Using Normalized Difference Vegetation Index (Ndvi) To Assessment The Changes Of Vegetations Cover In Surrounding Area Of Himreen Lake

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Abstract

The study area lies in the eastern part of Iraq, within Diyala and small parts of Salah Al-Din and Sulamanyah Governorates. The eastern boundary of the map represents Iraqi-Iranian International borders; it covers about 7010 Km^2.The present study depends on two scenes of Thematic Mapper (TM5) data of Landsat and one scene of Multi-Spectral Scanner (MSS) data of Landsat, these data are subset and corrected within the ERDAS 9.2 software using UTM N38 projection. Normalized Difference Vegetation Index (NDVI) was adopted as practical tool for monitoring the surrounding area of Himreen Lake. The obtained result shows the distributions of NDVI for period 1976-1992 were positive pattern of (High vegetation density and Moderate vegetation density) and negative pattern of (Low vegetation density).The distributions of NDVI for period 1992-2010 was negative pattern of (High vegetation density and Low vegetation density) and positive pattern of (Moderate vegetation density).

Key words: NDVI, change detection, Land use/Land cover, Himreen Lake

استخدام دليل اختلاف الغطاء النباتي لتقييم تغيرات الغطاء النباتي في المناطق المحيطة لبحيرة حمرين

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الخلاصة

تقع منطقة الدراسة في الجزء الشرقي من العراق ضمن محافظة ديالى واجزاء صغيرة من محافظة صلاح الدين والسليمانية . الحدود الشرقية للخريطة تمثل الحدود الدولية بين العراق وايران وهي تغطي مساحة 7010 كم² .

الدراسة الحالية اعتمدت على مشهدين فضائيين للقمر الصناعي لاندسات TM5 ومشهد للقمر الصناعي لاندسات MSS2 ، قطعت منطقة الدراسة باستخدام برنامج الايرداس وصححت بالمسقط UTM N38 .

استخدم دليل الغطاء النباتي كأداة تطبيقية لمراقبة الاراضي المحيطة لبحيرة حمرين وكانت النتائج المستحصلة لتوزيع الغطاء النباتي للفترة المحصورة بين 1976–1992 ذات نمط ايجابي للغطاء النباتي عالي الكثافة والغطاء النباتي متوسط الكثافة ونمط سلبي متمثل بالغطاء النباتي قليل الكثافة. اما الغطاء النباتي للفترة 1992–2010 فكان نمط التوزيع سلبي للغطاء النباتي عالي الكثافة والغطاء النباتي قليل الكثافة اما نمط التوزيع الايجابي فكان متمثل بالغطاء النباتي متوسط الكثافة.

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1. Introduction

Change Detection is the process of identifying differences in the state of an object or phenomenon by observing it in different times; it involves the ability to quantify temporal effects using multi-temporal data sets, and one of major applications of remotely-sensed data obtained from satellites is change detection, because of repetitive coverage at short intervals and consistent image

In this study, image ratioing (NDVI) was used to analyze and output data related to the change in environment, it included a description of physical conditions of vegetation. The base of this study depended on Landsat data for two periods (1976-1992) and (1992-2010).

1.1. Aim

Study and assessment the changes of vegetations cover in surrounding area of himreen lake for the periods (1976-1992) and (1992-2010).

1.2. Location

The study area lies in the eastern part of Iraq, within Diyala and small parts of Salah Al-Din and Sulamanyah Governorates. The eastern boundary of the map represents Iraqi-Iranian International borders, it covers about (7010) Km^2 and it is determined by the fallowing coordinates (Figure1).

Longitude 44° 34'48 ″ 45° 39' 01″
Latitude 33° 44' 51 34° 33' 20″

1.3. Geological Setting

The study area is located within foothills zone and Mesopotamian zone. It is characterized by undulated plains, hilly and mountainous areas that increase in elevation toward east and northeast. Quaternary sediments are covering part of the study area. Pre-quaternary sediments, belong to Tertiary (Middle Miocene-Pliocene) are represented by Fatha, Injana, Mukdadiyah , and Bai Hassan Formations [1-5].

2. Methodology

2.1. Data Collection

The present study depends on the following available data:

Two scenes of Thematic Mapper (TM5) data of Landsat Acquisition in 9/8/1992, and 2/7/2010 Scene168-36 in spatial resolution 30m and Multi-Spectral Scanner (MSS) data of Landsat 2 acquisition in 23/7/1976 Scene181-36 in spatial resolution 57m, downloaded from Website of USGS (http://glovis.usgs.gov/).

