MONITORING THE DETERIORATION OF THE VEGETATION COVER IN THE KANAAN AREA USING REMOTE SENSIN AND GEOGRAPHIC INFORMATION SYSTEM

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ABSTRACT

This study was conducted on the floor covering in the Kanaan area of Diyala province, central Iraq, between latitudes 44 ° 39 '21.29"- 45º 03' 19.99' and 33º 28 '34.79'- 33º 42'37.5'and an area of 882.508 km^2. To study the deterioration of the vegetation cover, the field survey was based on the identification of ground control points. We also used the first satellite data for the Landsat 7 sensor ETM + (row 37 and path 168) captured on 25/4/2000 and the second satellite Landsat 7 sensor ETM + (row 37 and path 168), which was taken on 18/4/2009. The unsupervised classification on the satellite data. The results of this classification showed that the study obtained 5 categories, namely vegetation cover including forest trees and orchards, unexploited agricultural land, exploited agricultural land, buildings and constructions and barren land. They were identified and compared with the 50 Land control points. The total accuracy of the classification was 85% and 81% for 2000 and 2009, respectively. The statistical scale Kappa was also used to calculate accuracy was 0.81 and 0.82% for 2000 and 2009, respectively, as well as reached a clear deterioration of the vegetation cover by 40.65%, equivalent to an area of 31.182 km^2.

Key words: vegetation degradation, classification, Remote Sensing, GIS.

INTRODUCTION

There is no doubt that vegetation is one of the living components of the ecosystem that contribute effectively to the continuation of the life cycle on the surface of the earth, therefore, degradation leads to environmental imbalance due to high levels of carbon dioxide in the atmosphere, increase in temperature and the prevalence of drought and desertification, which poses a serious threat to plant life in these areas. Using of land has necessitated the continuation of its monitoring and follow-up of its development to develop its management and investment programs through remote sensing sensors and Geographic Information System (GIS) to achieve this, because the data of these technologies are comprehensive, spectral and time-critical.

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Mohammed and Ahmed (2013) studied the degradation of natural vegetation in the Benghazi plain, based on the analysis of two satellite images from the Landsat satellite, which were captured in two different periods: 1986 and 2013. The non-vector classification and vegetative index NDVI were used. The study found a significant increase in land area which has a very low vegetation cover in 2013 at the expense of land with low or average vegetation cover in 1986. In a study of Al-Nakhshabandi (2013) in Zawaita area in northern Iraq, there was a loss of 4.24% of the area in 2009 compared to 1989 by analyzing the two satellite structures of Landsat for the years 1989 and 2009 using the classification method Non-router.

In a study using the vegetative index NDVI to detect changes in vegetation cover by Hassan (2014) on selected areas in Najaf governorate for the period 2001-2006, the researcher found that there was a decrease in the value of the vegetative index NDVI for the year 2006 compared with 2001. Inyoman (2016) studied the changes in vegetation cover for the years 2001-2015 in the Singaraja region of Bali, he found that there was a change of 11.17% (309768 ha) for the year 2015 compared to 2001. Alphonse et al., (2016) studied the change in the forest cover of the Nyungwe-Kibira region in West Africa for the years 1986-2015, they found that the change rate was 0.27% (4.97 km 2) using the spatial data of Landsat satellite with a spatial characteristic of 30 m. In a study of Uriel et al., (2017) to assess the change of land cover in Mexico using Landsat satellite data, the change rate was 22.21% (70128 km2) in forest cover and 19.74% (62313 km 2) for bushes between 1974-2015.

As the land coverings in Kanaan area have not applied administrative plans, which are very simple and are not based on modern scientific means to manage and preserve them. Therefore, this study aimed to adopting the modern scientific methods based on the required software to measure the extent of vegetation degradation, Development and practical applications that work on resource development and demonstrate the practical various applications of the Remote sensing and GIS system to prepare maps of the classification of the floor coverings and the amount of change there in.

MATERIAL AND METHODS

The studied area was determined by means of visited field and using the Global Positioning System (GPS). After determining the studied area, the first two satellite data were adopted for Landsat 7, the ETM + sensor (row 37 and path

168) captured on 25/4/2000 and the second satellite of Landsat 7 ETM + (row 37 and track 168) captured on 18/4/2009 as shown in Figure 1.

