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Land Cover and Land Use Changes Study of Shwan and Altun Kopre areas in Kirkuk governorate.

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ABSTRACT

The study was conducted to monitor the changes in Shwan-Altun kopre from Kirkuk governorate –Iraq.The study area is located between Longtitude (44° 38′ 22″-44° 22′ 29″)E, Latitude (35° 43′ 53″-35° 42′ 16″) N with an area of 117683.96 ha.Satellite image was collected for years,1997,2014,2020 and 2023 from Landsat 5, MSS, and Landsat 8 OLI.Maximum likelihood supervised classification, the following classes were found (Drainage and Channels, Bult-up land, Grain crops, Plowed agricuitural land, Abandoned agricuitural land, Transformation zones) was applied to classify these image.Obvious changes in land cover areas was occurred during study time from 1997 to 2023 especially fir bult up land wich was increased from 3.33% to 13.77%, followed by Abondoned agriculture land from 12.5% to 17.39%, but transformation zones was decreased from 61.14% to 40.37%.In order to reveal the final changes occurring during the study period it was found that the26 areas of the Drainage and Channels and bult-up land classes increased by 4% and 313%, with a difference of 27.45 hectares and 12287.51 hectares, respectively .As for the grain crops, they decreased by 28% with a difference of 1183.63 hectares.The Ploughed agricultural land and Abandoned agricultural land classes have increased the areas of these two classes by 34% and 39%, respectively .As for the sixth category Transformation zones, the area of this class decreased by 66% with a difference of 47,506.66 hectares. This is evidence of changes to all types of land covers in the study area during twenty-six years, as the areas of built-up land, factories and villages increased and were exploited at the expense of agricultural land, as their areas declined during that period. This research aimed to study the current status of land use and the changes it has obtained during previous years.

***Keywords*:** Remote sensing, Land cover, Directed classification, Kirkuk, Shwan and Altun Kopre.

INTRODUCTION

Land cover refers to the physical classification of the land, that is, the study of the presence of visible land covers, as well as the study of their spatial change over time, such as agricultural land, built land, and so on, as for land uses, they refer to how land cover resources are invested or evaluated to achieve human benefits [1].

The remote sensing techniques are used in the study of land cover changes, as they give a huge amount of important information that can be handled in analysis, interpretation and classification quickly and with clear accuracy.

[2] In his study on managing soils irrigated by Axial sprinklers with large areas, he points to the possibility of using remote sensing techniques in monitoring and studying these lands.

[3] in their study conducted in the musayyib region, pointed out that remote sensing technology is an important and accurate source of information when studying land cover and detecting temporal and spatial changes and building databases of those changes, as it was an effective and fast tool in obtaining the best results with the least time and effort and cheaper costs compared to traditional survey methods.

[4] used remote sensing techniques in his study of the Rusty Basin in Erbil governorate, which aimed to assess the size of the basin, appearance and external shape to assess floods and erosion rate that may adversely affect the sustainability of soil, water and Natural Resources Management.

[5] in the study he conducted in Nineveh governorate, which dealt with the assessment of the state of desertification and degradation of this governorate, where he stressed that space data Times should be taken into account when calculating the NDVI guide, what appears as Green Meadows will appear as arid lands at other times for the same area.

[6] used the NDVI guide in their study that dealt with the management of irrigated soils with axial sprinklers, where the results showed the possibility of diagnosing several behaviors of irrigated soils with sprinklers, such as the method of tillage and scheduling watering and the negative effects of soil management that may cause soil degradation in the study area.