2.2. Software

ERDAS Imagine V. 9.2 and ArcGIS V.9.3 software have been used. ERDAS Imagine 9.2 software was used for image processing and change detection. Arc GIS 9.3 software was used for data analysis and map composition.

2.3. Pre-processing

Two scenes of TM images, one scene of MSS images, and these data are subset it by using Area of Interest (AOI) tool. The images carried out with WGS84 datum and UTM N38 projection using nearest neighbor resampling. The nearest neighborhoods resampling procedure was preferred to others resampling such as bilinear or cubic and bicubic convolution, because it is superior in retaining the spectral information of the image [6].

2.4. Image processing

2.4.1. Change detection using remote sensing technology

The remote sensing detection of Land use/Land cover LULC change within Semi-arid and Arid areas is difficult. Therefore not all change detection methods are appropriate to all areas, or all types of imagery [7]. Before implementing a change detection study, or choosing a change detection method, careful consideration must be given to the characteristics of the area of interest, the remote sensor system being used, its image pre-processing requirements, the processing/computing abilities of available systems, as well as time and finances .There are a multitude of digital image change detection techniques, summarized by [8-12], each of which could be spatially, spectrally or temporally constrained [13]. This makes choosing the right one particularly difficult.

2.4.2. Thresholding

The threshold selection is commonly based on a normal distribution characterized by its mean and its standard deviation threshold values are scene-dependent, they should be calculated dynamically based on the image content. However, the thresholds can be determined by three approaches: (1) interactive, (2) statistical and (3) supervised. In the first approach, thresholds are interactively determined visually tests. The second approach is based on statistical measures from the histogram of techniques for selecting appropriate thresholds are based on the modeling of the signal and noise [14-16], which is carried out in this study. Third, the supervised approach derives thresholds based on a training set of change and no-change pixels.

