Change Detection in Hour-Ibn Nnjam / Middle of IRAQ by Using Water Index (W.I) Algebra

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Abstract

Change detection is one of the most widely used processing techniques in remote sensing. It is a process of identifying differences in the state of a geographic feature or phenomenon by monitoring at different times. In order to detect the changes in a phenomenon, the function Water Index (WI) is used to identify changes in water content of the marsh during different periods of time. Landsat satellite data is used of sensors MSS for the years 1974 &1992 and sensors TM 1984 and ETM sensors for the years 2003, 2006, 2009 By using Arc GIS software, the results are converted to thematic maps which represent water index coefficient through multiple years, as well as the use of Erase tool in the toolbox in the Arc GIS software, in order to find out the increase and decrease of the water content of the Marsh during the past years. The results showed that there is an increase in the area of the marsh in 1974 and 1984 and 1992 with an areas 210, 237, 219 km^2 , respectively and a decrease in 2003, 2006 and 2009 of 52, 58, 74 km^2, respectively.

كشف التغاير في هور ابن نجم/وسط العراق باستخدام دالة المعامل المائي

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الخلاصة

تعتبر طريقة كشف التغاير من التقنيات المهمة في تقنية التحسس النائي إذ تعرف هذه التقنية بأنها عملية مراقبة لظواهر أو أجسام خلال فترات متعددة الأزمنة. استخدمت دالة المعامل المائي Water Index (W.I) للتعرف على التغيرات التي طرأت على المحتوى المائي للهور خلال فترات زمنية مختلفة. استخدمت بيانات القمر لاندسات بالمتحسسات MSS للأعوام 1974 ، 1992 والمتحسس TM للعام 1984 والمتحسس ETM+ للأعوام 2003، 2006 ، 2009 . باستخدام برنامج Arc GIS تم تحويل النتائج الى خرائط غرضية توضح المعامل المائي خلال السنوات المتعددة، كما وتم استخدام الأداة Erase الموجودة في صندوق الأدوات في برنامج Arc GIS لغرض معرفة مقدار الزيادة والنقصان للمحتوى المائي للهور خلال السنوات المتعددة. أظهرت النتائج بان هنالك زيادة في المحتوى المائي لجسم الهور خلال الأعوام 1974و1984و1992 بمساحات 210، 237، 219 كم^2 على التوالي , ونقصان خلال الأعوام 2003، 2006، 2009 بمساحات 52، 58، 74 كم^2 على التوالي.

1. Introduction

Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times; it involves the ability to quantify temporal effects using multi-temporal data sets, and one of the major applications of remotely-sensed data obtained from satellites is change detection [1].

There are many types of these techniques, the most widely used are as follows [2].
- Image differencing.
- Image rationing.
- Principle component analysis.
- Change vector analysis.

The Mesopotamian Marshlands were one of the world's greatest wetlands and the largest such ecosystem in the southwest Asia. This wetlands ecosystem has been fundamentally changed as a result of upstream dam's construction starting in the late 1950, and the extensive deliberately draining and drying activities that started in the mid 1980.

2. Geographic Location

The study area lies in middle of Iraq, east of the Euphrates River and approximately 130 km south of Baghdad it lays between Al-Najaf, Babel and Al-Qadisea provinces. [4]. As in (Fig 1).

In the end of the 20th Century, the Mesopotamian Marshlands were almost vanished. Disappearance of such globally important ecosystem had significant impacts on the environmental equilibrium and the biodiversity on global scale. From 2003 on, significant efforts on national and International levels were started to rehabilitate these wetlands. The restoration management processes needs continuous supply of accurate and timely collected data about the marshlands status. Because of the vast area of the marshlands, and the unstable security, remote sensing and GIS techniques were adopted as practical tools for long term inventory and monitoring and restoration of the Mesopotamian Marshlands [3].