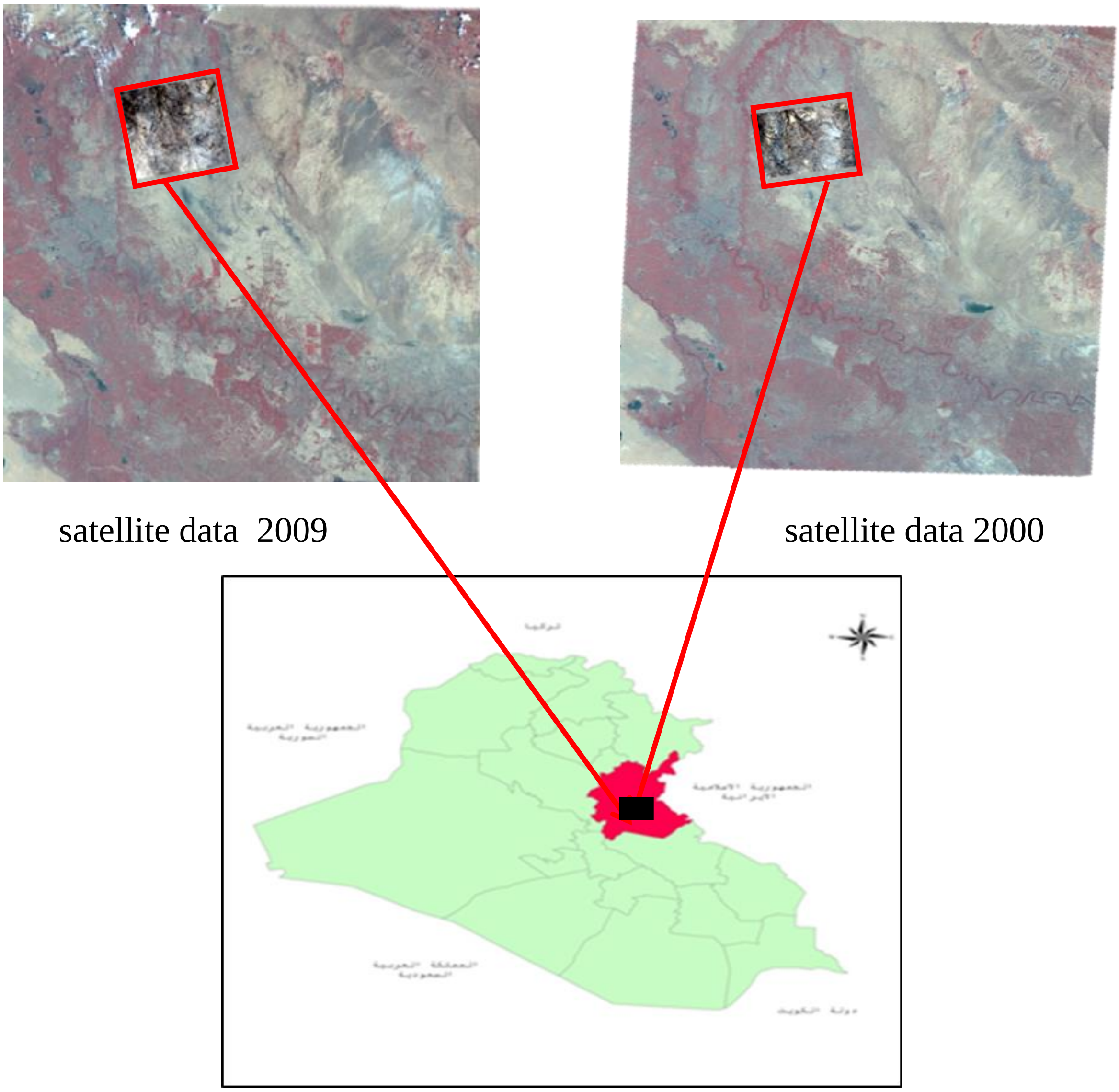
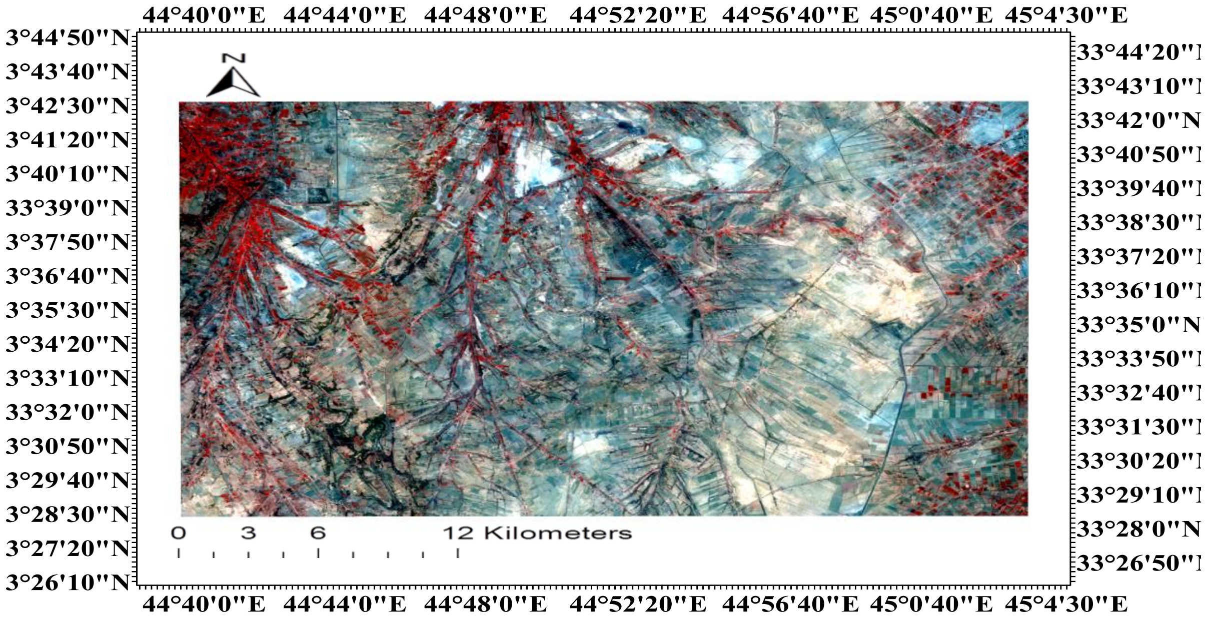