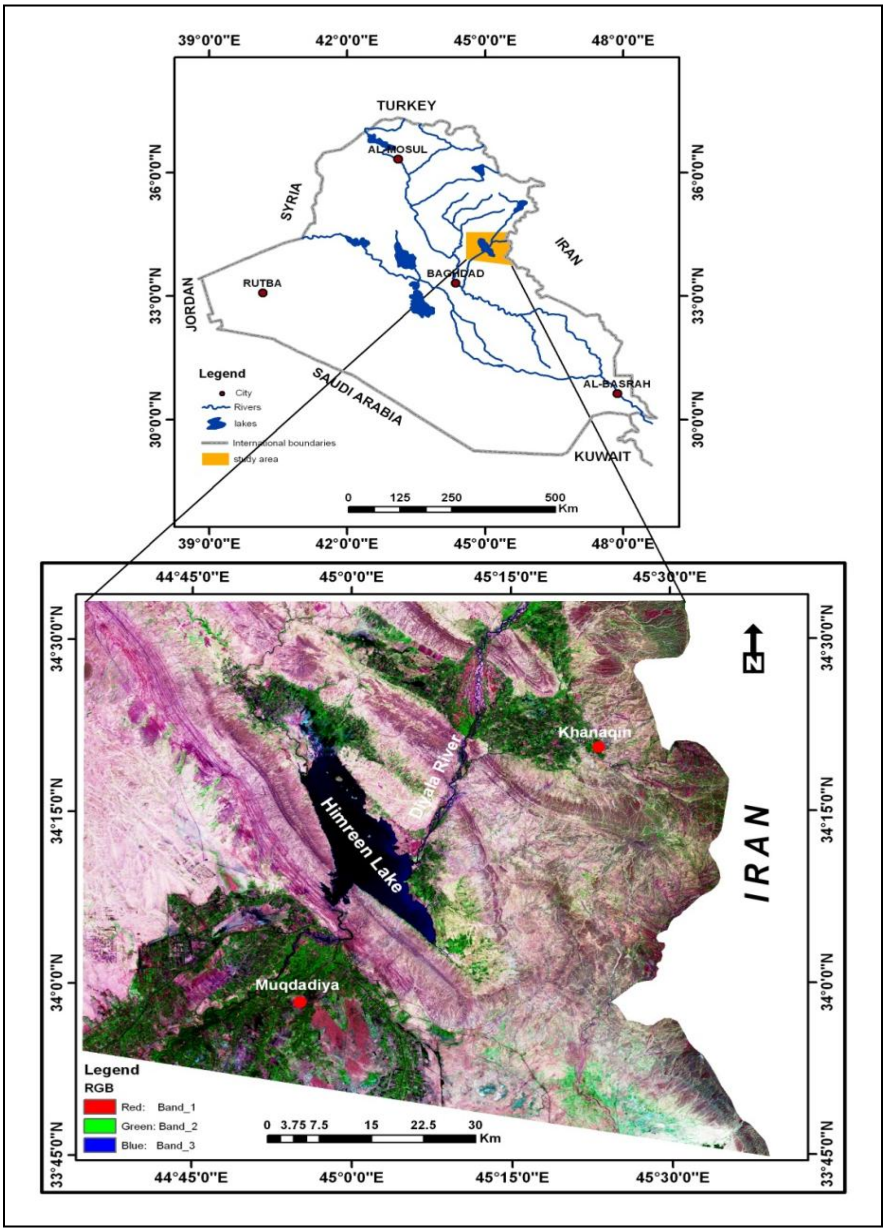

Figure 1- Location map of the study area

2.4.3. Normalized Difference Vegetation Index (NDVI)

The NDVI is an index used to identify vegetation and its health through the Levels of chlorophyll detected in the leaves. NDVI is calculated from the visible and near-infrared light reflected by vegetation. Healthy vegetation absorbs most of the incoming visible light, and reflects a large portion (about 25%) of the near infra-red (NIR) light, but a low portion in the red band (RED). Unhealthy or sparse vegetation reflects more visible light and less NIR light.

To apply the NDVI, the following formula is used [17,18]:

$$NDVI = (NIR - RED) / (NIR + RED)$$

The NDVI is a common and widely used transformation for the enhancement of vegetation information [19,20]. It is used to measure vegetation cover characteristics and incorporated into many forest assessment studies. It can be used for accurate description of land cover, vegetation classification and vegetation phonology .In some cases, multi resolution imagery and integrated analysis method were included along with NDVI for land cover classification [21,22].

Temporal dynamics of the NDVI or adding a NDVI image with the multispectral image is also useful in differentiating the vegetation .NDVI combines a multivariate data set of observations to a single index that is related to the amount of chlorophyll present in leaves of vegetation. It is an indicator of vegetation amount. The result of this algorithm is a single band data with NDVI and values ranging from -1 to 1 [23,24]. NDVI can highlight enhance specific spectral differences, which cannot be observed in the display of the original color bands [25]. The classification accomplishing of NDVI using GIS software depend on remotely sensed satellite data as the primary information source. Vegetated classification based on threshold values to classify the NDVI for the years 1976, 1992 and 2010 respectively; as shown in (Table.1) .The classification system developed for vegetation in the study area based on three categories: High vegetation density, Moderate vegetation density and Low vegetation density. The classified images are illustrated in figure-2. The vegetation covers for the period 1976, 1992 and 2010 of three categories and its percent shown in (Table-2).

The distributions of NDVI for the period 1976-1992 showed positive pattern of (High vegetation density and Moderate vegetation density) and negative pattern of (Low vegetation density). The Distributions of NDVI for the period 1992-2010 showed negative pattern of (High vegetation density and Low vegetation density) and positive pattern of (Moderate vegetation density) as demonstrated in (Table 3) and (Figure-3). (Figure-4) shows some photo of vegetation in the study area.

Table1- NDVI Thresholding

Land use - Land cover (NDVI)	***Thresholding***		
	1976	**1992**	**2010**
High vegetation density	0.643-0.123	0.537- 0.169	0.590-0.145
Moderate vegetation density	0.123-0.009	0.169- 0.004	0.145-0.005
Low vegetation density	0.009-(- 0.068)	0.004-(- 0.020)	0.005-(- 0.009)

Table 2.- Vegetation covers of NDVI area

Land use - Land cover (NDVI)	***Surface Area in km²***					
	1976	**p.%**	**1992**	**p.%**	**2010**	**p.%**
High vegetation density	213.4	14	404.4	22	355.7	20
Moderate vegetation density	362	24	985.4	53	1005.3	58
Low vegetation density	946.9	62	471.1	25	386.7	22

Table 3- Distributions of NDVI area Changes

Land use - Land cover (NDVI)	***Surface Area in km²***	
	1976-1992	**1992-2010**
High vegetation density	191	- 48.7
Moderate vegetation density	623.4	19.9
Low vegetation density	- 475.8	- 84.4

