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Remote Sensing and GIS Techniques in Monitoring Land Use Land Cover Change

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Abstract: This examination by utilizing GIS and Remote Sensing procedures to planning highlights of Al-Kut city, Iraq from 2004 to 2014, in order to classify developments that has occurred between these periods. The using of satellite image (Quick bird satellite) with depending on remote detecting and GIS to identify Land Use/Land Cover change which is defined as the amount of the distinct information and current change data that can incite continuously touchable bits of information into basic strategies, including land spread and land use changes. The process of defining the Changes related to LULC properties called change detection and it's referenced to Geo-registered high resolution. It is useful in many applications such as identification of land use changes, the amount of deforestation, urban extension, and other cumulative changes through spatial and historical analysis techniques. The dependable method briefly by data acquisition (satellite image with resolution 0.60 m) and geo-referenced with GCPs to produce a thematic map of feature classified and making the statistical analyzing.ARC map software help us to make this easy by depending on entering two types of data, first one is satellite image and second one is ground control points. This study shows a development in built-up land and expansion from 2004 to 2014, however in the city, land decreasing, which is due to the development and growth in it. Finally, the result shows the decreasing in waterbodies and waste land area with noticed increasing of using land. These progressions are mainly happening with uncontrolled urban growth.

Keywords: Remote sensing, resolution, GIS, LU/LC, change detection

1. Introduction

In last two centuries the Earth's land cover has changed by development and population growth, these rapid alterations are superimposed on long-term dynamics identified with atmosphere variability. Land cover change can upset the capacity of the land to keep human exercises through the sparing of various biological system administrations [1]. Finally, the acquired information on land cover which is the basis for many applications such as water bodies administering and agricultural yield [2]. Everything covers the surface of the earth called land cover such as water, snow, grassland, and bare soil and the land use term describe how the land is used, for example rural land, infrastructure etc. The remote sensing considers the most technique used through among many techniques for change detection, because of its cost-effectiveness and time-saving characteristics [3]. The types of resolution (spatial, temporal and radiometric) effects on digital change detection [4], therefore before applying change detection analysis, some settings must be fulfilled like exact registration of multi-chronological images; accurate radiometric and eliminate the effects, atmospheric reflectance by adjustment or standardization between different time images and a collection of the same spatial and spectral resolution images if possible.

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Land cover changes are brought about by awful administration of land assets which lead to serious natural issues. Clarification of data from earth-sensing satellites has become very important [5]. Changes in LULC are generally it has a widespread because of its negative impact on decisions all levels. The increasing growth of population and their effects on land was the primary reason for failure to preserve the land.

Geo-Informatics techniques facilitate the planners, to find out the spatial development of the particular area with the assessment of the statistical data, which helps in making decisions. One of the major studies is to find out the changes in the specific period. Change observing, which requires examination of two images of various occasions is a significant investigation procedure for urban studies [6]. Change detection processes consist of an illustrative visual method, Post characterization, comparison, knowledge-based visions etc. [7].

2. Objective of Study

The following definite goals would be obtained from this study:

- With high resolution remote sensing data is to create land use, land cover map.
- To create the spatial and geographic database for the Al-Kut city of two different time periods.
- To evaluate the change of specific classes.

3. Case Study

The study area is a city located in eastern of Iraq, on the side of the Tigris River, about 160 kilometers (99 miles) southeast of Baghdad. It’s placed on Iraq map at the geographic coordinates Latitude: 32 29' 51", Longitude: 45 49' 45", as shown in following Figure 1.

