Investigation of Changes in Water, Residential, Bare land and green Areas in Kabul Province from 2001 to 2018

Hamida Hassas

Assistant Professor of KPU, Kabul, Afghanistan

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Abstract *In this article, the changes of Kabul Province's water, residential, bare land, and green areas from 2001 to 2018 have been studied and maps of these areas have been prepared. To controlling them, the researcher obtained points from all covered areas by the Garmin-type GPS. To investigate the water, residential, bare land and green areas of Kabul province and consequently research the Interactive Supervised Classification method has been used in GIS and remote sensing technology which has suitable accuracy and simple than other methods. As a result of this study, it was founded that during these years the water areas decreased by 14,746 square kilometers, residential areas increased by 398,897 square kilometers, bare land and unused areas increased by 269,041 square kilometres and green areas decreased by 653.71 square kilometers.*

Key Words: *Kabul Province, Land cover map, GPS point, Interactive Supervised Classification, Remote sensing technology, GIS.*

1. INTRODUCTION

Since our country Afghanistan consists of 34 provinces and each province has special characteristics. Knowing the position, and provincial characteristics of each province is essential for the government in order to, according to the geographical location of that province, the government can adapt better its economic, Social, political, military plans, and etc. on the other hand, it can design effective and efficient plans for their improvement. In this research the irrigated, bare land, residential, and green areas of Kabul province were surveyed and their area was calculated meanwhile the map of different types of land cover of Kabul province also has been prepared, because Kabul is located in the central zone of the country, its capital is Kabul city which is also the capital of Afghanistan. In addition, it is being the economic and cultural centre of Afghanistan but it is a crowded city with more than 5 million populations [4]. The purpose of this research is that the map specialists and map users by using of satellite imagery, remote sensing technology, geographic information system software and GPS-derived field data to stabilize, detect, position, and map geographic features of different land areas can Provide practical maps and use them in the designing and implementation of any type of engineering, social, and economical project.

2. INVESTIGATION

Land cover refers to its various states such as vegetation, water, snow, construction, and etc. In due to time changes in land cover are natural phenomena. However, human interventions such as land alteration, establishment of roads and facilities, cutting down of trees, agronomy, and other causes increase the speed of land cover changes. To investigate these changes, need a device to readily available at different times. In order to it can examine the rapid changes in land cover. Land cover information can be obtained directly from suitable satellite images [1].

Landsat 7 and 8 images were used to carry out this research. These images were obtained in May 2001 and 2018 by the Landsat satellite from Kabul province. These images have high spatial resolution and radio metric [3]. Interactive Supervised Classification method has been used with high resolution images and GPS points from all covered areas [2]. After several stages of the process, the water related parts, residential, non-residential areas, and green areas have been merged and the file has been converted from raster to polygon to eliminate additional parts of the floors [5]. To control the accuracy of the work done, the 66 points which previously obtained from the surveyed areas by Garmin's manual GPS were used, the points being all four floors and their coordinates are listed in Table 1.

Table -1: Coordinates of points from the surveyed areas obtained by Garmin's type GPS.

Point ID	specification	X Coordinate	Y Coordinate	Point ID	specification	X Coordinate	Y Coordinate
1	Water Bodies	503101.75	3824213.54	34	Bare Land	564206.14	3830418.60
2	Water Bodies	502431.92	3823109.24	35	Bare Land	565492.41	3829962.19
3	Water Bodies	503071.68	3823750.59	36	Bare Land	565116.70	3829665.86
4	Water Bodies	564552.19	3834301.88	37	Bare Land	541026.94	3825651.73
5	Water Bodies	562856.65	3832342.19	38	Bare Land	540352.25	3824613.24