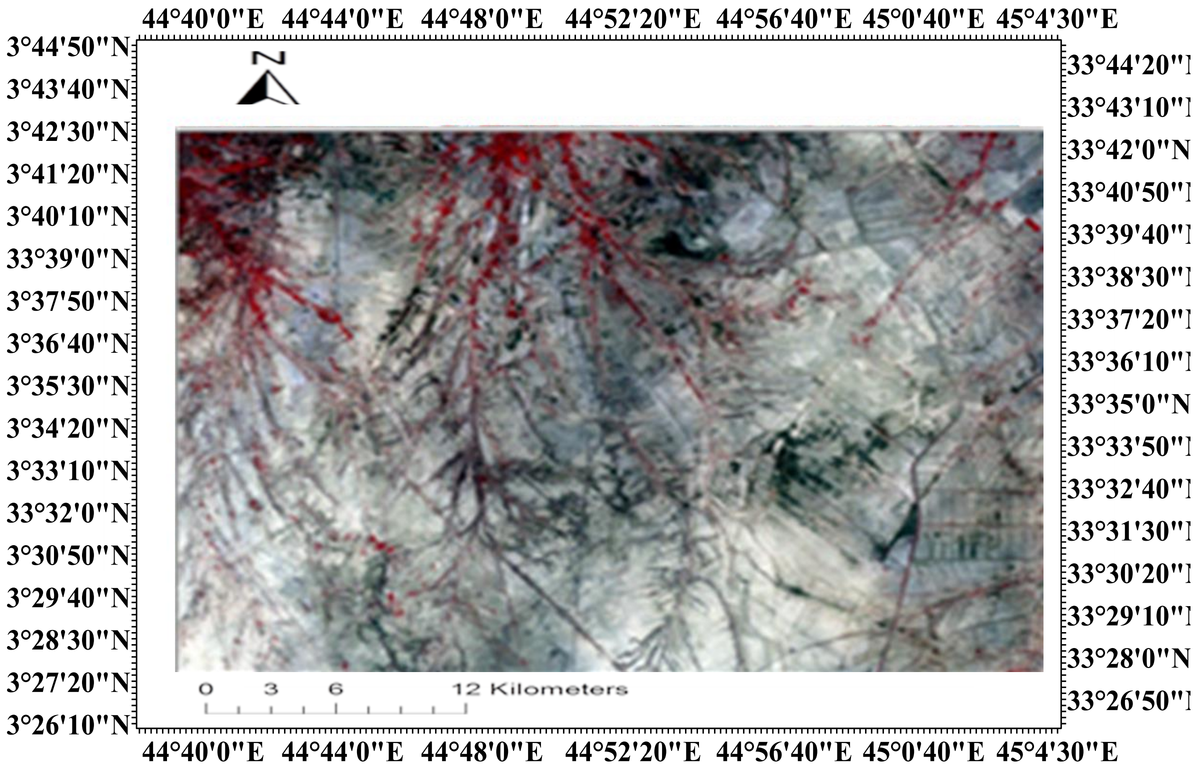