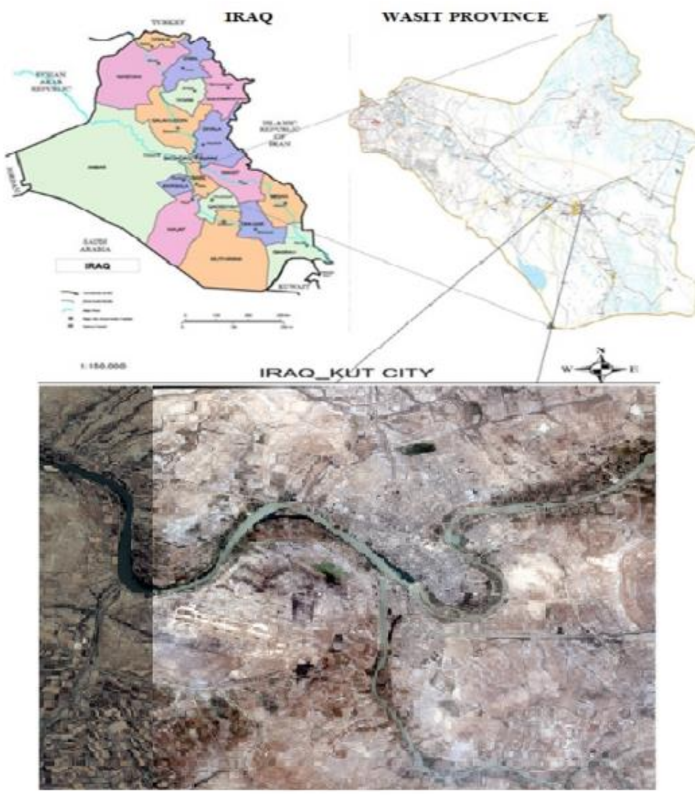

Fig. 1 - Location of study area on Iraqi map

4. Literature Review

1- The objective of this study was to observe the effect of land use growth on the natural environment and created maps for change detection within the time period 1976 to 2014 and to categorize the spatial and historical changes that happened within this time period using image indices and evaluate LULC class and compare the effects between them. The supervised classification was used in this study [8].

2- The goal of this study is to show the effects of urban development by using GIS and RS techniques. This study discovers the land use change pattern over 1990-2010, in Dhaka city by using supervised classification using Landsat images. The remotely change detection of LU/LC from 1990 to 2010 display that the city was slowly changed, as vegetarian cover have been mutilated into building zones. The unplanned urban expansion is the main reason for this change [9].

3- This study aims to classify LULC changes, and the image used for mapping and analyzing the development of LULC changes Landsat imagery between 1985 to 2017. During the valuation period, the areas of settlement developed approximately 50%, while areas with forested vegetation cover increased in size since 2001.The conclusion of the paper is represented as a foundation to allow investigator and decision-makers to emphasis on the most significant signs of orderly land [10].

4- the purpose of this study is an assessment LULC change between tow period in Texas, the results were increased inland about 71%, and noticed an increase in the rate of land development along the coast more than others. Practically 90% of all created land were inside 50 km of the secured zones in the two years. Generally, our results point, all the people and infrastructure exposed to increased coastal dangers. This study can give useful information about preparation of economical administration choices that reduced both of beach front weakness of people and framework, and leads to conserve of biodiversity in the region [11].

5. Methodology

Generation of thematic layers' database is accomplished through a series of procedural steps. Basically, the methodology comprises of the following functional components: Data acquisition, Geo-referencing, field verification, final production thematic maps and then, statistical analysis and change detection.

5.1 Data Acquisition

The spatial data inputs consist of both satellite images, ground data, administrative / town data and legacy thematic map data. Each of the above needs to be processed for uniformity, consistency and feature matching. Topo sheets are required for determining the district boundary. Quick bird satellite image with resolution 0.60m used for two period 2004 and 2014 respectively. Spectral bands (0.45-0.90 microns), radiometric resolution (11 bits),

5.2 Data Geo-Referencing

Satellite information which is accessible in raster structure should be geo-referenced to a map coordinate system in order to create spatial data to be utilized in this manner in a GIS environment. The process of Geo-referencing includes determining a coordinate system & converting raster image which allow to modifying, adding and processing data entered. To reduce types of errors in the image by rectification and then convert to the UTM projection system and WGS-84 datum. Georeferncing of images as reference with uniformly distributed Ground Control Points (GCPs), with first order polynomial transformation with RMS (root mean square) error of 0.6 pixels and the image was resembling by the nearest neighborhood method.

