

Motoring the Environmental Changes in Al-Hawizeh Marsh using Remote Sensing Techniques

Ebtesam F. Khanjer

Department of Astronomy and Space, College of Science, University of Baghdad

Abstract: Remote sensing data in combination with the appropriate multispectral bands such as Landsat OLI/TIR and TM data were used to get change detection of amount of water changes cover using multi-spectra and spatio-temporal Landsat satellite images for the periods of 1990 – 2015 in Al-hawizeh marsh in southern of Iraq. Multi Pre-processing image techniques have been adopted include geometric correction, atmospheric correction, image clipping and Enhancement. After these steps has been used results images classification to chafe these changes in Hawizeh marshes by using supervised classification technique. From the results of classification process indicate the water bodies was much decreased in year 2000 than 1990 and increased in 2015 than 2000 but less than 1990.

Keyword: AL-Huwiza marsh, Landsat satellite images, change detection, image classification

1. Introduction

Change detection is the measurements the extent of the change in the characteristics of the selected area, and the disclosure of these changes involves a comparison the satellite images with different time intervals to detected environmental changes using two or more images for same geographical area [1]

The method of change detection after classification is the most simple change detection analysis techniques based on the classification. After classification compare method can be used to two or more images after registration, including a classification step and a comparing step. Each image of multi-temporal images is classified separately and then the classification result images are compared. If the corresponding pixels have the same category label, the pixel has not been changed, or else the pixel has been changed [2,3].

2. Image Preprocessing

The preprocessing is an inevitable step in the change detection. In this study, the preprocessing included radiometric and geometric corrections of the satellite images. Radiometric correction comprised the process of histogram matching of the satellite images from different time periods, whereas geometric correction meant registration of the satellite images, so that the images could overlap in the best possible way. This is important because some of the essential methods are based on the comparison of the two images from different time periods [4,5].

3. Supervised Classification

In this study is based on the supervised classification. Change detection is based on the classification of all the image pixels from one time period in accordance with the pre-set number of classes, where the classes represent the appropriate land cover class. By using specified number of classes and they mathematically [7]

Recognize classes by measuring image pixels valuedifferences. In supervised classification, it is necessary to select several characteristic training samples from the image for each of the classes. After that computer examines whole image and classifies pixels into one of the created classes. In this study, the Maximum Likelihood algorithms have been [6] used for the classification the surface cover

4. Maximum Likelihood Classification

Maximum likelihood classification is the most common type supervised classification method used with remote sensing image data. It was based on using appropriate algorithms for naming each image pixels as representing specific ground cover Types, or classes. Regardless of the specific method chosen, the fundamental practical procedures, [8]:

- 1) Select and decide the regions or types into which the image is to be divided. These are the information classes and could, for instance, be water, Vegetation, Wet soil, dry soil, and Mixed soil.
- 2) Choose prototype or representative pixels from each of the required group of classes. These pixels are said to be region of interest (ROI) or training data. Pixels for a given class located in a mutual regions surrounded by a border.
- 3) Training data are using to estimate the parameters of the particular classifier algorithm to be used, these parameters will be the properties of the probability model used or will be questions that define partitions in the multispectral space.
- 4) By using the trained classifier, naming or classify every pixel in the image into one of the desirable ground cover kinds (information classes). Here the entire image segment of interest is commonly classified.
- 5) Produce tabular summaries or thematic (class) maps which summarize the results of the classification.

5. Study Area

Marsh is one of the most important areas in the south of Iraq is considered an economic resource and a tourist resort in the future. Its play an important role for improves the economic, social, biodiversity status in the country [10].

Al Hawizeh marshes lie south of Iraq to the east of the Tigris River between the Iran-Iraq border, the marshes cover an approximate area of at least 3,000 km², with length 80Km, width 30Km depth 6m they are fed by kahlah and train full flows from mountains of Iran, the time of train full was between November and May months. The northern and

central parts of the marshes are permanent, but the southern parts become seasonal in the natural state. The province of Basra has established a natural reserve in it. It was called Al-Safi Reserve [11].