Figure 1. The studied area in Canaan is part of the satellite's Landsat 7 (2000), Landsat 7 (2009)(upper fig.) and Diyala Governorate (lower fig.)

Using the Erdas Imagine V.9.1 program, the studied areas was cut off as shown in Figure 2.



A



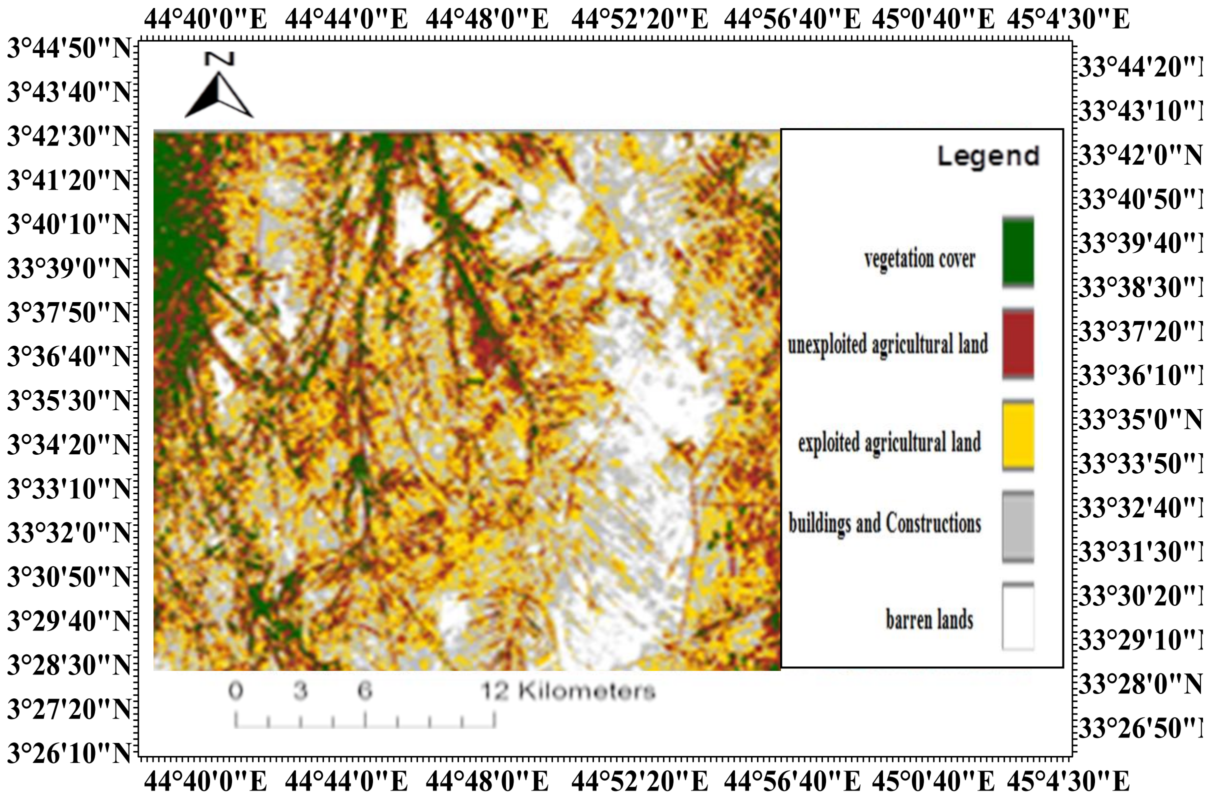
B

Figure 2. The studied area in Canaan is part of the satellite, A: (Landsat 7 2000), B: (Landsat 7 2009)