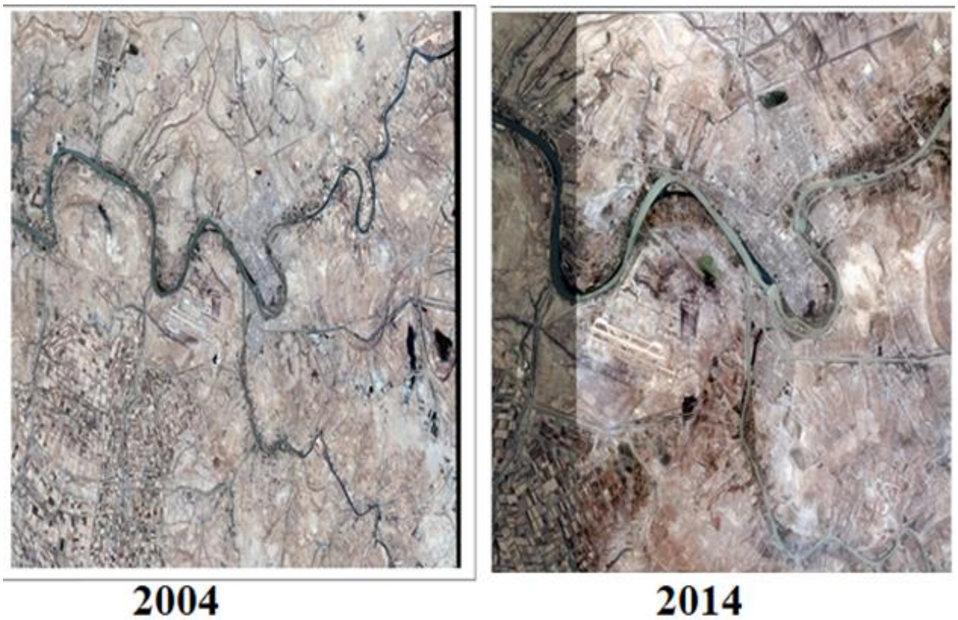

Fig. 2 - Satellite data of A-Kut City, IRAQ, 2004 and 2014

5.3 Attribute Database

In a Geo-database the attribute features can be created in the table associated with the particular feature class. In design data structures, the necessary attributes, data elements for each feature, according to the level / type wise classification, and ground truth data were added as text fields to the same table.

5.4 Field Confirmation

The information that is collected "on location" is called Ground truth. It is necessary to connect image information to real world on the ground. The randomly distribution of GCPs over twenty positions to rectify the satellite image. Control points allow to modification of data, helps in clarification and analysis of what is being sensed. The preliminary interpreted maps were taken to the ground for verification. Doubtful areas were checked in the field and modifications were done as per ground verification. GPS points were stored in the form of latitudes and longitudes. After coming back from ground truth, all the GPS points were transferred to computer using GARMIN software. After preparing dbf file of GPS points it was then converted to point shape file in ArcMap software. After that, shape file opened on the geodatabase.

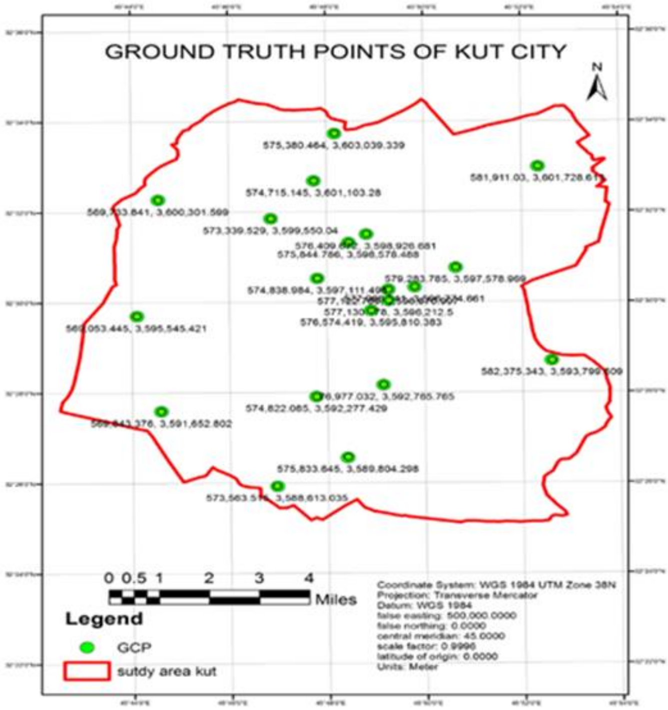

Fig. 3 - Distribution of ground truth points of KUT City

5.5 Final Production of Thematic Maps

An Arc Map report contained the Geo-database structure. Utilizing the standard Arc GIS interfaces, the output was created dependent on the structure guidelines and layout of a plan. The region covered by each layer/subject of the complete region under examination, such as Built-up urban, Built-up Rural, Water Bodies and so on. In rate, was determined. The output was produced depends on the authoritative and arranging limits of city/town.