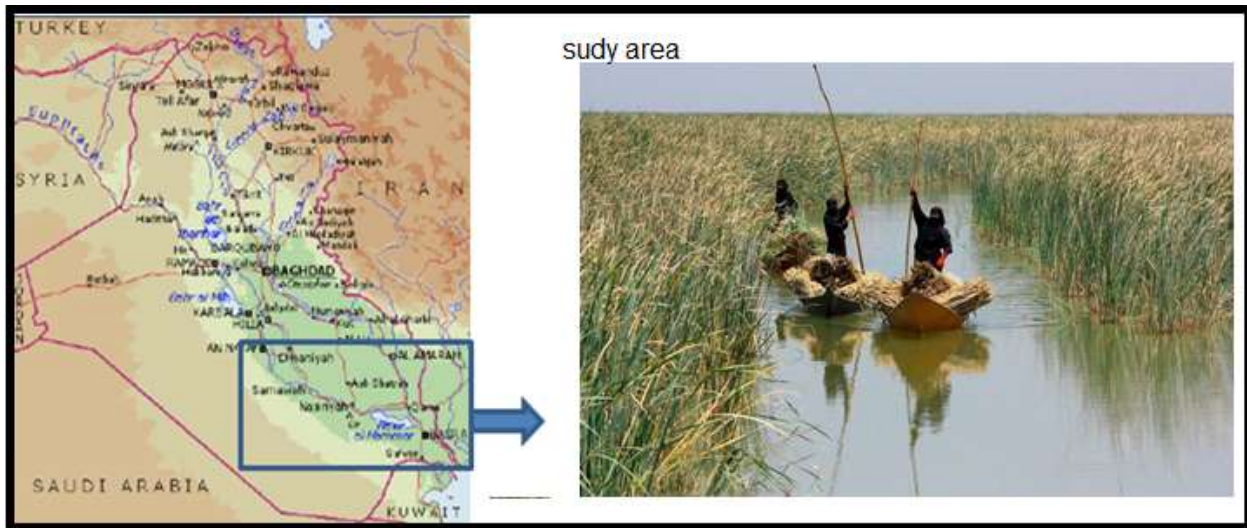


Figure 1: Show the location of study area in south Iraq

6. Methods and Material

The aim of this paper is to detect the water change from 1990 to 2015. The multispectral satellite data is used to image processing for estimation this change. The software ENVI 5.1 and MATLAB is used data acquisition and processing. The data utilized is given in the following table(1) for the years 1990 and 2015. Multi-bands spectra are shown in the figure() for each year.

Table 1: The Landsat and date of captured each original image

Original images	Source
Marshes (1990)	Landsat5 Thematic Mapper (TM), 5-7-1990 path 166 Row 38
Marshes (2000)	Landsat 7 Enhanced Thematic Mapper Plus (ETM+) Scan Line Corrector On (SLC-On) 4-7-2000 path 166 Row 38
Marshes (2015)	Landsat 8 OLI (Operational Land Imager) and TIRS (Thermal Infrared Sensor), 5-5-2015 path 166 Row 38