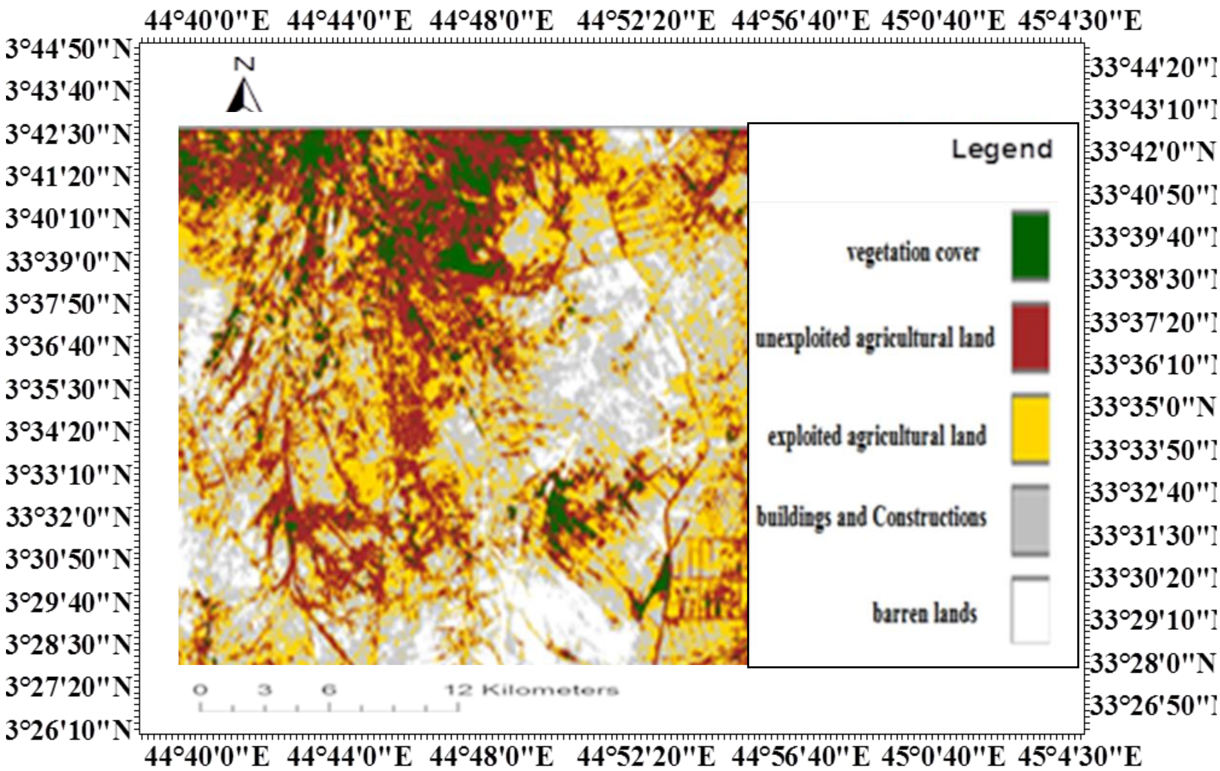
As for field work, a group of random control points was selected randomly distributed to the study area (it is the simplest and most widely used method of producing classification maps for floor coverings). It was obtained through several visits and field surveys to the site of the study and using a GPS device by selecting 30 samples (5 samples per category) using the random stratified method and each layer representing a class of floor coverings of the Canaan region (Emad *et al*., 2014) with a distance of 28.5 m × 28.5 m according to the spatial accuracy of the satellite image. Samples and then take the coordinates of this point to represent the ground control points for these samples.

Preparation of classification map of floor coverings

The Landsat 7 satellites were adopted for the purpose of finding ground items in the study area, relying on the ERDAS-9.1 software in the unsupervised classification method, where the spectral layers are first grouped according to visual information only and subsequently adapted or adapted to the information layers. The interpreter usually determines the number of groups to be searched for or categorized and may also specify the boundaries between these groups and the change within the group. The final product of this iterative process is a set of layers that the interpreter may wish to combine with Dawod (2015). In this study, five varieties were obtained for various land coverings, vegetation cover (including forest trees such as *Eucalyptus* sp., *Casuarina* sp. and orchard trees such as *Citrus* sp., Dates palm sp., *Punica granatum*), unexploited agricultural land, exploited agricultural land, buildings and constructions and barren lands, as in Figure 3.