Materials and Methods

Study area is geographically located in the north-eastern part of the province of Kirkuk include terms (Shwan) and (Altun Kopre), area an between Longtitude (44° 38′ 22″-44° 22′ 29″) E, Latitude (35° 43′ 53″-35° 42′ 16″) N with a total area amounted

to(117683.96 hectares). (Figure 1)

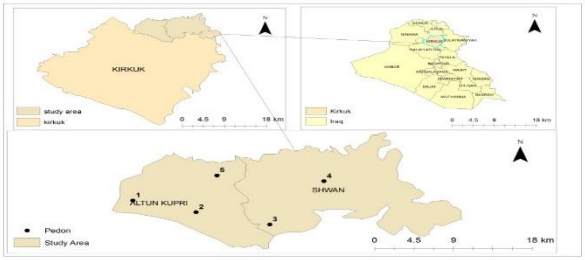

Figure 1: Study area

Satellite images taken by the Landsat 5 MSS on (1997/8/3) as well as land sat 8 taken on (2014/7/20), (2020/7/20) and (2023/7/21). The images were in hanced,corrected geometrically, analyzed super classified and interpreted using Arc GIS 10.4.1 software.

Maximum likelihood supervised classification was used based on Geological Survey classification system developed by Anderson colleagues in (1976), because it is characterized by comprehensiveness and flexibility, as Hamdani(2020) , confirmedthat it was designed to comply with the Landsat satellite visuals that were relied on in this study.Figure (2,3,4,5).

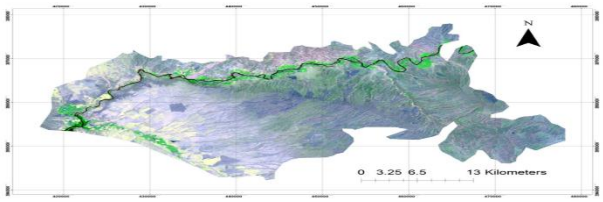

Figure :2 composite satellite image resulting from the synthesis of (7, 4 ,2) of the image taken in 1997

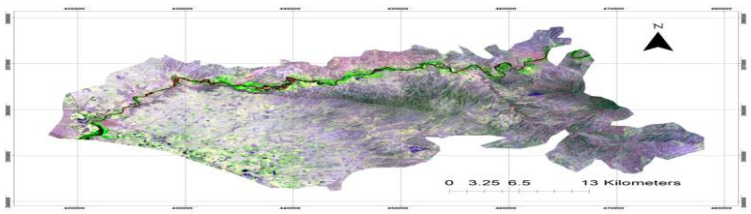

Figure :3 composite satellite image resulting from the synthesis of (7, 5 ,3) of the image taken in 2014

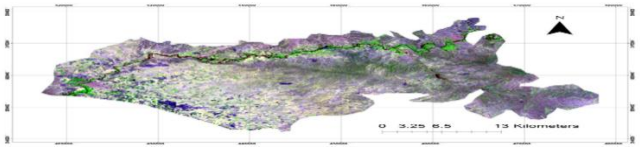

Figure :4 composite satellite image resulting from the synthesis of (7, 5 ,3) of the image taken in 2020

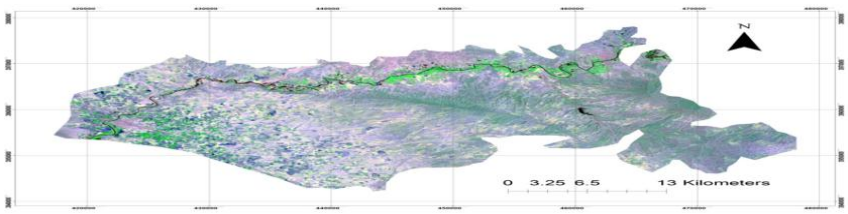

Figure :5 composite satellite image resulting from the synthesis of (7, 5 ,3) of the image taken in 2023

Table: 1 of Bands 2,4,7 for satellite images in 1997

Landsat 5 TM Bands	Wavelength(micrometers)	Resolution(meters)
Band 2-Green	0.52-0.60	30
Band 4- Near Infrared (NIR)	0.76-0.90	30
Band 7- Shortwave Infrared (SWIR)	2.08-2.35	30

Table: 2 of Bands 3,5,7 for satellite images in 2014,2020,2023

Landsat 8 OLI Bands	Wavelength(micrometers)	Resolution(meters)
Band 3-Green	0.52-0.60	30
Band 5- Near Infrared (NIR)	0.76-0.90	30
Band 7- Shortwave Infrared (SWIR)2	2.08-2.35	30

RESULTS AND DISCUSSION

The numerical analyses resulting from the supervised classification of the study area for the years (1997 ,2014 ,2020, 2023) as shown in (Table 1) and (figures 6,7,8,9) showed the diversity of land cover and varying areas.