The study area had the coordinates as follow:
The Longitudes (44.20, 44.45E)
The Latitudes (32.16, 32.50N)

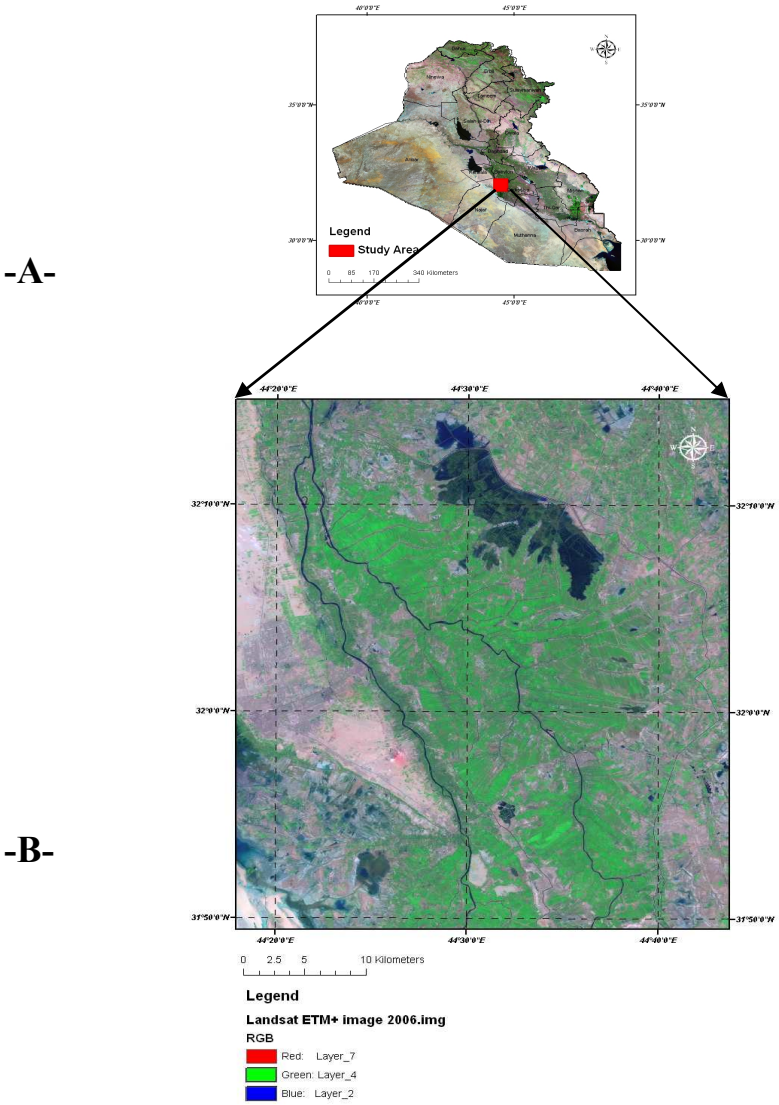


Figure 1- Shows The Location Of Study Area, A. Location Study Map, B. Hour Ibn-Najam

2. The Methodology

This study is achieved by the following steps as shown in Fig (2).