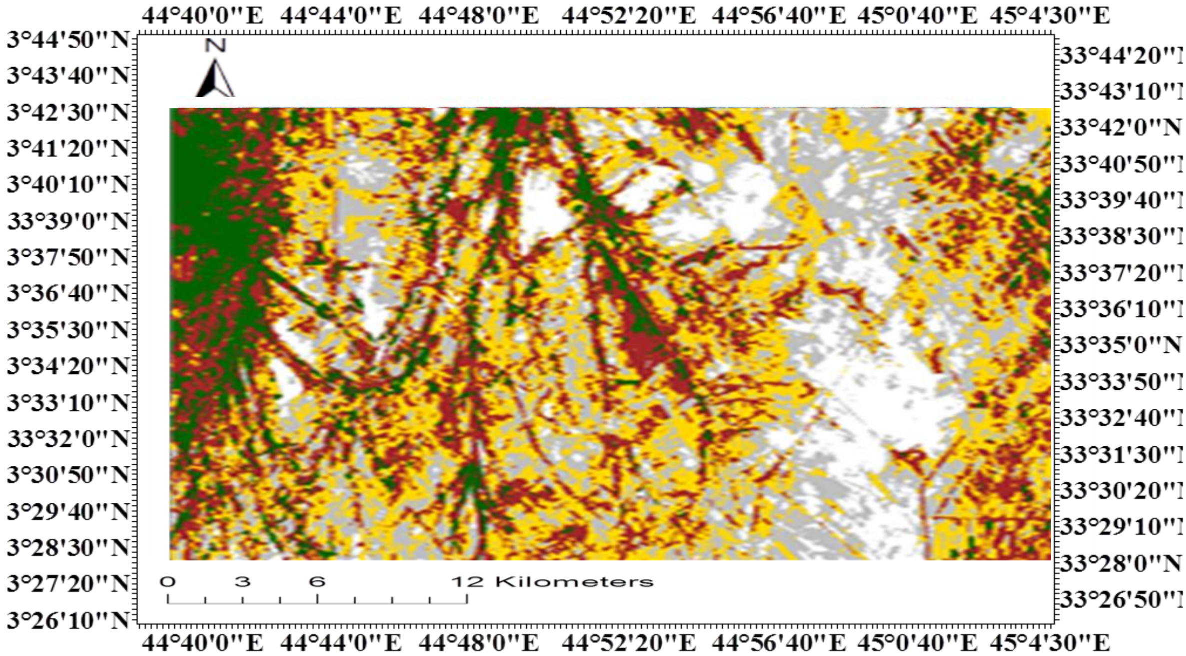
A



B

Figure 3. Classified satellite data for land covering in Canaan area, A: (2000), B: (2009)

For the purpose of distinguishing the items with a better plan, the filtration process was performed on the classified image using the candidate Majority 3x3 and twice using the Erdas Imagine V.9.1 program, the result was as in Figure 4.



A

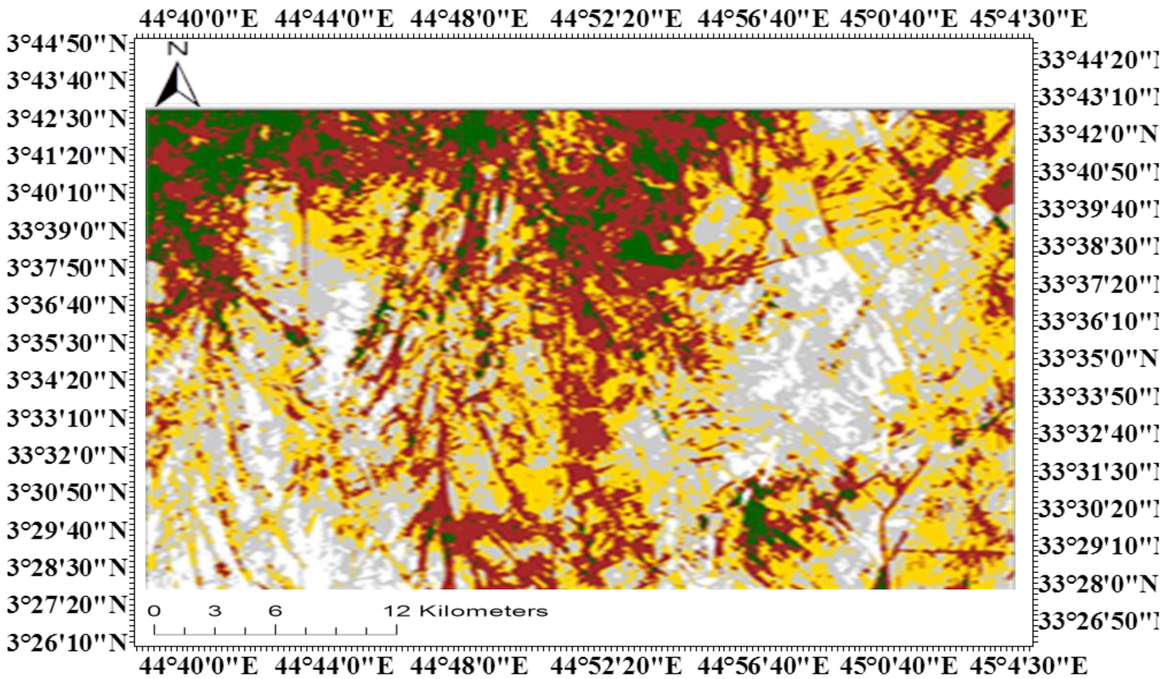


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Figure 4. Classified satellite data for land coverings in the Canaan area after filtration, A: (2000), B: (2009)

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RESULTS AND DISCUSSION

Using the Unsupervised Classification method, two satellite data were classified. After verification, the items were found to be identical to those in the area. These items included vegetation cover (forest trees and orchards), unexploited agricultural land, exploited agricultural land, buildings and Constructions and barren land. Pixels for each category and area of coverage of the study area in Canaan, after the filtration process we obtained Table 1.

Table 1. Number of Pixels units for floor coverings of the study area in Canaan for each category and area

No	Category	2000		2009		Amount of change / km^2	Percentage change
		Number of Pixels	Area km^2	Number of Pixels	Area km^2		
1	vegetation cover	94443	76.712	56053	45.529	-31.183	40.65
2	exploited agricultural land	263854	214.315	265206	215.413	1.098	0.51
3	unexploited agricultural land	317017	257.497	317690	258.044	0.547	0.21
4	buildings and Constructions	274097	222.635	282166	229.190	6.555	2.94
5	barren lands	137087	111.349	165382	134.332	22.983	20.64
	Total	1086498	882.508	1086498	882.508	0	

Table 1 shows that there was a decrease in the area of vegetation cover by 31182 km^2 (40.65%), while there was a slight increase in the area of exploited and unused agricultural land 1.098 km^2 and 0.547 km^2 (0.51% and 0.21% respectively), in the area of buildings and structures 6.555 km^2 (2.94%) and a large increase in the area of barren land 22.983 km^2 (20.64%).