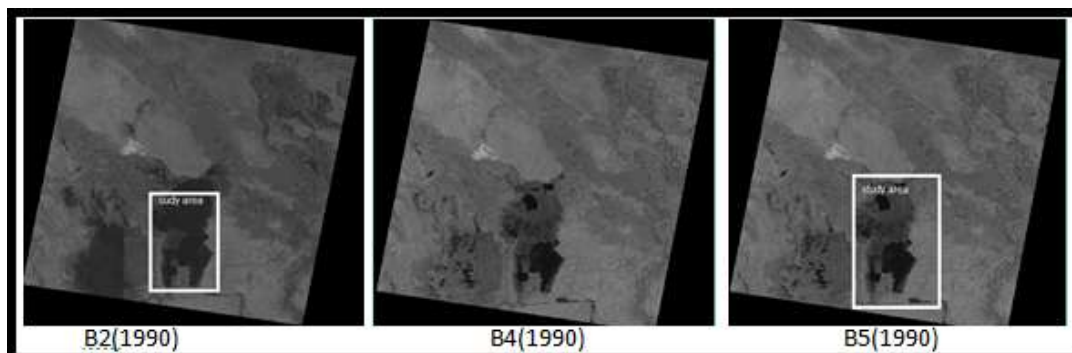


Figure 2: Show the Multi-band images in 1990 Bath166, Row38

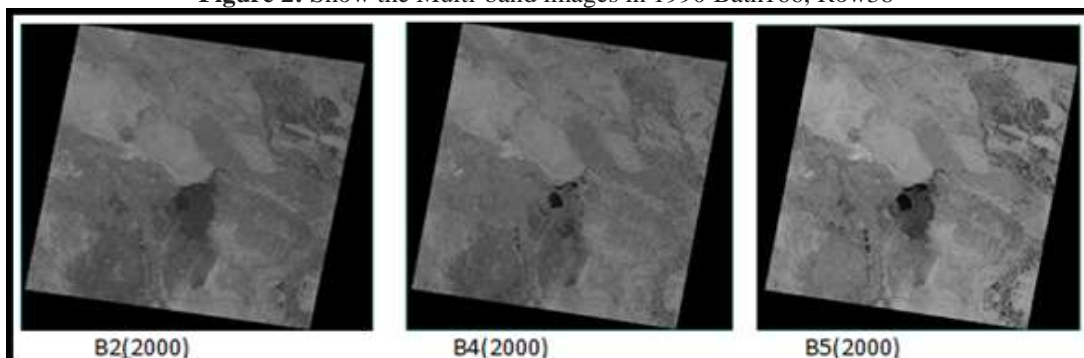


Figure 3: Show the Multi-band images in 2000 Bath166, Row38

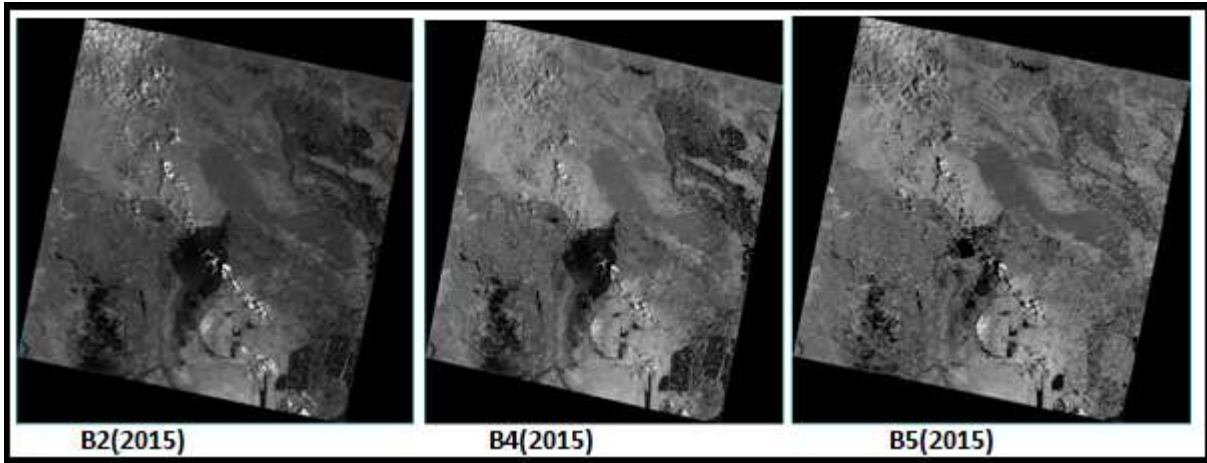


Figure 4: Show the Multi-band images in 2015 Bath166, Row38

Area Clipping

The study area Al Hawizeh marshes location in south of Iraq with following geographic coordinate:
 Proj: UTM, Zone 38: Datum WGS-84: ULGe. 47° 25' 88":
 Pixel=30m: diameter of clipping area

(ROI)=1463x2714(Byte)[BSQ]. The following figure shows the selected area with different time.