Land uses and land cover were classified according to the Anderson system [7] into six main classes (Drainage and Channels, Built-up land, Grain crops, Ploughed agricultural land, Abandoned agricultural land and Transformation zones). The lowest area of the first class(watercourses and canals) in the year(2020) was(555.95 hectares) by(0.47%) and this noticeable decrease is a natural result of the dry seasons experienced by the study area during this period ,the highest area was in (2014) by(800.22 hectares) and by (0.68%), as for the second category (built land), the great sovereignty of this class was in the year(2023) with an area of(16208.23 hectares) and by(13.77%), the lowest area was in the Year (1997) of(3920.72 hectares) and by(3.33%) this is evidence of the increased exploitation of land by man for civil purposes such as the expansion of urban areas, the construction of buildings and industrial areas, the expansion of roads and other facilities at the expense of agricultural land, One of the most important reasons for the increase in the areas of land built at the expense of agricultural land is due to the increase in population as well as because of the deteriorating political situation in the country, which led to the weakness of the state's policy towards trespassers on state land, and this is evidence of a deterioration of the study area.As for the third category (grain crops), the lowest area in 2023 was (2959.13 hectares) by (2.51%), the highest area was in (2020) by(7128.34 hectares) by (6.06%), and the fourth class (plowed agricultural land), where the lowest area was (21045.9 hectares) in 2014)) by (17.88 as for the highest area was in 2020 (34181.06 hectares) with a percentage of(29.04%), as for the fifth class (abandoned agricultural lands), a fluctuation was observed in its areas during the study years, the sovereignty of this category was in (2014) with an area of (50140.16 hectares) with a percentage of (42.61%), the lowest area was in(2020) of (10624.34 hectares) and (9.03%), as for the sixth and last class, which is (Transformation zones), its highest area was in the year (1997) of (71953.51 hectares) and (61.14%), while the lowest area was for the same category in the year (2014) of(34639.17 hectares) and (29.43%), this scientific method of monitoring trends of change in the cover it is one of the successful methods in monitoring changes in land cover, and its results are helpful in explaining the change in land uses if satellite images of the same area are available for multiple years.

Table :3 Miscellaneous land covers and their areas during the extended period (1997 ,2014, 2020, 2023)

Description	1997 Area (ha)	Ratio	2014 Area (ha)	Ratio	2020 Area (ha)	Ratio	2023 Area (ha)	Ratio
Drainage and Channels	709.23	0.6	800.22	0.68	555.95	0.47	736.68	0.63
Bult-up land	3920.72	3.33	6059.83	5.15	11155	9.48	16208.23	13.77
Grain crops	4142.76	3.52	4998.69	4.25	7128.34	6.06	2959.13	2.51
Plowed agricuitural land	22252.66	18.91	21045.9	17.88	34181.06	29.04	29806.99	25.33
Abandoned agricuitural land	14705.08	12.5	50140.16	42.61	10624.34	9.03	20466.28	17.39
Transformation zones	71953.51	61.14	34639.17	29.43	54039.28	45.92	47506.66	40.37
Total	117683.96	100%	117683.96	100%	117683.96	100%	117683.96	100%

