. It's about 786 millimeters

This lake, with this ecosystem and beautiful scenic views, is one of the main tourist and tourist areas in Kurdistan province. Having the quantitative and qualitative changes in lake water are one of the most important parameters of lake health .and in recent years, algae have grown from the lake floor.There are many reed in around the lake, which is likely to turn the lake into a marsh. In this research, we try to use from remote sensing,to monitoring of changes in the level of the lake water level over a period of time,to with the help of this information, will make it possible to plan its future and its future.predicted.

One of the most important problems of human life near the lake is entering of a part of Marivan city sewage (with seven villages of around the lake) directly into the lake. Which has many environmental and health effects on the wetland. In addition to temperature changes,Has damaged the livestock ecosystem in the lake. Due to the high volume of sewage and small size of the lakeThere is a big danger to health of lake.

According to this fact that the water of Zrewar lake has comes from fountain of floor of the lake,and the water of lake follows a river from the lake. In 1997 constructed dam on the output of zrewar, this river was built on the outlet of the lake, which prevents the exodus of wastes and algae and causes more pressure on boiling fountain of floor of lake.

Remote sensing and geographic information system (RS&GIS), for ease of operation, high speed and low cost compared to other disciplines, today, as a powerful tool in the hands of specialists and scientists of various sciences, has solved many problems in the world. Progress and expansion the spatial information systems and the high power of these systems, in the management, storage, analysis of geographic data, it has made researchers of various sciences to take advantage of this technology in their research.

Satellite imagery for their special features such as repetition, digitization, etc has made it possible for researchers to be able to accelerate trend of process of preparing and updating various types of maps in applied sciences and engineering. Experts and authorities from use of the remote sensing and GIS in the field of engineering and coastal management can, identifying changes in these areas and their trends and also provide predictions future changes.

BACKGROUND OF RESEARCH

- Omrani & etal (2013) by using satellite images of landsat (TM) 1989-2011, They studied the vegetation changes of Urmia lake. (5)
- Bhargava D S and Mariam (1992) Investigate the combined effect of salinity and suspended solids on the spectral response of the water in the laboratory. (6)
- Yusefi & etal (2013) The study of the process of Zagros forests changes, using remote sensing and geographic information system in the Marivan region. (7)
- Na'imi nezam abad & etal (2010), Study of changes in coastline persian Gulf using remote sensing techniques in the Assalouyeh.(8)
- Rahimi bluchi & etal (2012), Evaluated environmental changes in Shadegan wetland using remote sensing (9)
- Ale sheikh & etal (2005), They monitored the coastline of Urmia lake using remote sensing (10)
- Zebar dast & Jafari (2011), Anzali wetland changes were studied using remote sensing (11)

METHOD

The aim of this research is investigate parameters zrewar lake in the Marivan and the purpose is study of changing of water surface since 1985Until 2015.

Data of remote sensing systems, including aerial photos and images from scanners (satellite imagery), have errors various. They are basically "corrected" before being interpreted and analyzed. These errors can be divided into two categories geometric and radiometric.

Geometric correction: Geometric errors are created by various factors such as rotation of the earth, satellite state change, earth roughness, curvature of the earth and sensitive geometric features. that cause differences between the real coordinates of the phenomena and the coordinates of the image.

Geometric corrections are, in fact, a way to eliminate these errors, and has two methods, systematic and non-systematic. Geometric errors are related to the position of phenomena or pixels in the image in proportion the that phenomena and its real position. Satellite data also can be corrected by using one of the methods of using ground control points, using satellite orbital parameters and geometric correction correlation, and with one Basis matched

Radiometric correction: The radiometric error relates to the reflection recorded in the image.

Radiometric errors are caused by various factors. These factors cause the image of any phenomenon on satellite data with that image in the close distance, there are different. Some of the factors affecting the create of radiometric errors are different sensitivity of

the sensors, the side and height of Sun, topographical effects, and atmospheric effects.

Some of the radiometric errors generated are resolving at the ground receiver stations, and some of them should be removed by the user. The most important parameters that cause radiometric errors in an image are atmospheric effects. Radiometric errors include two groups of errors, device errors and atmospheric errors.

Methods of correcting of device errors: It is divided into two types of correction of lines and correction of strip. Lines depending on the occurrence of a problem with the system, it made while capture, send or receive data or to record and reproduce data. And error strip tape is created due to the same failure of the detectors of the sensor.