6. Results and Discussions

This paper proves the power of GIS and RS in catching locational data. From satellite data quick bird with high resolution 2004, 2014 by using GIS and compute the change rate for each class and the range of improvement. The total area covered in the year 2004 by the different land use/land cover agriculture comprises 66.01 %, followed by built-up 18.33 %, waste land 9.04 %, water bodies 4.13% and vegetation with the occupancy of 2.49% covering 16262.4 ha, 4514.998 ha, 2226.2924 ha, 1016.8321 ha and 614.58 ha respectively;

It can see from table-1. The total area changes percentage of different classes in the classified different LU/LC maps, the total change in built-up 2.47 %, followed by agriculture 1.54 %, vegetation 0.58 % with the increasing, while waste land is decreasing highly, which reveals the development and uses of this category under built-up and agriculture and notice that the waterbodies 0.24 %with decreasing.

Table 1 - Change detection between the years 2004 and 2014

SI. No.	Land use/Land cover Class	2004 (Area in ha.)	2014 (Area in ha.)	Change total area %
I.	**Agricultural Land**			
1	Crop Land	**16262.4**	**16641.789**	**1.54 %**
II.	**Built Up**	**4514.998**	**5122.925**	**2.47 %**
2	Village	114.568	233.245	0.48 %
3	Mining /industrial	1632.01	1822.14	0.78 %
4	Rural	281.02	412.14	0.53 %
5	Urban	2487.4	2655.4	0.68 %
III.	**Vegetation**	**614.58**	**755.64**	**0.58%**
IV.	**Wasteland**	**2226.2924**	**1157.174**	**- 4.34 %**
6	Sandy Area	286.75	122.15	- 0.66 %
7	Scrub Dense	732.58	411.254	- 1.3 %
8	Scrub Open	871.8614	512.45	- 1.46 %
9	Wetland	335.101	111.32	- 0.91 %
V.	**Water Bodies**	**1016.8321**	**957.5745**	**- 0.24 %**
10	Canal	234.82	165.66	- 0.28 %
11	Lakes /Ponds	161.34	145.56	- 0.06 %
12	River	620.01	645.51	0.1 %
13	Tank	0.6621	0.8445	0.0007 %
	Total	**24635.1025**	**24635.1025**	100