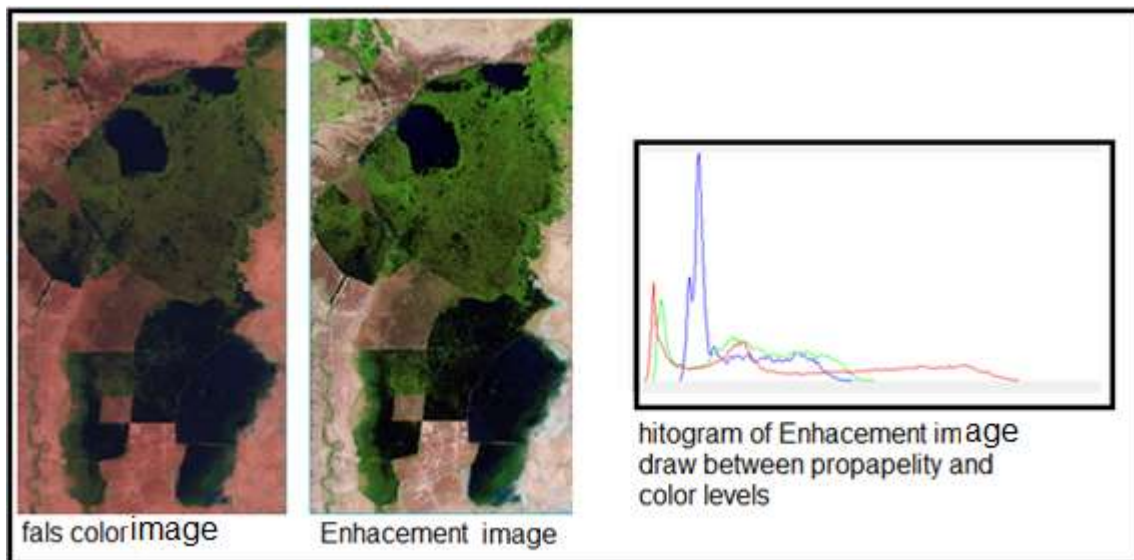


Figure 5: Show selected area with false color , enhancement image and it's histogram (1990)

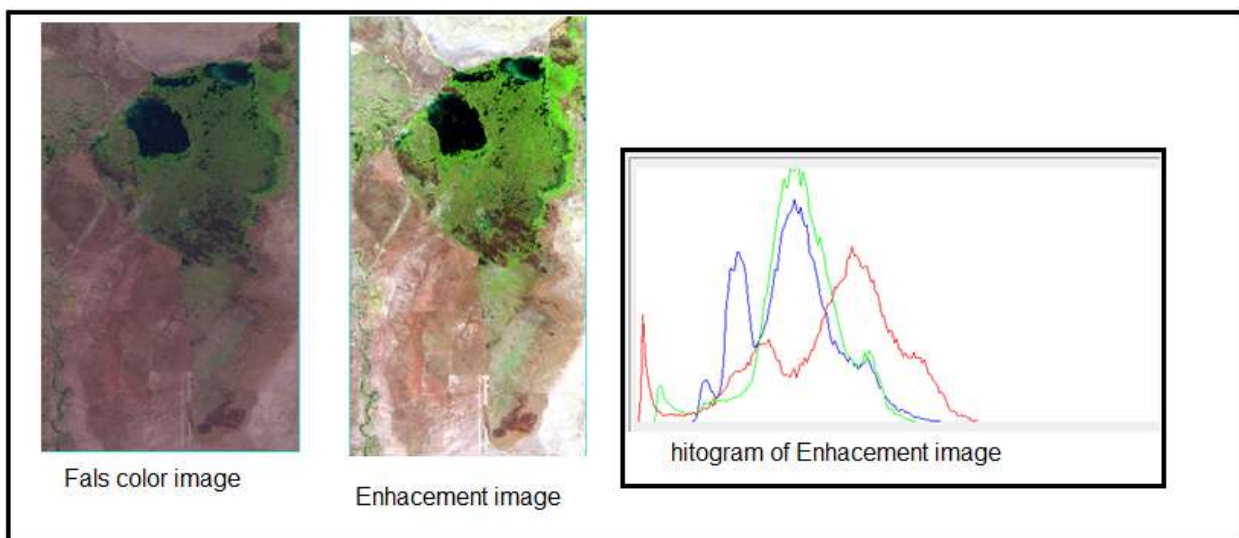


Figure 6: Show selected area with false color, enhancement image and it's histogram (2000).