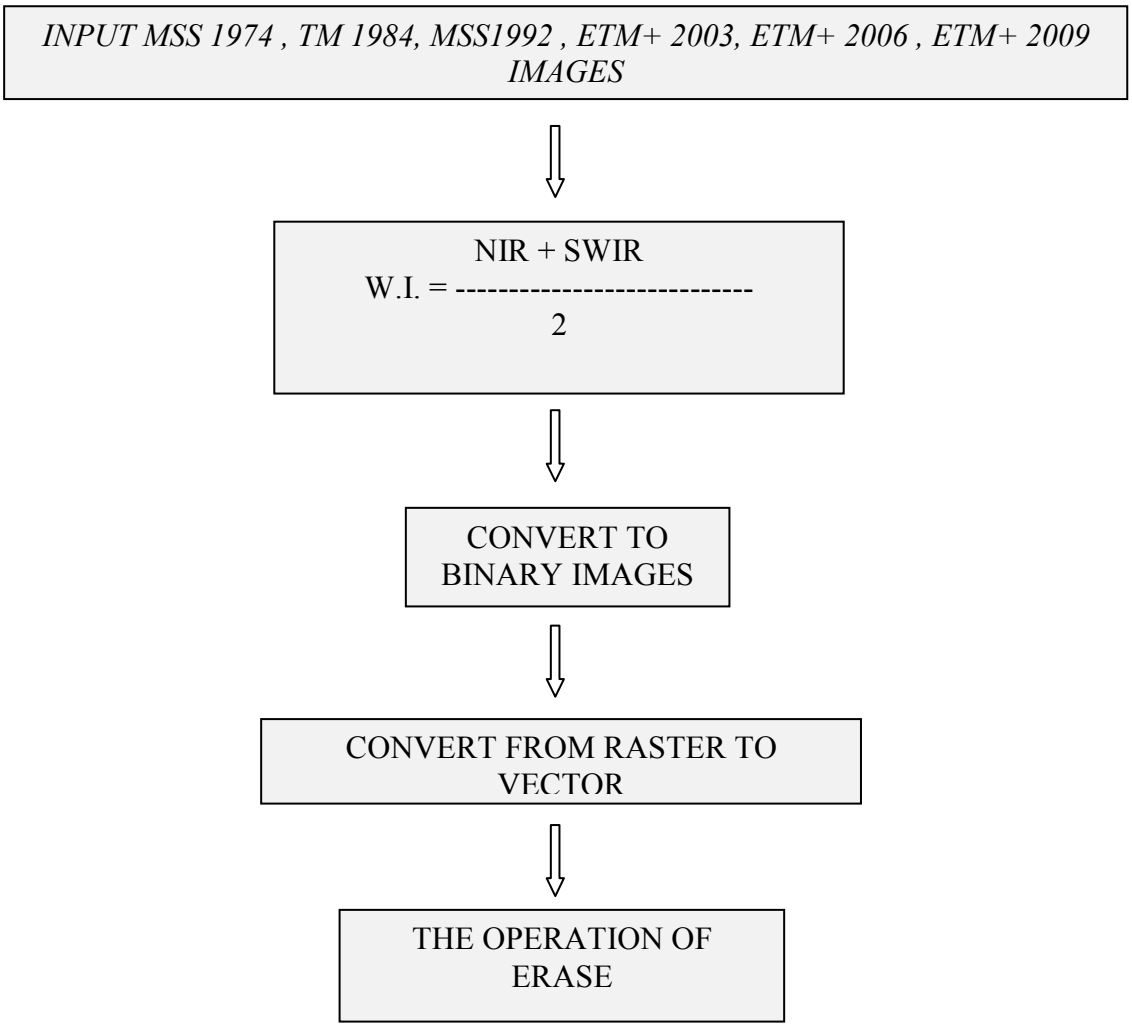


Figure 2- Shows The Methodology Of The Study

3. Change Detection Techniques

Change detection is one of the most widely used processing techniques in remote sensing. It is a process of identifying differences in the state of a geographic feature or phenomenon by monitoring at different times.

4. Water Index (WI)

The water index was used to oversee the situation of the water in the research's area. Equation (1) is used with the ETM and TM depending on bands 4 and 7 and with MSS sensor depending on bands 4 and 7 that represent NIR and SWIR bands, respectively. [5].

5. Integration of Remote Sensing and GIS Data

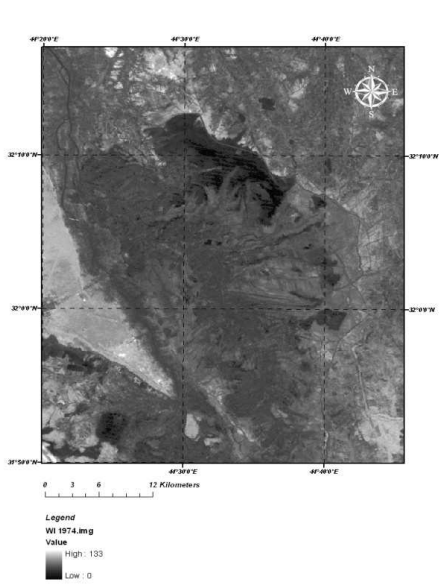
From satellite images all the images of (WI) are converted to vector by using Arc GIS programs to calculate the change in six images and to get a binary maps have (0,1) value the threshold of (0) value have no water and the (1) value is the water Fig (4).

In order to detect the changes in a phenomenon, the multi-date images are used. Usually, one of the images is taken before the event (pre-event) and the other is acquired after the event (post-event). [2].