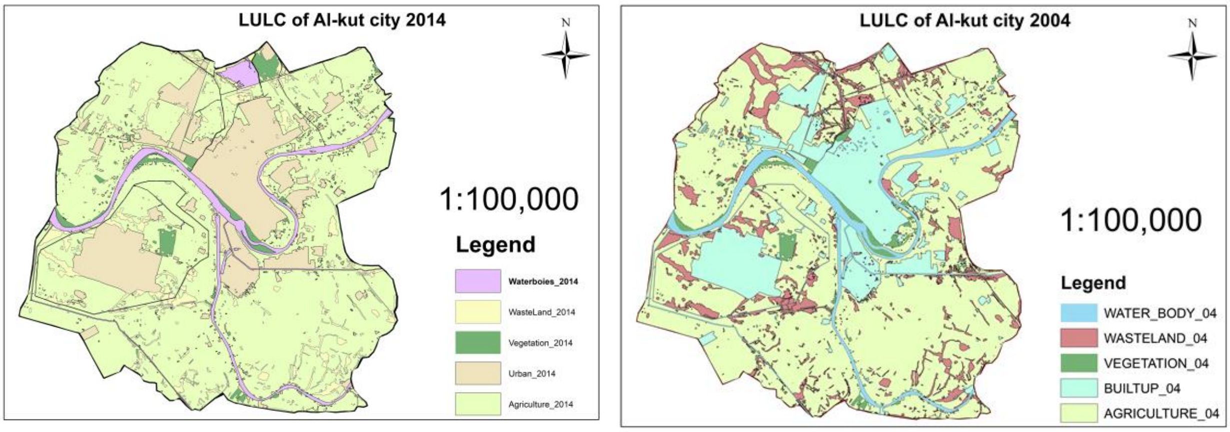

Fig. 4 - LU/LC map of the Al-Kut City, 2004 to 2014

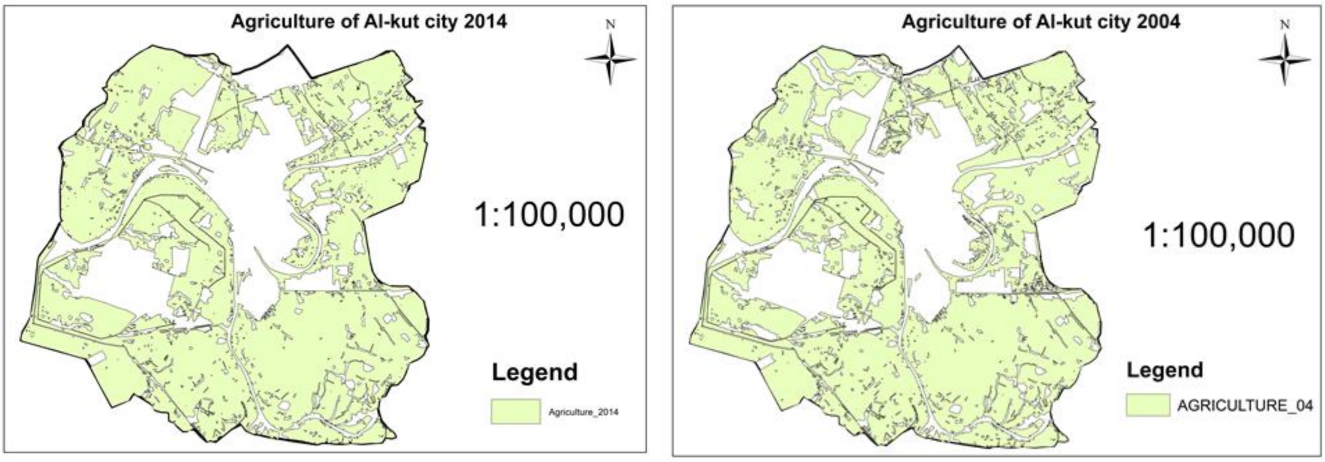

Fig. 5 - Agriculture land map of the Al-Kut City, 2004 to 2014

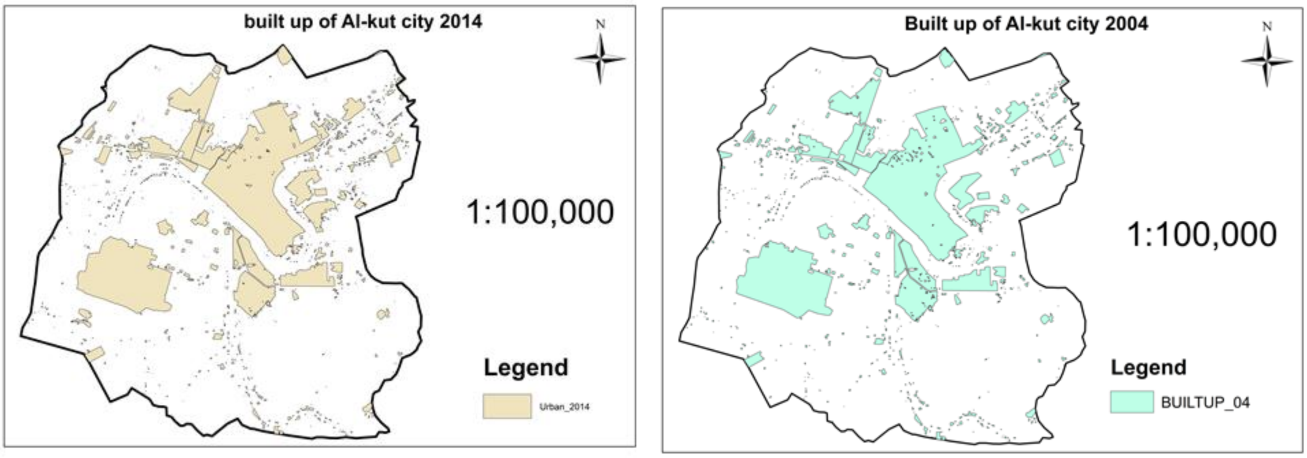

Fig. 6 - Built-up Land map of the Al-Kut City, 2004 to 2014

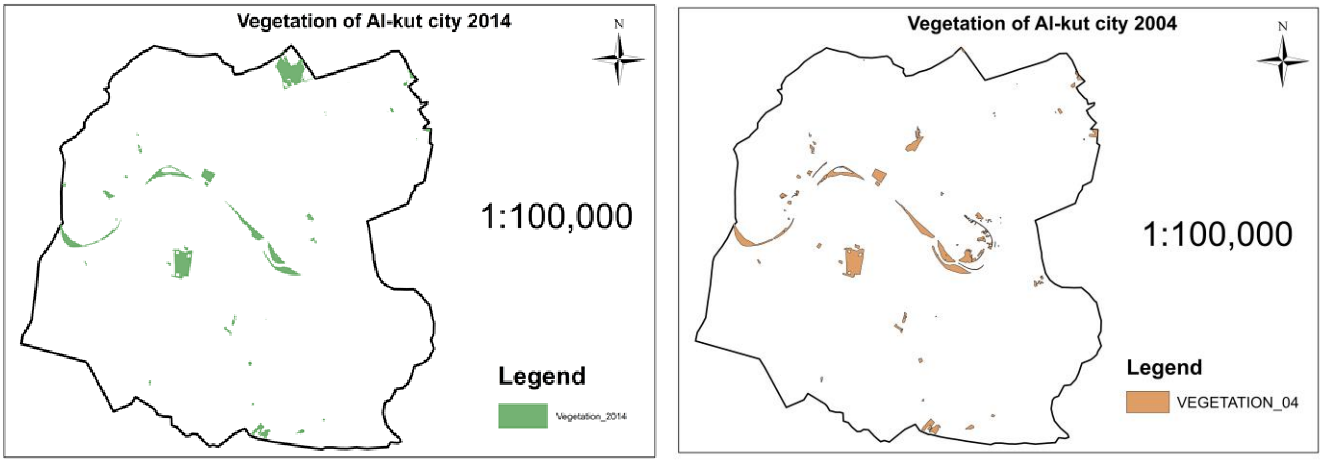

Fig. 7 - Vegetation cover map of the Al-Kut City, 2004 to 2014

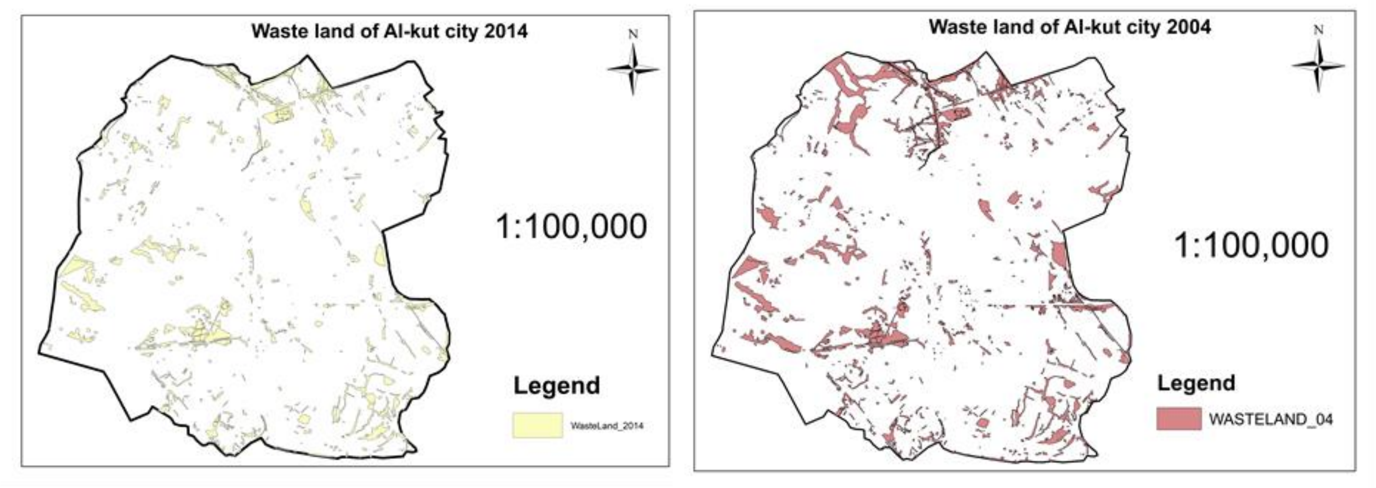

Fig. 8 - Waste Land cover map of the Al-Kut City, 2004 to 2014

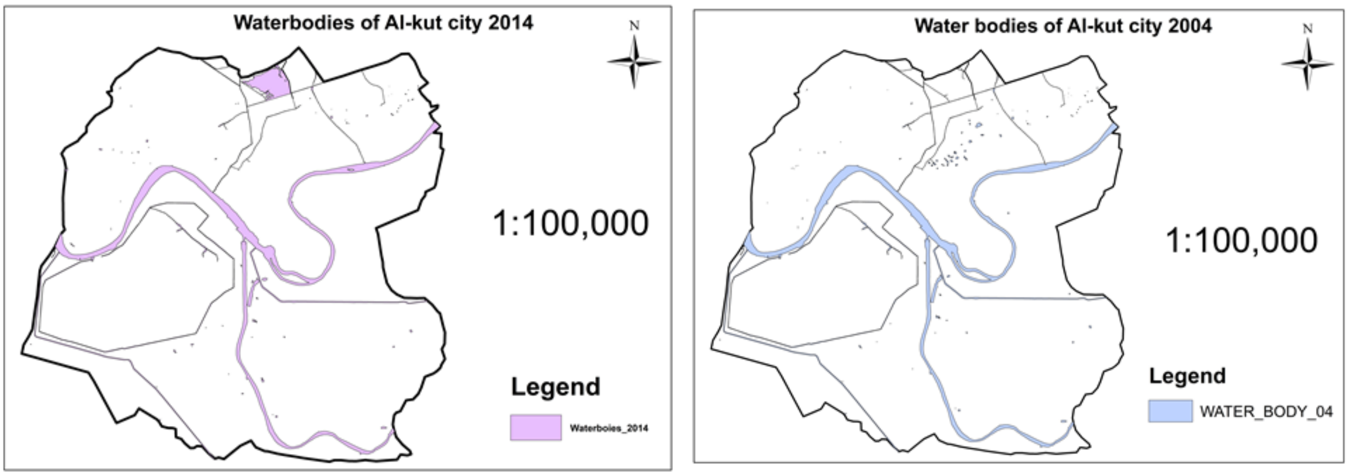

Fig. 9 - Waterbodies map of the Al-Kut City, 2004 to 2014

6.1 Analysis and Interpretation

The Classified map of 2004 and 2014. At present in the map 246.351025 square km. The agricultural area is dispersed throughout the study area while settlement mostly concerted in middle and North direction. The Wasteland also distributed throughout the study area. The Forest area is covered along the river and in the center, north and south direction in 2014. The waterbody also covers in the form of river, tanks and canals. and canals. The results are obtainable of