Atmospheric error correction methods: are due to atmospheric absorption and dispersion and are divided into two types of modeling and general correction.

In the method of modeling by measuring the parameters affecting on the electromagnetic energy such as temperature, humidity, pressure and ... and provide a model of that effect on posted energy from the surface of objects. In the general correction method, it has been attempted to reduce the atmospheric effect and is relative. Haze effect is one of the atmospheric common errors.

RESULTS

As we said, we use Landsat satellite imagery for this research, and according the length of the period (30 years), model of 5.7 and 8 of Landsat satellite is used. So, we took 3 pictures of the lake from 1985, 2000, and 2015. (row=35, path=168) The point that matters here are that our image is visible and the amount of cloudy of the image weakens the accuracy of the research. So it's better to be amount of cloudy image may be low. In this case, summer images are desirable because the sky is often flat and cloudy in summer It’s not working. We will then choose the months of August or September.

And since 2003 Landsat 7 has been got (SLC) mechanical error, it is better to get Landsat 8's last image (2015). because the cut-off error in the Landsat 7 (SLC) is causing loss of 20% information of image (Fig. 1, 2).

An image of 2015 Landsat 7, the target area was associated with the SLC problem, which was resolved by the gap-file Landsat extension in ENVI software.by using the classification processing (Maximum Likelihood Classification) and sampling, we get the output.

In the end, after processing of classification, on ENVI, we get an output with suffix of TIFF and converts it into polygon on ARCGIS software. Polygon of any image is it output. Now can estimate the surface of each complication.