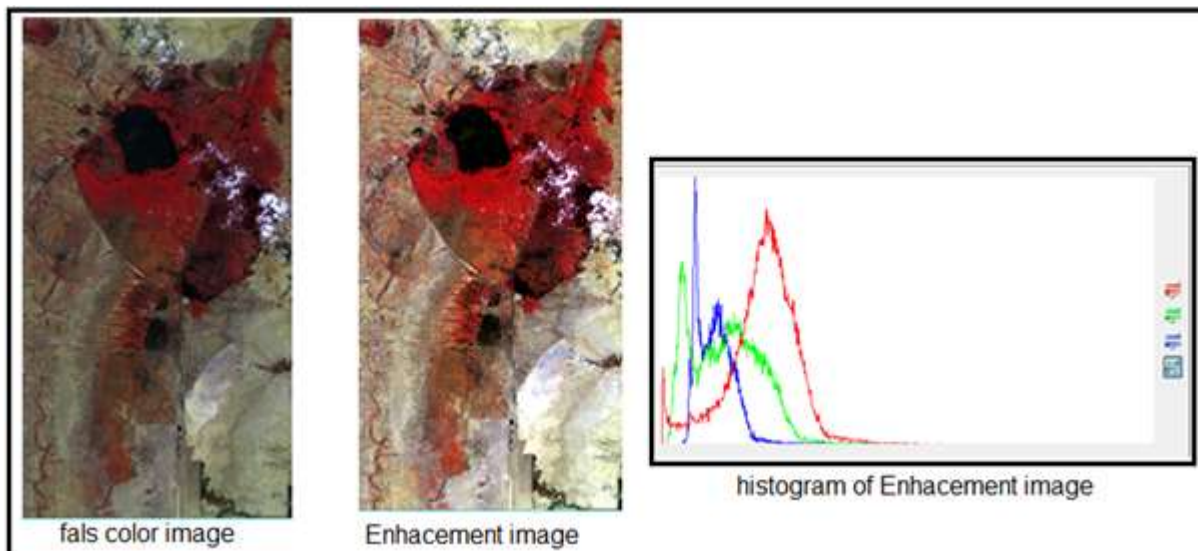


Figure 7: Show selected area with false color, enhancement image and it's histogram (2015)