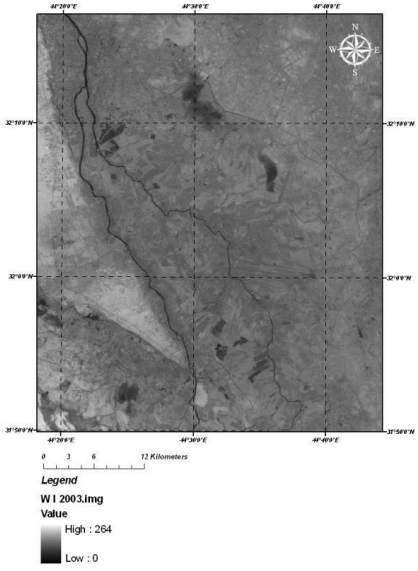
$$WI = \frac{NIR + SWIR}{2} \quad \text{.....(1)}$$

The result data was a binary map showing the water index in multi-temporal dates Fig (3, 4).

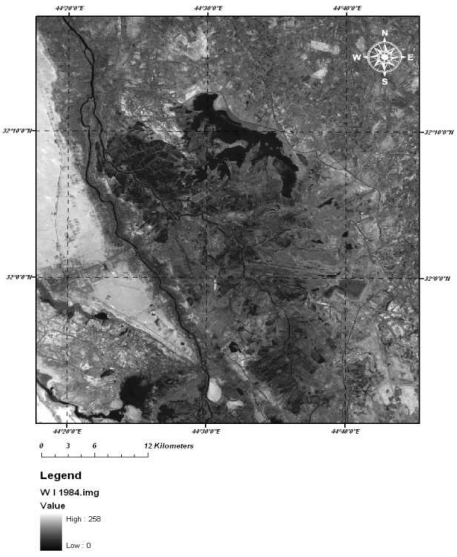
The results of water index as shown in fig (4) for the periods (1974, 1984,1992,2003,2006, and 2009) was (210, 237, 219, 52, 58, 74) Km2 respectively.