6	Water Bodies	560771.73	3833855.61	39	Green areas	514476.21	3817959.65
7	Water Bodies	569051.88	3828593.04	40	Green areas	514527.80	3817822.07
8	Water Bodies	570806.07	3827870.72	41	Green areas	514150.51	3818368.39
9	Residential areas	513601.10	3818356.04	42	Green areas	514424.35	3818496.98
10	Residential areas	511621.09	3826752.88	43	Green areas	512684.05	3816889.99
11	Residential areas	511640.20	3828417.24	44	Green areas	510969.05	3821266.30
12	Residential areas	513524.06	3827209.09	45	Green areas	502216.98	3821858.50
13	Residential areas	516387.23	3826811.09	46	Green areas	498762.41	3825159.61
14	Residential areas	516555.79	3824797.22	47	Green areas	497801.97	3826178.26
15	Residential areas	525398.36	3823030.64	48	Green areas	497622.05	3827040.80
16	Residential areas	529665.48	3819973.64	49	Green areas	498151.22	3826826.49
17	Residential areas	520220.21	3819276.41	50	Green areas	503423.32	3824307.91
18	Residential areas	505475.85	3817559.69	51	Green areas	503533.92	3824466.14
19	Residential areas	514253.30	3816916.40	52	Green areas	522134.68	3822357.25
20	Residential areas	506383.79	3848265.53	53	Green areas	523250.89	3825208.29
21	Residential areas	507837.68	3827830.52	54	Green areas	524174.29	3828084.31
22	Residential areas	503915.64	3821219.45	55	Green areas	524293.72	3829335.11
23	Residential areas	523500.55	3827575.85	56	Green areas	522595.18	3834194.37
24	Residential areas	507053.97	3854608.50	57	Green areas	511193.74	3825811.87
25	Bare Land	503634.19	3824839.61	58	Green areas	508353.43	3839857.06
26	Bare Land	503329.39	3824907.34	59	Green areas	508399.99	3840451.85
27	Bare Land	502493.84	3822419.20	60	Green areas	509689.18	3841766.30
28	Bare Land	507606.83	3847237.47	61	Green areas	506519.91	3848250.81
29	Bare Land	503008.29	3850560.04	62	Green areas	506910.17	3848294.47
30	Bare Land	506779.80	3854824.36	63	Green areas	506621.51	3848451.91
31	Bare Land	507597.64	3852769.92	64	Green areas	505140.37	3849857.64
32	Bare Land	506729.44	3850786.67	65	Green areas	503798.13	3850429.94
33	Bare Land	561760.02	3829471.71	66	Green areas	507273.68	3853858.83

These points are added to the satellite image (Figure 1)in the GIS panel using the Arc Toolbox option.
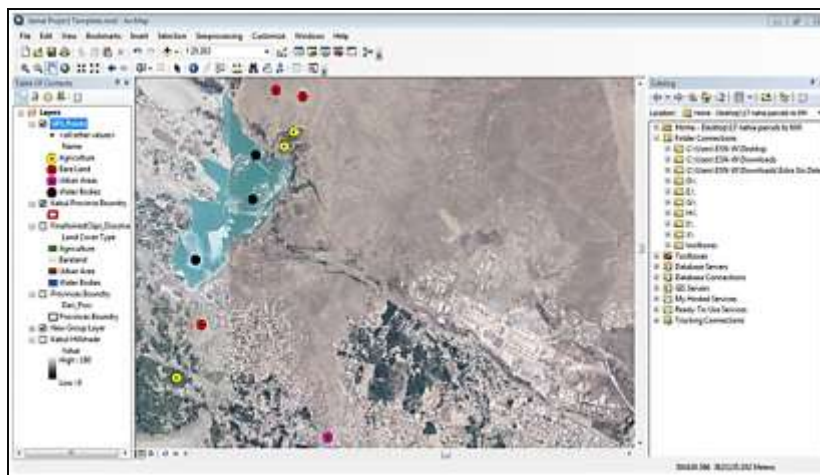

Figure- 1: GPS points added to the Satellite image.