Changes in the characteristics of land use and vegetation cover between 2000 and 2009 indicate changes in the nature of land use as well as the environmental impacts that had led to significant variation in both categories vegetation, unexploited agricultural land, exploited agricultural land, buildings and barren land, and this study was able to determine the area of "change in land used and plant cover during the two periods. The analysis of the change in land used, which can increase the understanding of the changes occurring during the two periods, and in Table 1 we noted the change in general for each category of items that appeared in the region, as some of these varieties changed significantly Vegan has lost a portion of its space while the other varieties have increased their area, when applying the chi- square test (χ^2), we obtained the calculated χ^2 value of 17.62, which is greater than the value of the χ^2 table 3.84 (0.05 level), that indicating that there are significant differences between the two periods. The better understanding of the amount of increase and decrease from the area of "coverage that can be gained or lost from that variety can be seen in Table 1, we can find a change in the covers. The vegetation lost 31182 km^2 of its area to the other covers, the increase in the area of "the rest of the varieties, especially the barren land, buildings and structures at the expense of the area of vegetation, that there is deterioration in land use and the conversion of plant coverings to a lower level of use Al-Naqshabandi (2013). The largest percentage of land (20.64%) was 22983 km^2 and the buildings and constructions were 6,554 km^2 and part of the vegetation lands was transferred to agricultural lands. From the result above, we believe that there should be an effort to improve the site and manage it better. Through the reduction of unproductive land and its exploitation as productive land for other purposes, for example, the expansion of afforestation, the establishment of industrial forests and the increase in green areas. At the same time, the site needs to perform better to reduce the unplanned and unplanned exploitation resulting in a significant loss of vegetation.

The loss and gain on plant cover or other items shows that there was a regular change of these two periods. The change indicated that there were two directions (Uriel *et al.,* 2017). The first trend represents the development of performance or work in the exploitation of agricultural sites that can be exploited for the production of different agricultural crops and the cultivation of land and barren land to productive land. The second was a deterioration in the vegetation due to the loss of part of the area in favor of the other covers .

Rating accuracy

The process of evaluating the accuracy of the classification of the elements of the different spatial statement is particularly important to the classification of vegetation covers and land classification. Through this accuracy we can determine the compatibility of the classification with these covers, and the possibility of reliance on the map prepared and used in the future. The random sampling method was used to evaluate the classification accuracy of plant coverings in the Kanaan area by taking 50 (10 points per category) ground adjustment points to determine this accuracy. Achieving accuracy of more than 70% is good. The accuracy of the classified data was calculated (2000 and 2009) and we obtained an accuracy of (85%) and (81%) respectively, indicating that the overall rating accuracy of each of the above categories was good. A single classification accuracy was obtained for each category. The ratio to 2000 was high for all cultivars (100%) for vegetation and the lowest (77%) for barren land. This is acceptable (McCoy, 2005)

As for the classification map for 2009, the highest category of the vegetation cover was (90%) and the lowest of the buildings and constructions (75%). The reason was the small number of points in this category and the overlap between this category with other varieties. Kappa method (Al-Nakhshabandi, 2013) has also been used to calculate accuracy as this measure the degree of difference between the land-based control points taken and the changes that have been classified in the classification map of the same site and compared them (Lilles et al., 2004).

Many researchers have pointed out that the value of Kappa, which is greater than 80%, is a good and appropriate classification and is recommended, while this value is limited to 40-80% and an average rating of the statement is shown. 40% show that this classification is poor and unreliable. The 2009 classification was higher than the 2000 classification and was (0.82 and 0.81) respectively, as a general average of classification, which is good as shown in Table 4. Through this scale, Kappa showed that there was a high classification of both (vegetation and exploited agricultural land) for 2009, while the rest of the varieties were well classified to average. While the value of this scale of 2000 (vegetation and exploited agricultural land) was good by this classification except for barren land, the accuracy was moderate (0.71).