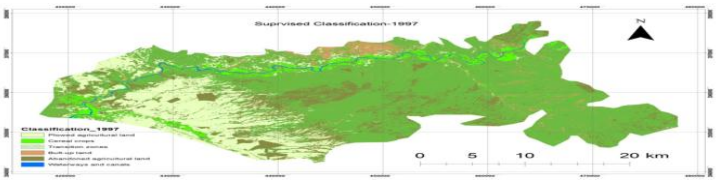

Figure :6 Suprvised Classification-1997

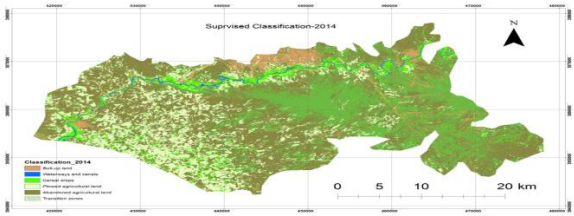

Figure: 7 Suprvised Classification-2014

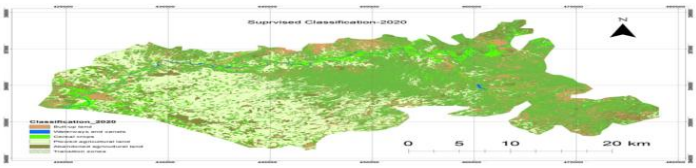

Figure :8 Suprvised Classification-2020

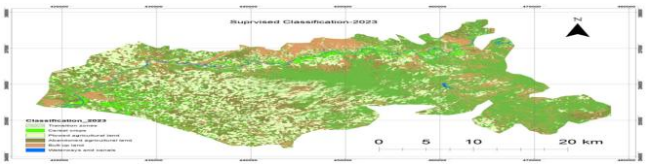

Figure :9 Suprvised Classification-2023

It is noted from the table (2) that there has been a change in the areas of land cover, where this change occurred for all classes, which differed from one class to another. The area of Drainage and Channels changed its area from 1997 to 2014 by an increase of 12%, where the difference between the two periods was 90.99 hectares, while from 2014 to 2020 it decreased by 30% with a difference of 244.27 hectares, while in 2020 to 2023 it increased by 32% with a difference of 180.37 hectares. The area of Bult up land changed from 1997 to 2014 by an increase of 54% with a difference of 2139.11 hectares and then increased from 2014 to 2020 by 84% with a difference of 5095.17 hectares and then continued to increase by 45%, The Grain crops variety was the percentage of change between 1997 and 2014 with an increase of 20%. Then this increase continued between 2014 and 2020 where the percentage of the change was 42%, with a difference of 2129.65 hectares, after which a decrease was observed in this class from 2020 to 2023, where it became 58% with a difference of 4169.21 hectares .As for the Plowed agricultural land category, the areas of this class decreased between 1997 and 2014 by 5%, with a difference of 1206.76 hectares, then these areas increased between 2014 and 2020 with a change of 62%, but between 2020 and 2023, these areas decreased by 12%. Abandoned agricultural land there was a flactuated in the rates of change there was an increase between 1997 and 2014 by a change of 240%, while these areas decreased between 2014 and 2020 by a change of 78%, then it was increased between 2020 and 2023 by a change of 92% by difference of 984,194 hectares. Transformation zones class decreased between 1997 and 2014 by a change of 51%, then increased between 2014 and 2020 by a change of 56%, then decreased between 2020 and 2023 by a change of 12%.

Table :4 The percentage of change in land cover areas

Description	Area(ha)				Change 1997,2014		Change 2014,2020		Change 2020,2023	
	1997	2014	2020	2023	Area(ha)	Ratio	Area(ha)	Ratio	Area(ha	Ratio

						change		change	)	change
Drainage and Channels	709.23	800.22	555.95	736.68	+90.99	+12	-244.27	-30	+180.37	+32
Bult-up land	3920.72	6059.83	11155	16208.23	+2139.11	+54	+5095.17	+84	+5053.23	+45
Grain crops	4142.76	4998.69	7128.34	2959.13	+855.93	+20	+2129.65	+42	-4169.21	-58
Plowed agricuitural land	22252.66	21045.9	34181.06	29806.99	-1206.76	-5	+13135.16	+62	-4374.07	-12
Abandoned agricuitural land	14705.08	50140.16	10624.34	20466.28	+35435.08	+240	-39515.82	-78	+9841.94	+92
Transformation zones	71953.51	34639.17	54039.28	47506.66	-37314.34	-51	+19400.11	+56	-6532.62	-12
Total	117683.96	117683.96	117683.96	117683.96						

In order to reveal the final changes occurring during the study period (26 years) (Table 1).
it was found that the areas of the Drainage and Channels and bolt-up land classes increased by 4% and 313%, with a difference of 27.45 hectares and 12287.51 hectares, respectively. As for the grain crops, they decreased by 28% with a difference of 1183.63 hectares. The Plowed agricultural land and Abandoned agricultural land classes have increased the areas of these two class by 34% and 39%, respectively. As for the sixth category Transformation zones, the area of this class decreased by 66% with a difference of 47,506.66 hectares.