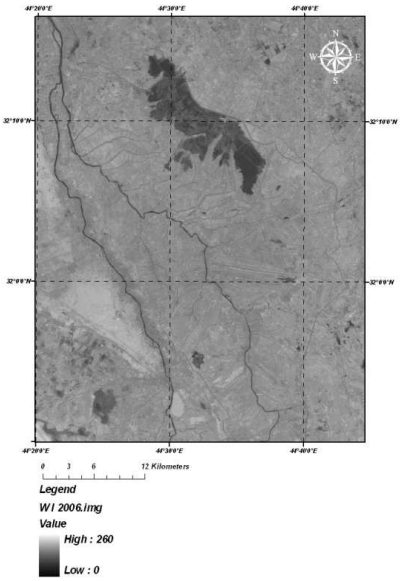
1974



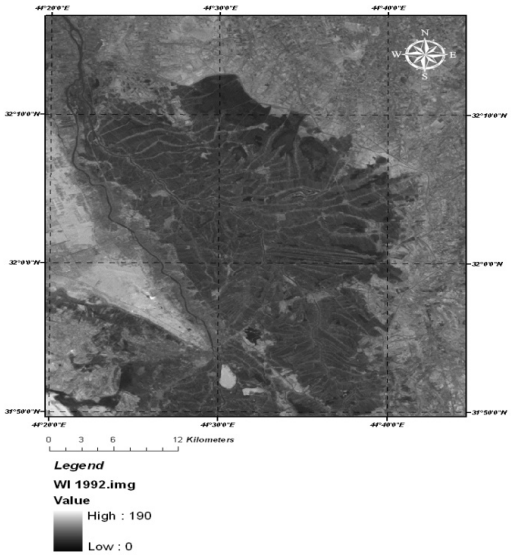
2003



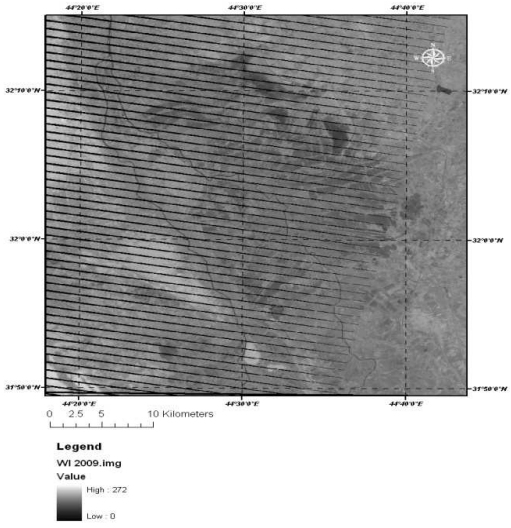
1984



2006



1992



2009

Figure 3- Water Index Maps For Periods (1974, 1984, 1992, 2003, 2006, And 2009)

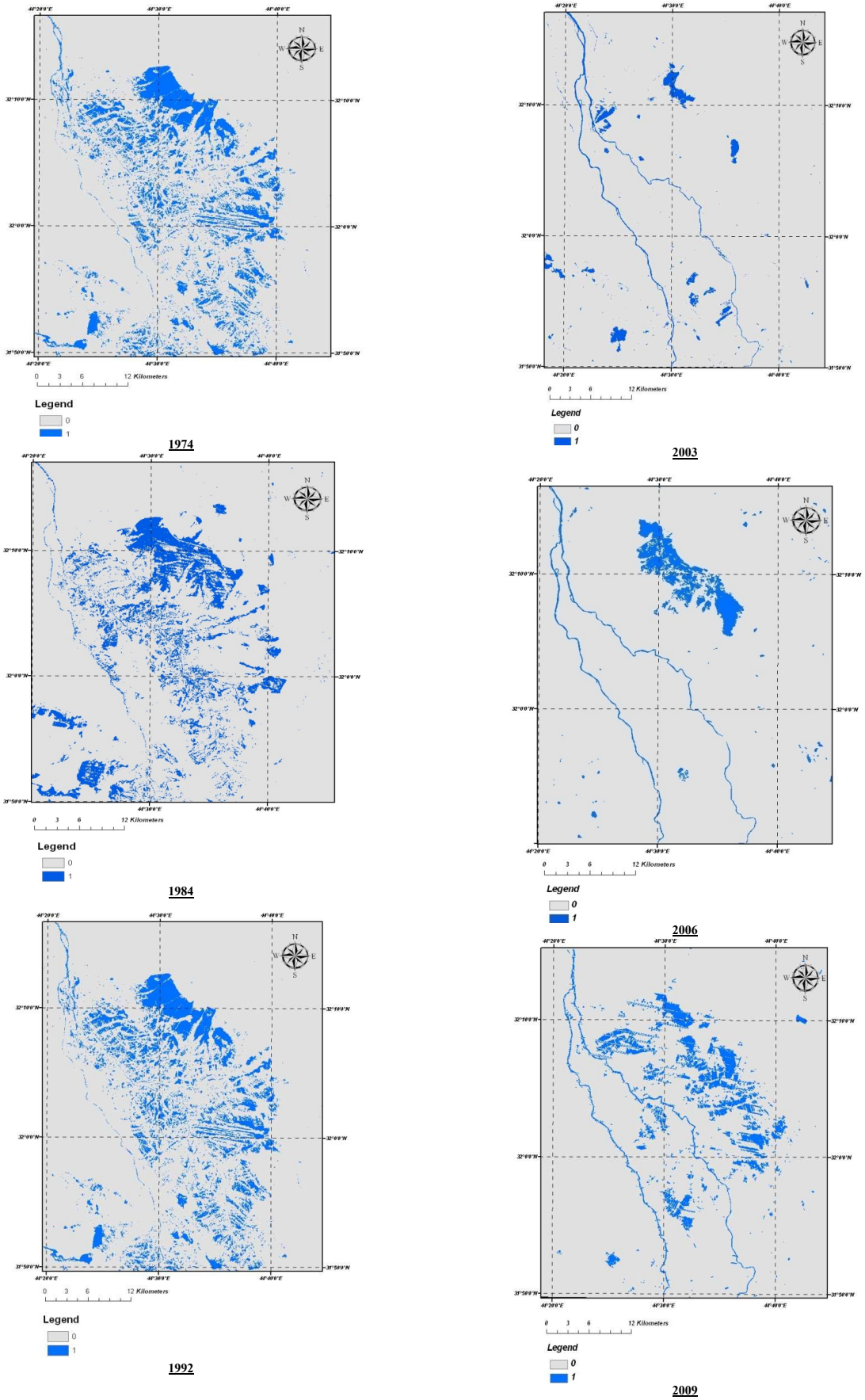


Figure 4- Shows The Water Index Binary Maps For Periods (1974, 1984,1992,2003,2006, And2009)

6. The Operation of ERASE

Erase is creating a feature class by overlaying the input feature with the polygons of the erase features. [6]. As in Fig (5).