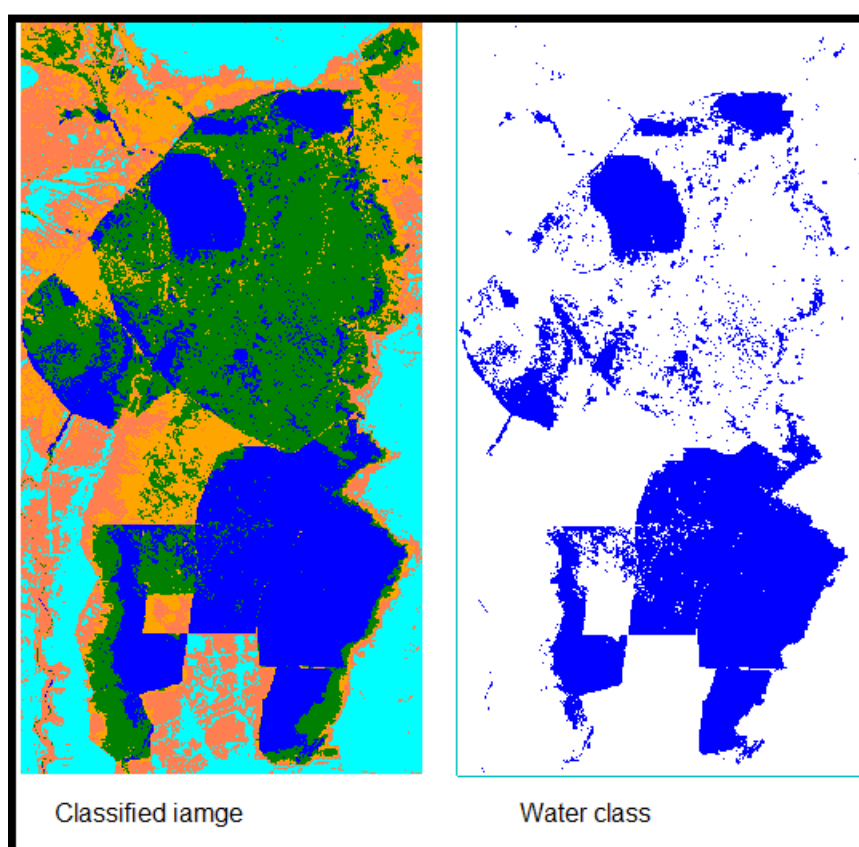


Figure 8: Show classified image and water class for 1990

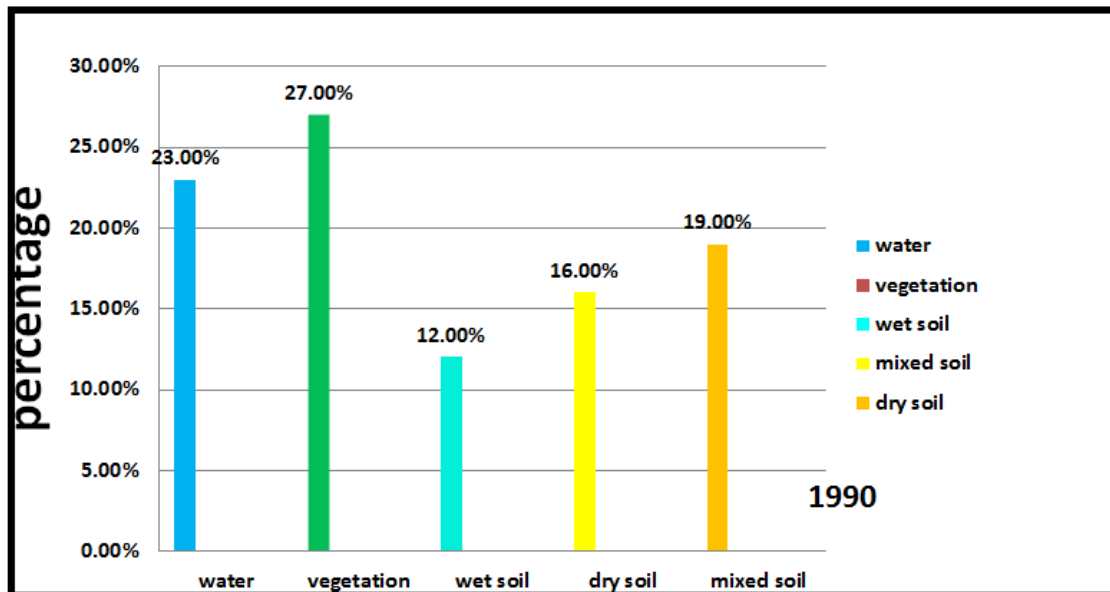


Figure 9: Show statistical results of classified image for 1990

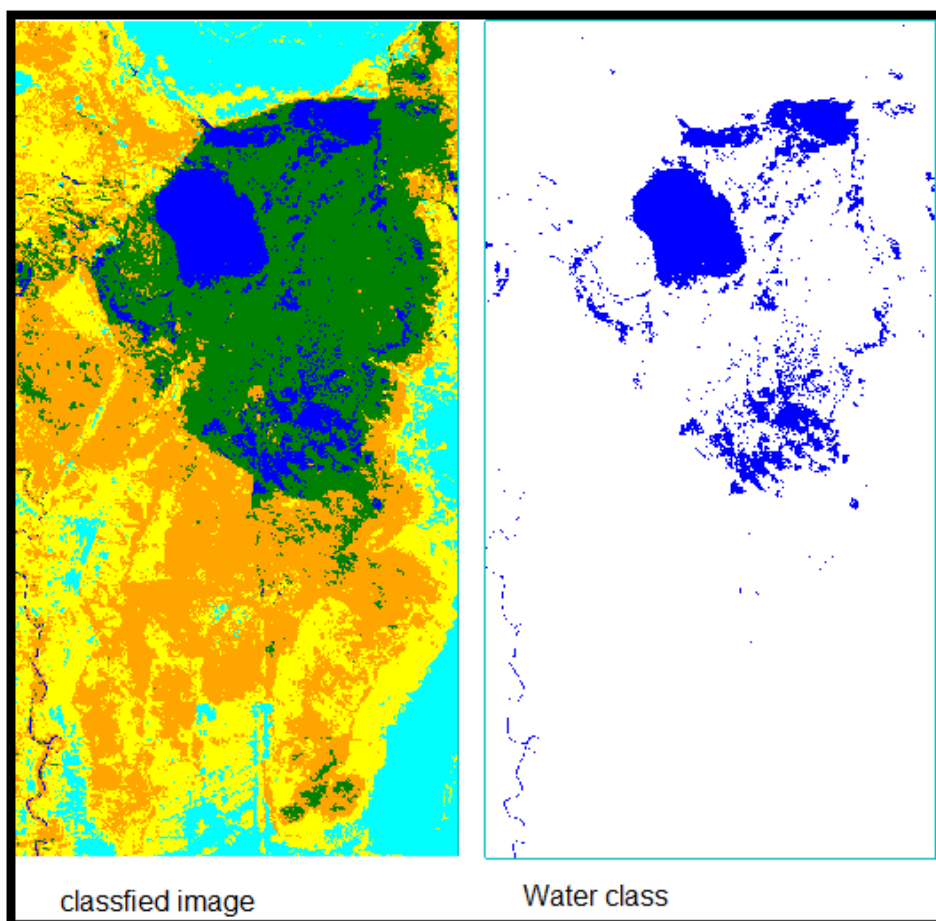


Figure 10: Show classified image and water class for 2000

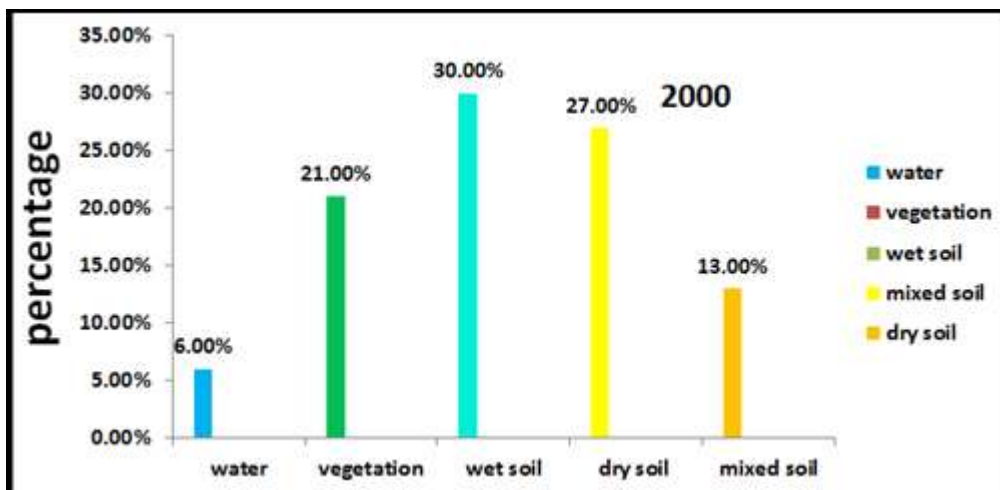


Figure 11: Show statistical results classified image for 2000

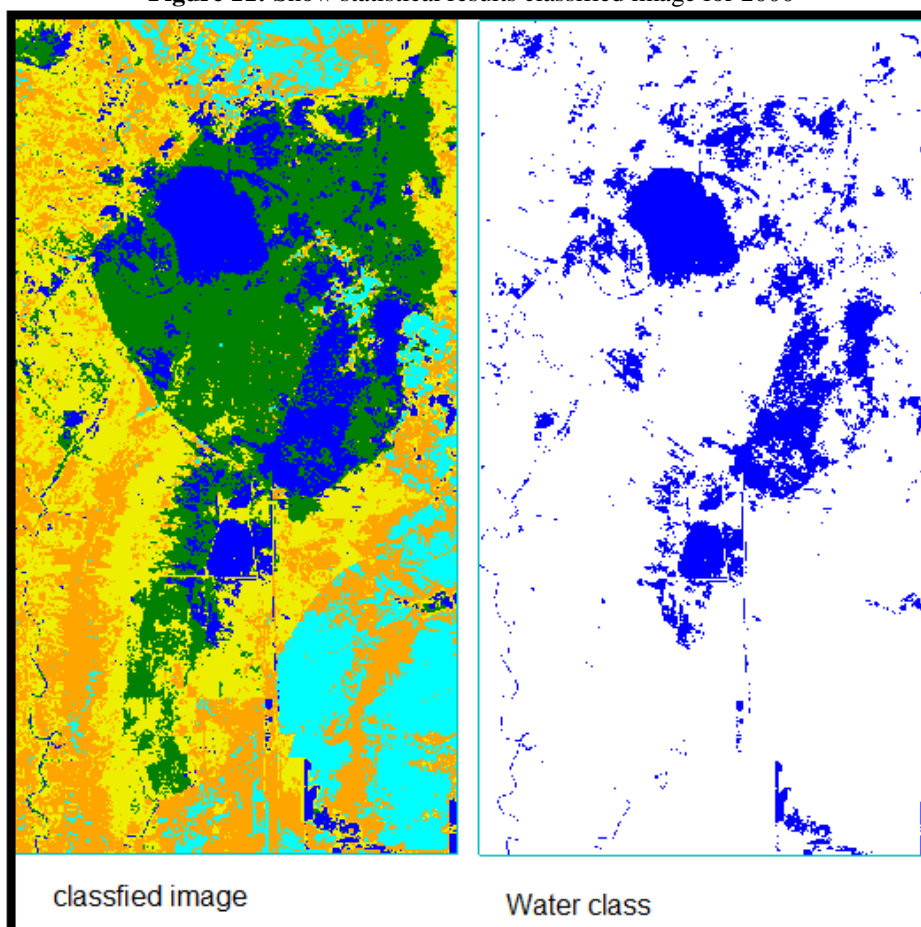


Figure 12: Show classified image and water class for 2015

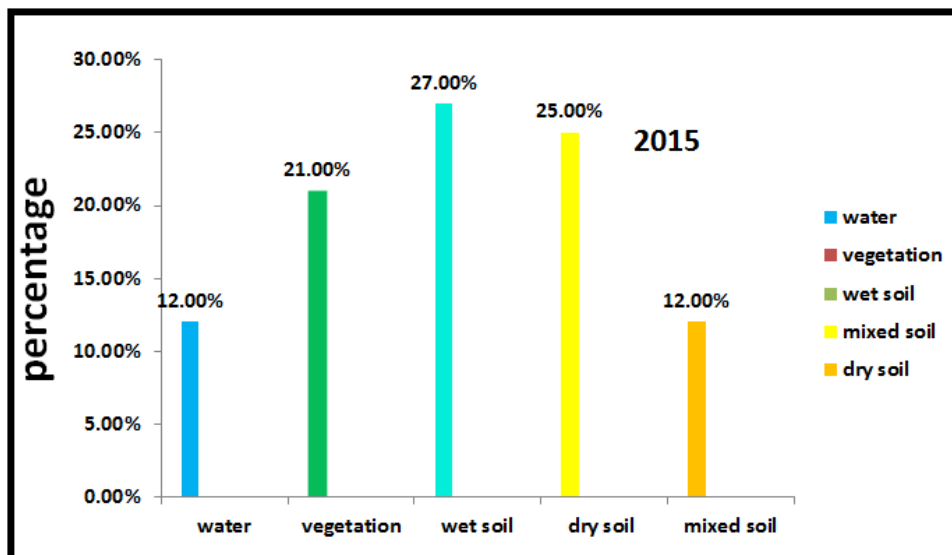


Figure 13: Show statistical results classified image for 2015

7. Conclusion

Many monitoring techniques were employed to detect the water cover of Al-Hawizeh marsh, supervised classification has been applied and the results shown the decrease of the water cover in 2000 compared with the past years (1990), Water levels decreased from (23% to 6%). This is due to the policy of deliberately drying the marshes in the previous government. After