Table 2. Accuracy of the classification map prepared by Landsat 2000

Category	vegetation cover	exploited agricultural land	unexploited agricultural land	buildings and constructions	barren lands	Total
vegetation cover	11	0	1	1	0	13
exploited agricultural land	0	9	0	0	1	10
unexploited agricultural land	0	1	8	1	0	10
buildings and Constructions	0	0	1	8	1	10
barren lands	0	0	0	0	7	7
Total	11	10	10	10	9	50
Accuracy%	100	0.90	0.80	0.80	0.77	0.85

Table 3. Accuracy of the classification map prepared by Landsat 2009

Category	vegetation cover	exploited agricultural land	unexploited agricultural land	buildings and Constructions	barren lands	Total
vegetation cover	10	1	0	1	1	13
exploited agricultural land	1	9	1	0	0	11
unexploited agricultural land	0	1	7	1	0	9
buildings and Constructions	0	0	1	6	1	8
barren lands	0	0	0	0	9	9
Total	11	11	9	8	11	50
Accuracy%	0.90	0.82	0.77	0.75	0.82	0.81

Table 4. Kappa's statistical value of 2000 and 2009

No	Category	The value of kappa 2000	The value of kappa 2009
1	vegetation cover	0.88	0.90
2	exploited agricultural land	0.85	0.89
3	unexploited agricultural land	0.82	0.74
4	buildings and Constructions	0.81	0.80
5	barren lands	0.71	0.78
	Accuracy%	0.81	0.82

To estimate the coverage of each category, the DOT GRID METHOD was used in Arc GIS V 9.3 by creating a layer of points and dropping it on the classified satellite data, Table 5.

Table 5. Percentage of the distribution of floor coverings for the study area in Kanaan

No	Category	2000		2009		Percentage change
		Number of points	Percentage	Number of points	Percentage	
1	vegetation cover	24	9	14	5	-4
2	exploited agricultural land	68	24	68	24	0
3	unexploited agricultural land	82	29	82	29	0
4	buildings and Constructions	71	25	73	26	1
5	barren lands	35	13	43	15	2
	Total	280	100	280	100	

Table 5 shows that the highest coverage rates for 2000 and 2009 was for unexploited agricultural lands (82%) and the lowest for vegetative cover. This is in line with the reality and table 1 in terms of areas. However, there was a decrease in vegetation by 4%. However, there was a decreased in the vegetation by 4%. This indicates a decline of vegetation due to poor and bad exploitation and the conversion of green areas to residential land on which houses, factories and other facilities were built, or removal of the vegetation and leaves the land uncovered, which turned to a barren land (Inyoman, 2016). This is shown in table 5 which confirmed an increase in building construction areas and land.

CONCLUSION

In this study, we found that there was a change in the area of vegetation cover for the benefit of other ground cover. This was evident through the analysis of the satellite image, the use of remote sensing techniques and geographic information systems it a great importance in interpreting the results through different software.

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مراقبة تدهور الغطاء النباتي في منطقة كنعان باستخدام التحسس النائي ونظم المعلومات الجغرافية

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المستخلص

أجريت هذه الدراسة على الأغطية الأرضية المنتشرة في ناحية كنعان التابعة لمحافظة ديالى وسط العراق والواقعة بين خطي طول ″21.29 ′39 °44 – ″19.99 ′03 °45، ودائرتي عرض ′28 °33 ″34.79 – ″37.51 ′42 °33، وبمساحة مقداره 882508 كم². ولغرض دراسة تدهور الغطاء النباتي، تم الاعتماد على المسح الحقلي لتحديد نقاط ضبط ارضية ،وكذلك استخدمنا بيانين فضائيين الاولى للقمر الصناعي 7 Landsat المتحسس +ETM (الصف 37 والمسار 168) الملتقط بتاريخ 2000/4/25 والثانية للقمر الصناعي 7 Landsat المتحسس +ETM (الصف 37 والمسار168) الملتقط بتاريخ 2009/4/18، إذ تم إجراء عملية التصنيف غير الموجه unsupervised classification على البيان الفضائي، واظهرت نتيجة التصنيف حصولنا على 5 أصناف غطاء نباتي وتشمل أشجار غابات وبساتين، اراضي زراعية غير مستغلة، اراضي زراعية مستغلة، أبنية ومنشاءات وأراضي جرداء. وتم التعرف عليها ومقارنتها مع نقاط الضبط الارضي والبالغ عددها 50 نقطة، حسبت دقة التصنيف للبيان الفضائي وتقييمها معتمدين على مصفوفة الأخطاء Error Matrix النسبة المئوية لكل صنف وللخارطة ككل، وكانت دقة التصنيف الكلية 85% و 81% لـ 2000 و2009 على التوالي، وقد استخدم أيضا المقياس الإحصائي Kappa لحساب الدقة وكانت 0.81 و 0.82 لـ 2000 و 2009 على التوالي، وتوصل البحث الى تدهور الغطاء النباتي بنسبة 40.65% اي مايعادل مساحة 31.182 كم².

الكلمات المفتاحية: تدهور الغطاء النباتي، التصنيف، التحسس النائي، نظم المعلومات الجغرافية GIS.