The use of this operation is to determine the changes in six periods. This operation was done by using prior's periods with previous periods and called it (increase) and used previous periods with prior's periods called (decrease). As illustrated in Fig (6).

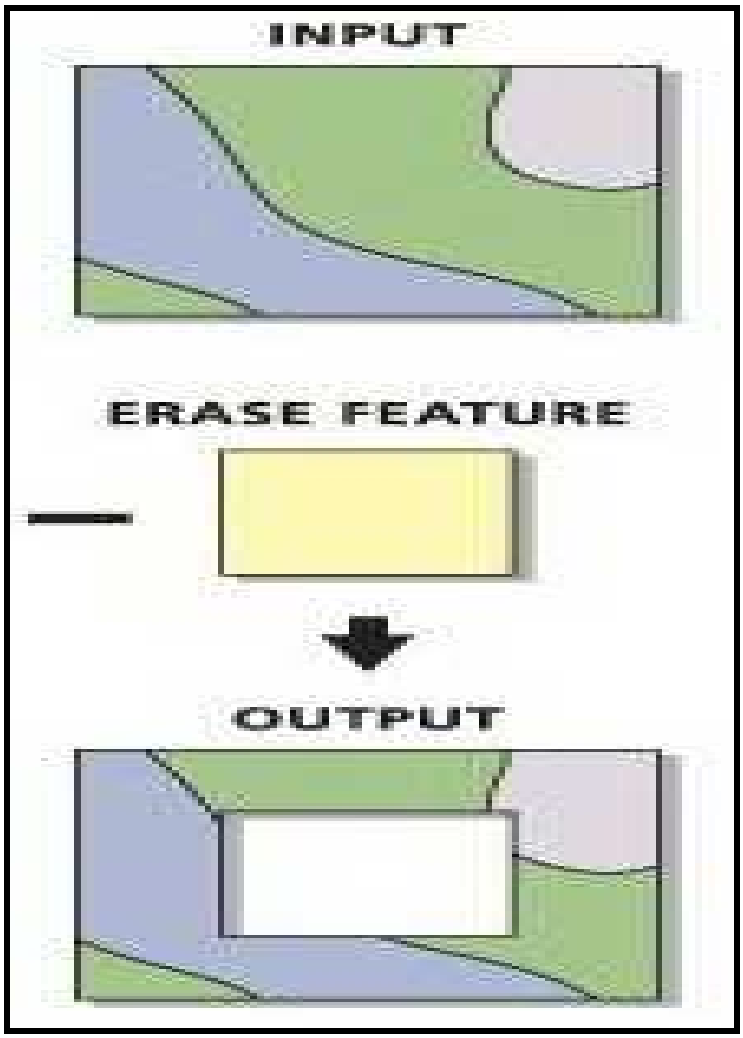
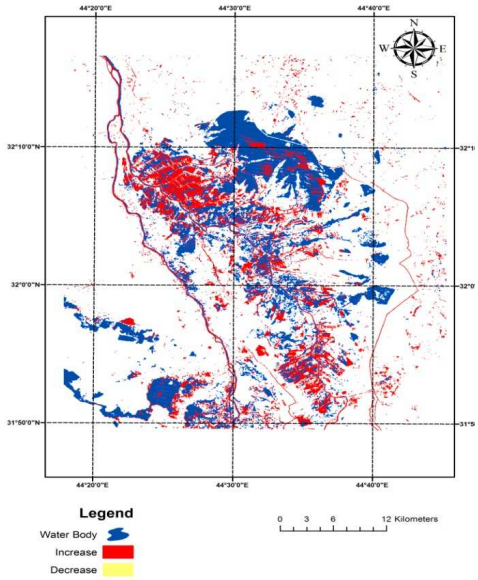
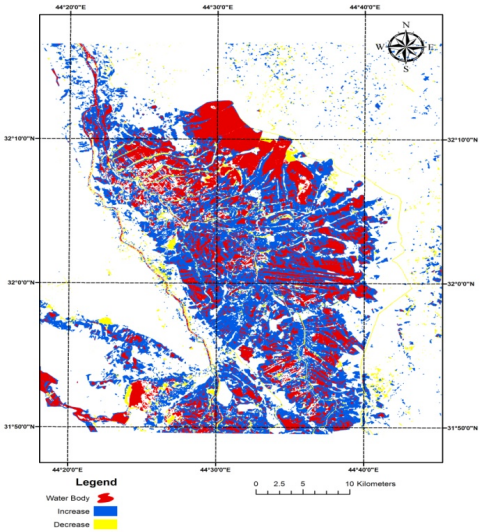