that, the same area witnessed an increase in water cover in 2015 from (6% to 12%), this is clearly evident through the results in the figures (8,10,12) from classification image and isolation water class (Mask filter). This is the result of a strategy to revive the marshes of Iraq.

Results of this research shown in figures (9,11,13) indicate that surface under vegetation and mixed soil have been reduced from 1990 to 2000 as (27% to 21, and 19% to 13) respectively, and then increased in 2015. On the other hand, the dry soil has increased from (16% to 27%) at year 2000 with respect to 1990, and the decreased in 2015.

References

- [1] Giacomo Capizzi, Grazia Lo Sciuto, Marcin Wozniak, Robertas Damasevicius. (2016) A Clustering Based System for Automated Oil Spill Detection by Satellite Remote Sensing, ICAISC (2): 613-623.
- [2] Schowengerdt, Robert A. (2007). Remote sensing: models and methods for image processing (3rd ed.). Academic Press. p. 2. ISBN 978-0-12-369407-2.
- [3] Schott, John Robert (2007). Remote sensing: the image chain approach (2nd ed.). Oxford University Press. p. 1. ISBN 978-0-19-517817-3.
- [4] C.H.Chen (2006). "Image processing for remote sensing". the material previously published in signal and image for remote sensing Taylor and Francis 2006.
- [5] R.A. Schowengerdt (2007). "Remote sensing, Model
- [6] Šarić, M., Dujmić, H., & Russo, M. (2013). Scene Text Extraction in HSI Color Space using K means Algorithm and Modified Cylindrical Distance. *Przegląd Elektrotechniczny*, pp. 117-121.
- [7] Richards, J. A. and Jia, X. 2012. *Remote Sensing Digital Image Analysis*. Springer Berlin Heidelberg New York, pp. 78-196.
- [8] UNEP and H.Partow (2001) "the Mesopotamian Marshland: Demise of an Ecosystem,"
- [9] D.A. Scott (1995) "A directory of wetlands in the Middle East" IUCN.
- [10] D.C. Munro and H. Touron (1997) "the estimation of marshland degradation in southern Iraq using multitemporal Landsat TM images" *INT.J.Remote sens.*, vol.18 no.7, pp.1597-1606.