Figure 1. Primary images

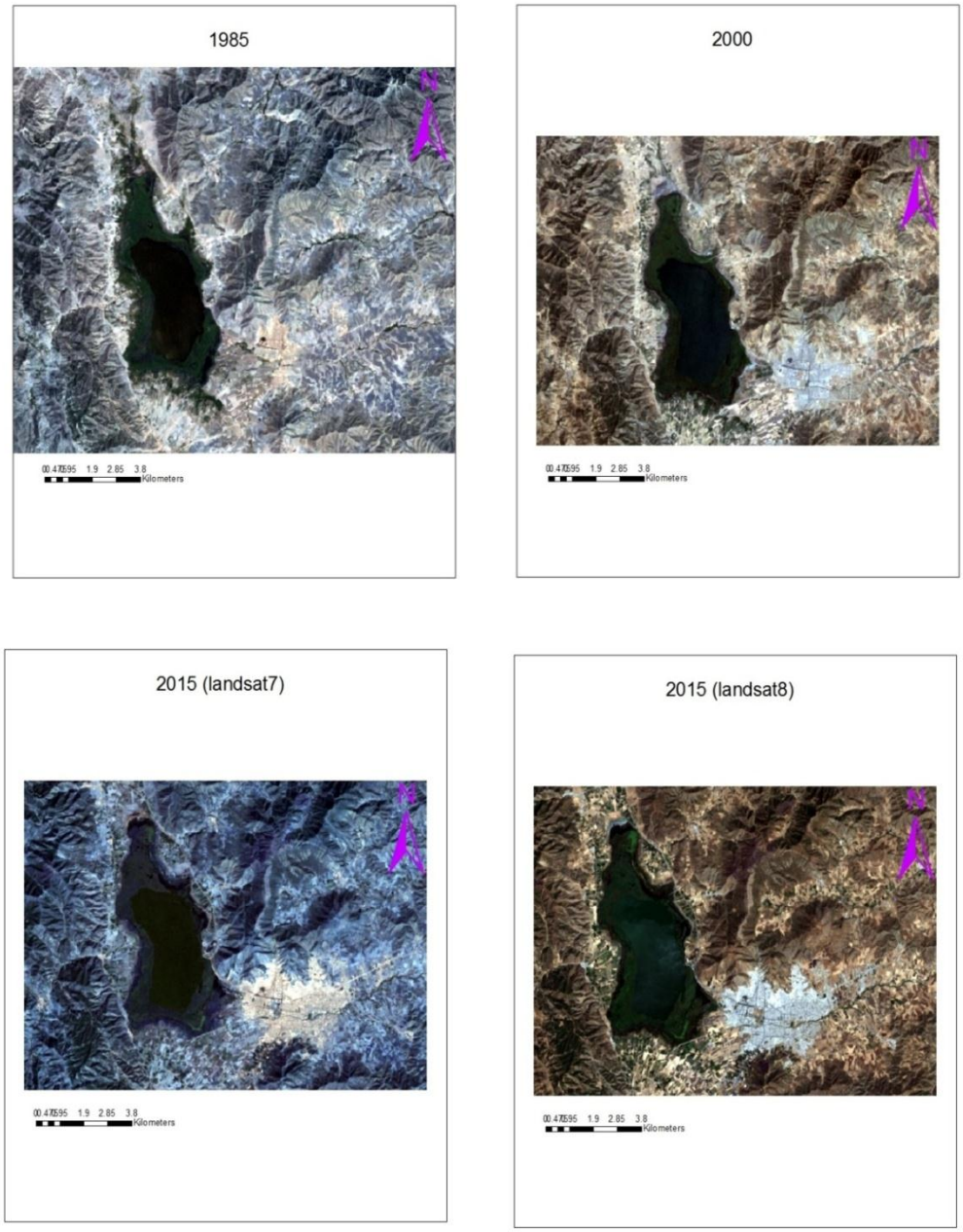

Figure 2. Calibrated images, Calibration and correction apply to each image

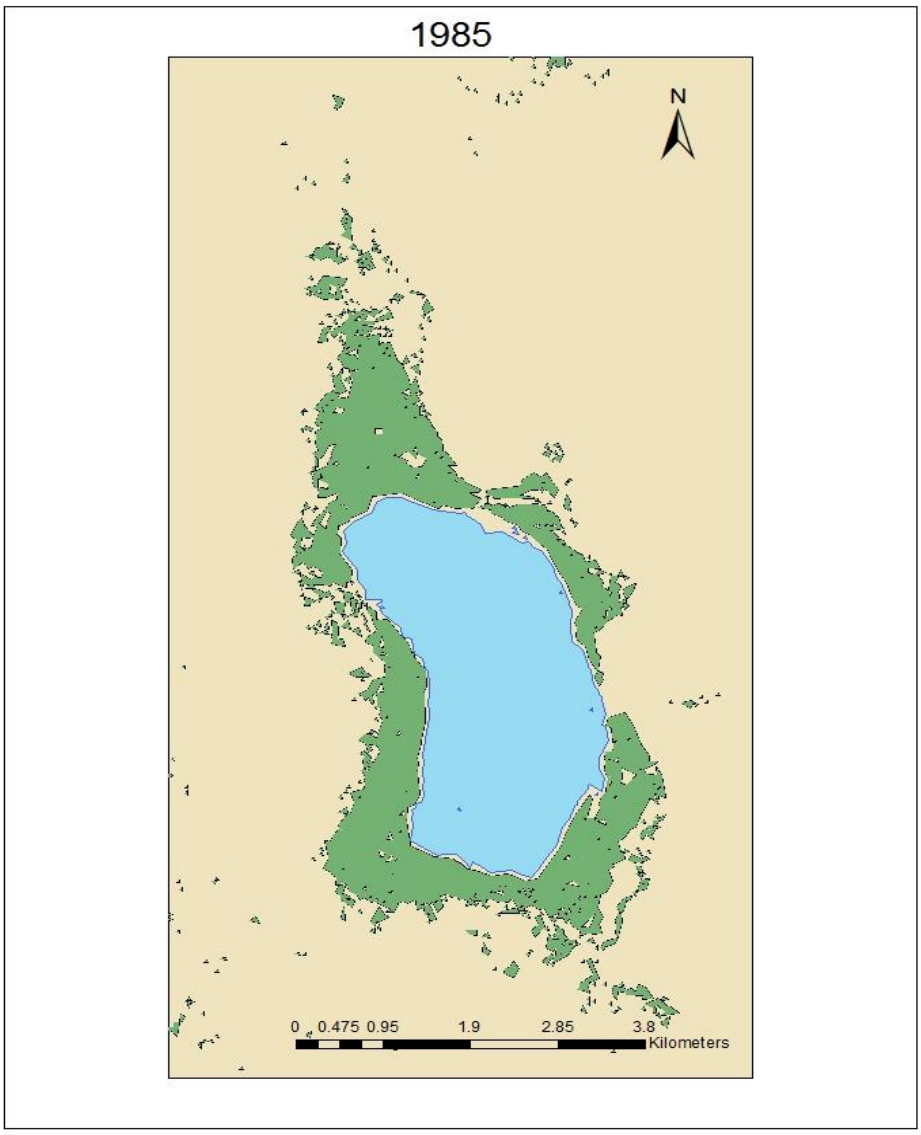

Figure 3. Output of 1985 year, Water surface: 790 hectares

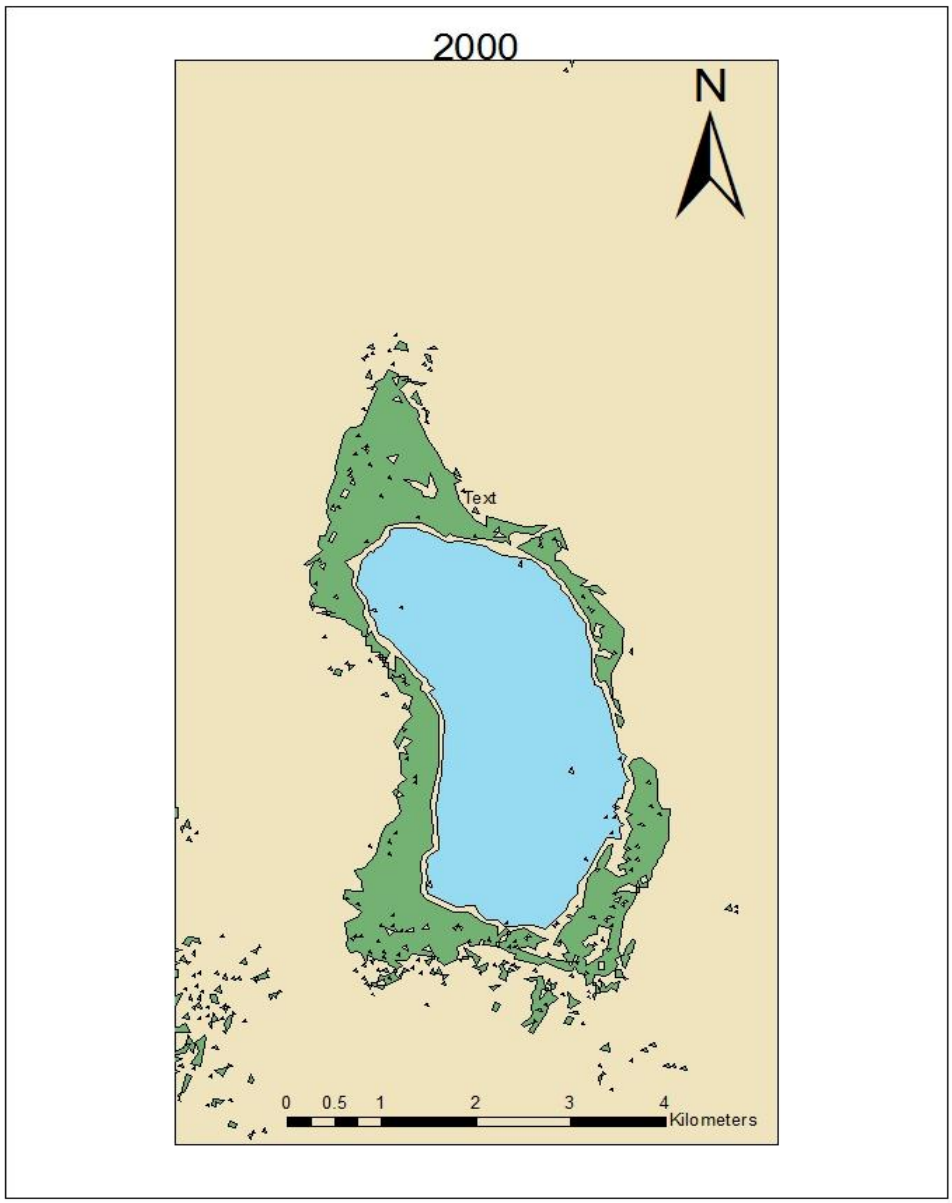

Figure 4. Output of year 2000, Water surface: 791 hectares

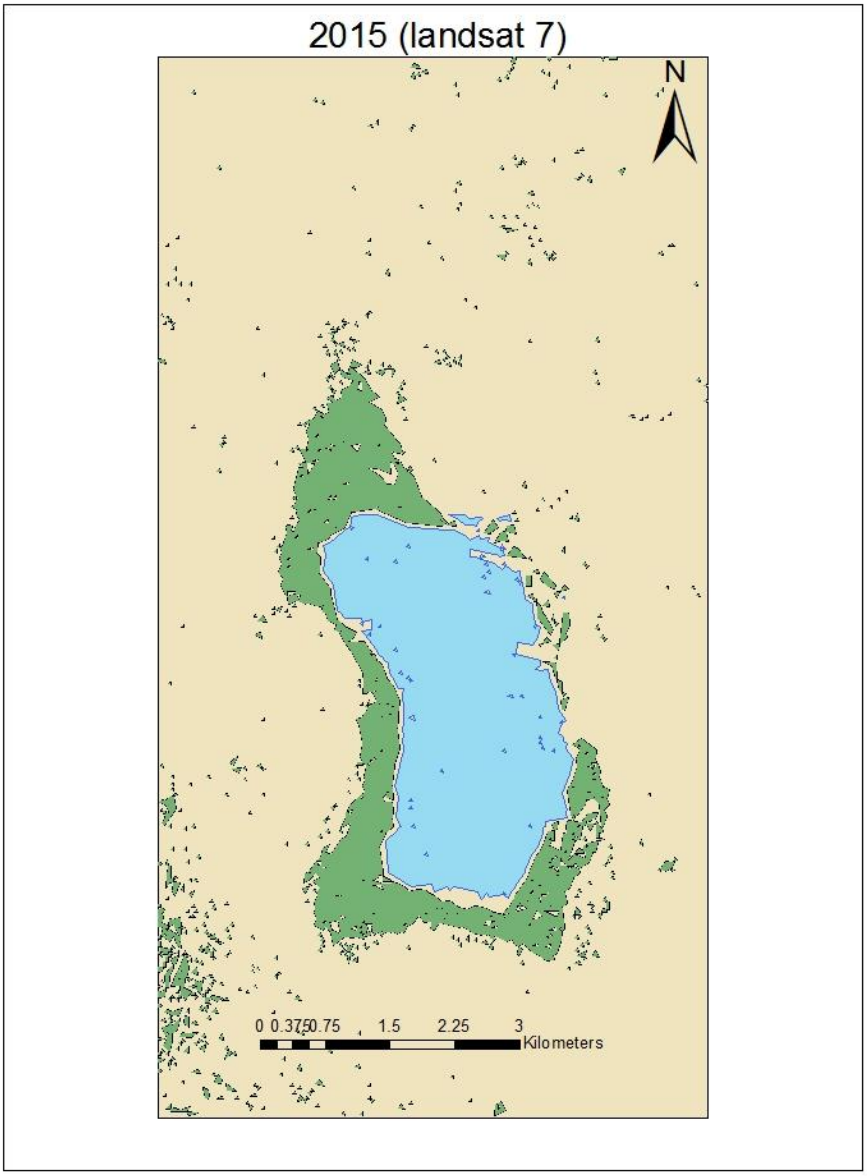

Figure 5. Output of 2015 (Landsat 7), Water surface: 788 hectares

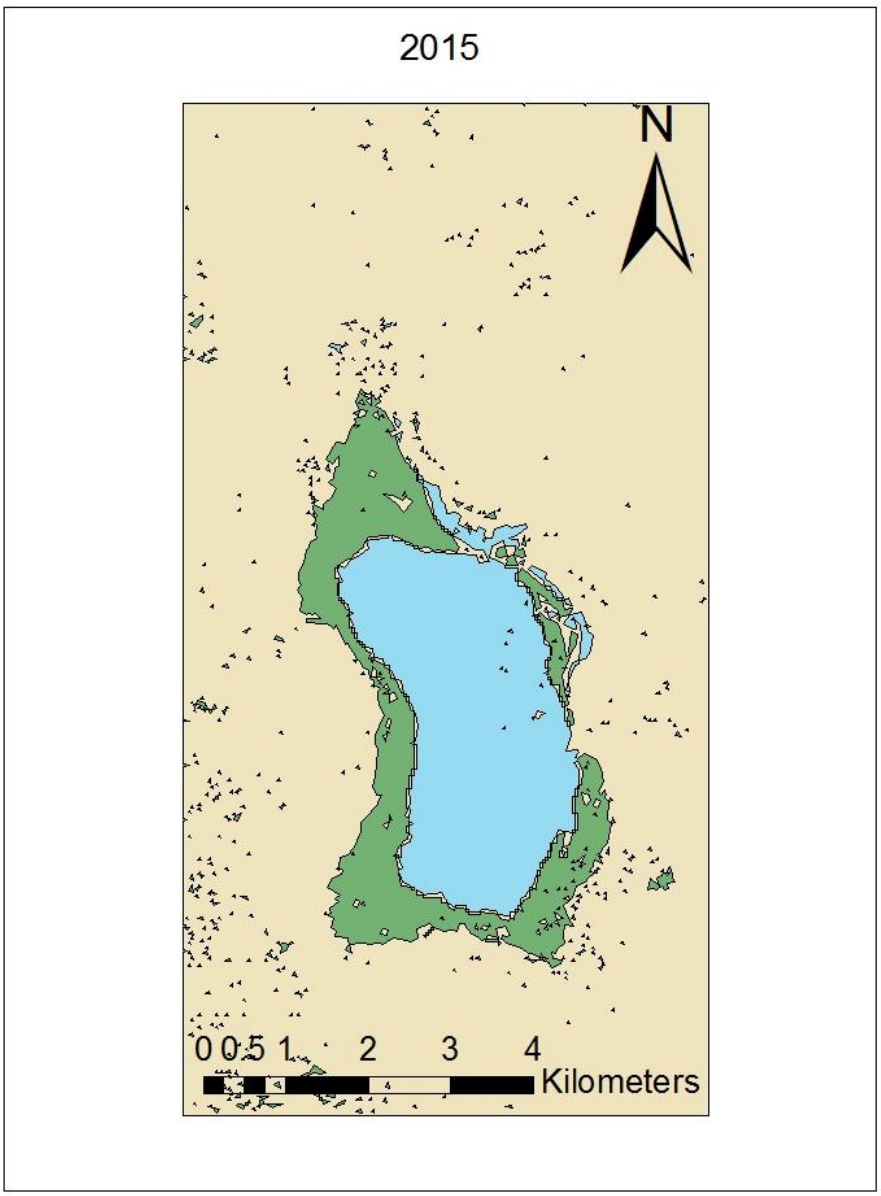

Figure 6. Output of 2015 (Landsat 8), Water surface: 850 hectares

EVALUATION AND VERIFICATION

After the classification processing (Maximum Likelihood Classification), by ROIs of water and vegetation carried out. Use the ground points we knew about be water or be vegetation, and test our classification. (test ROIs) and the Kapa coefficient calculated. Here, the accuracy of the work was above 80%.