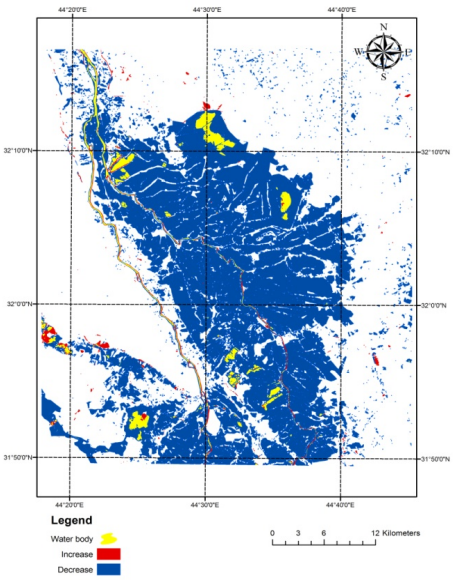
Figure 5- Shows the erase operation



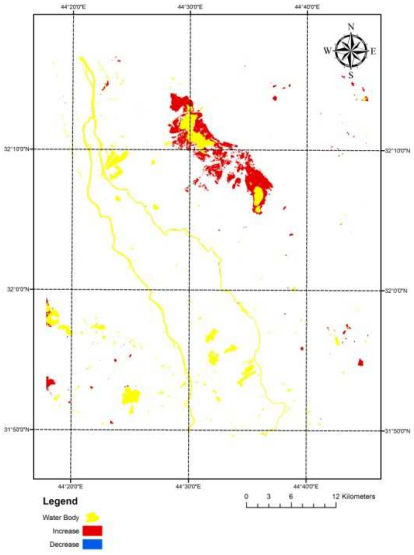
A



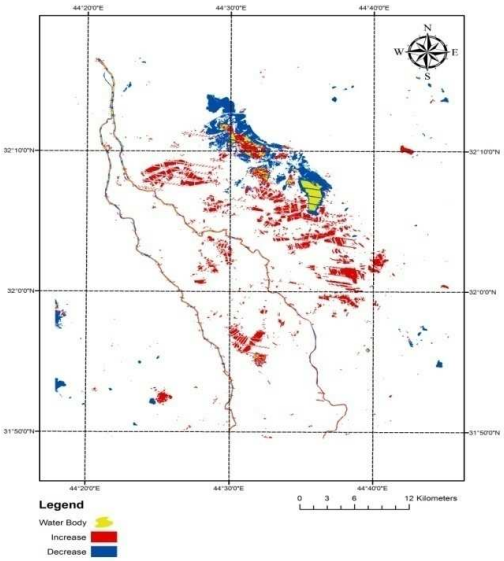
C



B



D



E

Figure 6- Shows The Erase Operation A,B,C,D, And E For Periods (1974-1984, 1984-1992, 1992-2003, 2003-2006, And 2006-2009) Respectively

The results of erase operation as in table (1)

Table 1- Shows Decrease And Increase Periods In The Hour Water Body

Periods	Type	Area(Km2)
1974-1984	Decrease	119.6
	Increase	146.7
1984-1992	Decrease	30.7
	Increase	572.2
1992-2003	Decrease	736.1
	Increase	8.8
2003-2006	Decrease	32.6
	Increase	38.8
2006-2009	Decrease	39.7
	Increase	54.8

The result of the erase operation is shown in the Fig. (7).