Table :5 The percentage of change in land cover areas over 26 years

Description	Area(ha)		Change 1997,2023	
	1997	2023	Area(ha)	Ratio change
Drainage and Channels	709.23	736.68	+27.45	+4
Bult-up land	3920.72	16208.23	+12287.51	+313
Grain crops	4142.76	2959.13	-1183.63	-28
Plowed agricuitural land	22252.66	29806.99	+7554.33	+34
Abandoned agricuitural land	14705.08	20466.28	+5761.2	+39
Transformation zones	71953.51	47506.66	-47506.66	-66
Total	117683.96	117683.96		

Conclusion

It is noted obvious changes in land cover areas during twenty-six years, as these changes include the vegetation cover, water body, urban areas and soil, when comparing the percentage of change in land cover areas of the study area, it was found that the percentage of change in the (watercourses and canals) has increased in 2023 compared to 1997, as for the (built land), its percentage has increased significantly in 2023 compared to previous years, as for the (grain crops), its percentage has decreased in in 2023, unlike the previous two classes compared to 1997, the (plowed agricultural lands) and the (abandoned agricultural lands) increased their percentage in 2023 compared to 1997, as for the last class (Transformation zones), its percentage decreased significantly compared to the previous years.

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دراسة تغييرات الغطاء الارضي لناحيتي شوان والتون كوبري في محافظة كركوك.

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الخلاصة
اجريت هذه الدراسة لرصد التغيرات الحاصلة للغطاء الارضي في شوان و التون كوبري من محافظة كركوك-العراق. تقع منطقة الدراسة بين و-***(44 38′ 22″ E 44 22′ 29″)*** و(35 43′ 53″-35 42′ 16″) ***N*** مع مساحة اجمالية 117683.96 هكتار.تم جمع صورة الفضائية لسنوات 1997 ، 2014 ، 2020 و 2023 من ***landsat8 OLI*** ، ***landsat 5 TM***.تم استخدام التصنيف الموجه لتصنيف هذه الصورة.حدثت تغيرات واضحة في مناطق الغطاء الأرضي خلال فترة الدراسة من عام 1997 إلى عام 2023 ، خاصة اراضي المبنية حيث ازدادت من 3.33 ٪ إلى 13.77٪ ، تليها الأراضي الزراعية المتروكة من 12.5 ٪ إلى 17.39٪ ، ولكن قلت المناطق الانتقالية من 61.14 ٪ إلى 40.37%. من أجل الكشف عن التغييرات النهائية التي حدثت خلال فترة الدراسة خلال ستة وعشرون سنة وجد أن مساحات صنفي المجاري المائية والانهار وصنف الاراضي المبنية قد ازدادت بنسبة 4 ٪ و 313 ٪ ، بفارق 27.45 هكتار و 12287.51 هكتار على التوالي .أما بالنسبة لمحاصيل الحبوب ، فقد انخفضت بنسبة 28 ٪ بفارق 1183.63 هكتار.ازادت مساحات الأراضي الزراعية المحروثة وصنف الأراضي الزراعية المتروكة من بنسبة 34 ٪ و 39 ٪ على التوالي .أما بالنسبة للصنف السادس المناطق الانتقالية ، فقد انخفضت مساحة هذه الصنف بنسبة 66 ٪ وبفارق 47506.66 هكتار.

الكلمات المفتاحية: تحسس النائي، الغطاء الارضي، التصنيف الموجه، كركوك،شوان والتون كوبري.