DISCUSSION AND CONCLUSION

In this project, changes in the surface of water and vegetation of the Zrewar Lake between 1985 and 2015 was studied and examined. In total, the changes in these two 15-year periods are not large, and the project for the construction of the docks and a coastal park on the southeast coast and near the city of Marivan was the main factor to the removal of many reeds and vegetation. and water has reached to the coast. That means, the reeds are remove and water and the water has been replaced.

Another note, there is a small difference between the two Landsat 7 and 8 images in 2015, that the results of Landsat 8 are preferable because 20% of the data of Landsat 7 is failed and the software image file has been modified. Water up volume in Landsat 8 is due to the spring and rainy time of taking pictures. We can conclude that there are only a few variations changes in the surface of water, that climate and annual rainfall also affecting on it. But there are no meaningful changes in the surface of water and vegetation during this 30-year period.

It is hope, in the future, with the using of radar images, and other bands that have a minor penetration, it is possible to reach through remote sensing, penetrating to depths of the Zrewar lake and provided an analysis of it. To provide water quality changes in the lake. Institutions of environment for this quality changes in the lake have made a warning.

Due to the good circumstances of surface and vegetation of water, the problem of lake returns into the depth of lake and its qualitative changes. It was found that the lake is not in crisis due to the surface of water and vegetation. And it is necessary to do the work of water quality and depth. Since the source of water of the lake is the fountains of floor of zrewar, it is said that by entering the waste water of the surrounding villages (even in the area of the city of Marivan) into the lake, which cause increasing the plants of depths of the water, And it's harder for life conditions of other aquatic animals. Also closing the outlet of the lake water by a dam, preventing to exit of sediments and causes their sedimentation on the floor of lake. Due to the fact that the water of the lake comes from the fountains of the floor of zrewar, these sediments and plants in the deep may cause destroying the fountains, and this have made the environmental institutions to give suggestion of dredging of the Zrewar lake.

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