maps, statistical tables included the static, change in LU/LC for each category. A comparative evaluation of the satellite data affecting to years 2004 and 2014 revealed that significant changes occurred during this ten year.

6.2 Land Cover Change Analysis

The results are obtainable of maps, statistical tables. They include the static, change in LU/LC in each category. A comparative evaluation of the satellite data affecting to years 2004 and 2014 revealed that significant changes occurred during this ten year.

6.3 Discussion

The use of Remote Sensing data with GIS approaches can enhance the current poor spatial dynamic of GIS. The use of these datasets instead of medium and low resolution satellite data can transform the analysis as many of the countries are pursuing many of projects especially in urban studies. The development remote sensing and its products with GIS domain and its vast database greatly enhances the application of it with the human mankind to the social, public and e-governance etc.

7. Conclusions

In the study area the analyses of LULC changes during 2004 and 2014 as shown in figures (4 to 9) and from table (1) revealed the following.

1. In figure (6) : Built up land in the study area has considerable increased 4514.998 ha to 5122.925 ha from 2004 to 2014.

2. In figure (5) : Agricultural land has increased from 16262.4 ha to 16641.789 during 2004 to 2014.

3. In figure (7) : Vegetation area has also increased from 614.58 ha to 755.64 during 2004 to 2014, due to the availability of water bodies.

4. In figure (8) : Wasteland area has decreased from 2226.2924 ha to 1157.174 between 2004 to 2014, because increasing land cover changes due to rapid population growth and cultivation of agricultural land, built-up area and due to changes in water capacity in the study area.

The above four classes are the attempt that has been made to link the LULC change accord in the study area to the socioeconomic conditions of the area. Because it is well known factors with increases in population, built up area increases, cultivable waste land reduces. Agricultural land increases, waste land decreases and water bodies also decreased.as shown in figure (9).

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