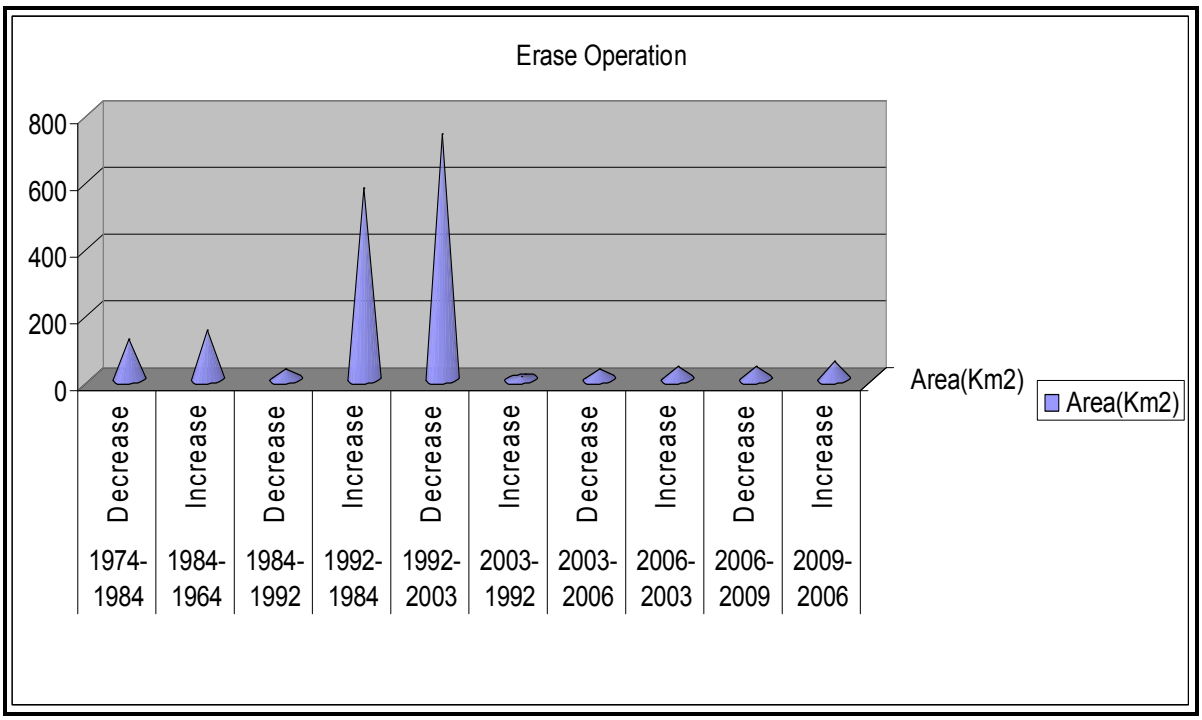


Figure 7- Shows The Result Of Erase Operation

7. Conclusions

1- The use of multi-temporal images (MSS, TM and ETM) remote sensing data offer an effective tools to identified the changes in water quantity in research area as well as low cost.

2- By using water index (W.I) equation we conclude that water body in research area during the periods(1974,1984,1992,2003,2006, and 2009) was (210, 237, 219, 52, 58, 74) Km^2 respectively.

3- From the erase operation we conclude the periods of (increase, decrease), the increase periods represents earlier years with late years while the decrease periods represents late years with earlier years, the water body in the study area (the decrease periods) was (1974-1984), (1984-1992), (1992-2003), (2003-2006), (2006-2009) , 119.6 Km^2 , 30.7 Km^2, 736.1 Km^2, 32.6 Km^2, 39.7 Km^2 respectively, and the water body area for the (increase periods) was (1984-1974), (1992-1984), (2003-1992), (2006-2003),(2009-2006), 146.7 Km^2, 572.8 Km^2, 8.8 Km^2, 54.8 Km^2 respectively.

4- The difference in water body due to upstream country policy, human activities, climates.

8. Referances

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