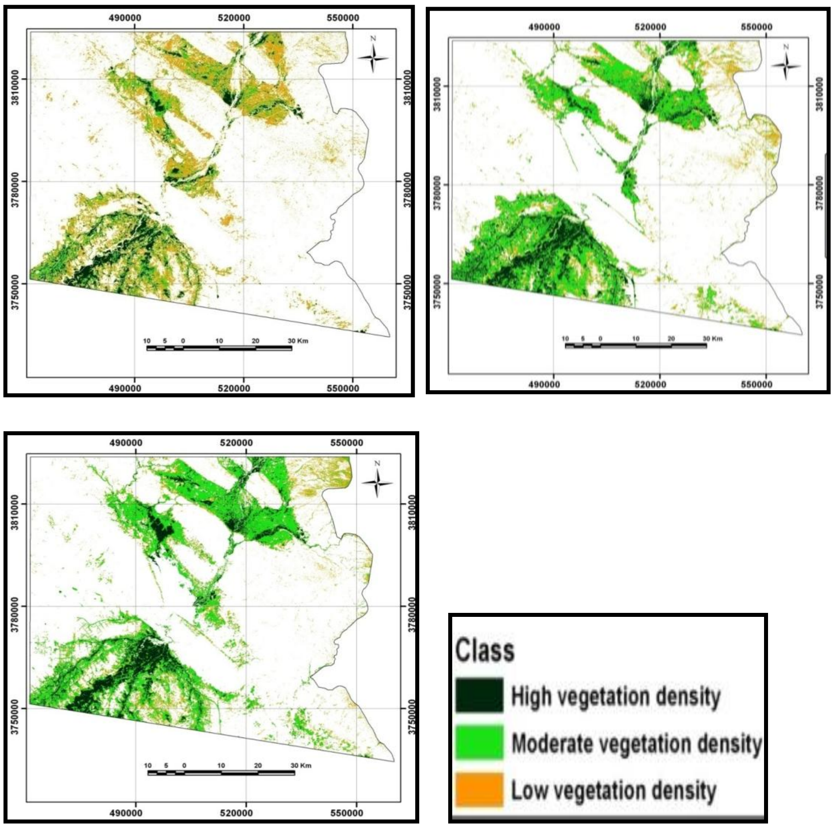

Figure 2- The classified images of NDVI for the years 1976, 1992 and 2010

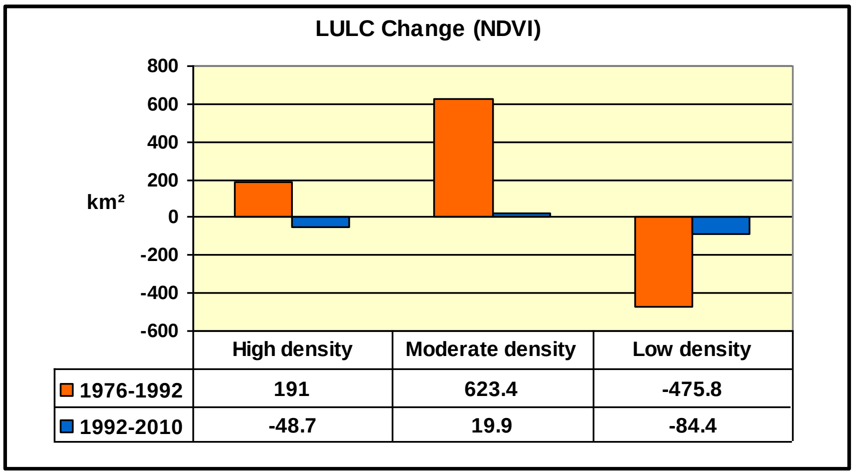

Figure 3- Plot diagram shows the LULC change (NDVI) for two periods

Figure 4- Vegetation in the study area

3. Conclusion

The study area underwent significant environmental changes during more than 30 years as follows.

The distributions of NDVI for period 1976-1992 showed positive pattern of (High vegetation density and Moderate vegetation density) and negative pattern of (Low vegetation density). The Distributions of NDVI for period 1992-2010 showed negative pattern of (High vegetation density and Low vegetation density) and positive pattern of (Moderate vegetation density).

4. Recommendations

1) It is recommended to build a basic database about the natural resources in the area (such as soils, water and vegetative cover), i.e. to classify the area on hydromorphologic bases by determining the water- bearing layers or units, their size or extension, such as their production and water quality data also flowing rain water and the nearby rivers, in addition to prepare maps to classify the soils in the area to estimate the capability for plantation and growing suitable plants.

2) Establishing a management for training national individuals to develop projects to protect these lands from deterioration through collective cooperation (between the people and the government) to treat desertification phenomenon.

3) This study proved that the Remote sensing Technique is an effective tool in studying Land use/Land cover, therefore it is recommended to use this tool in similar studies.

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