In the Above image GPS points are shown on the green areas with yellow, on the bare land areas with red, on the residential areas with pear, and on the water areas with black colors, and each once was located in the aforementioned areas respectively, make ensure that the work is done accurately. The Kabul Province land cover Extracted from above satellite image,. To mapping the types of land cover of Kabul Province, at first DEM(Digital elevation model)of Afghanistan was added in GIS page and from that, the Kabul DEM was obtained. The Hill shade map has prepared by using of the Arc Tool box option. As a result, Map of Kabul Land Cover types have been prepared in 2001 and 2018 as shown in Figure 2 and Figure 3.
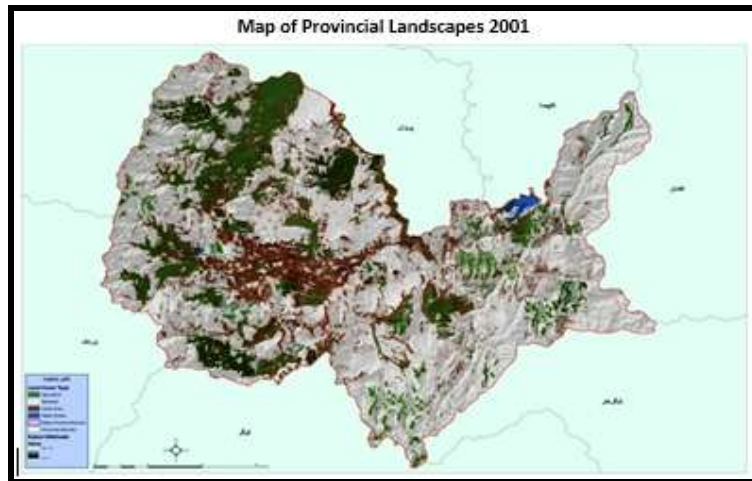
Figure- 2: Final prepared land cover map of Kabul Province 2001.
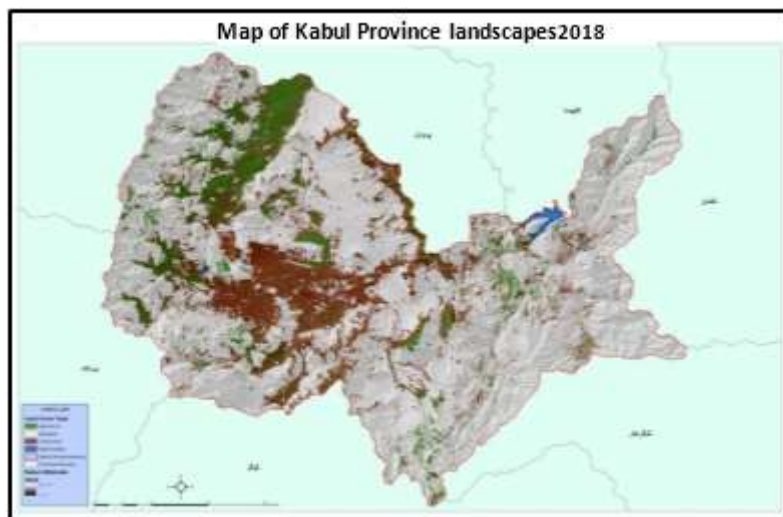

Figure- 3: Final prepared land cover map of Kabul Province 2018.

The areas of covered areas are calculated in Arc Map application, which is inserted in Tables 2.

Table – 2: Area of Covered Areas from 2001 to 2018

Number	Specification	Area in square Kilometers in year		Decrease in km²	Increase in km²
		2001	2018		
1	Water Bodies	30.994	16.248	14.746	
2	Residential areas	462.276	861.173		398.897
3	Bare lands	2839.44	3108.481		269.041
4	Green areas	1253.96	600.250	653.71	
Total		4586.67	4586.152		

As a result of the survey it was found that in 2001 the area of 30,994 km² of water area decreased to 16,248 km² in 2018 and the residential area of 462,276 km² in 2001 increased to 861,173 km² in 2018 and Likewise, in 2001, non-use areas with an area of 2839.44 km² increased to 3108.481 km² in 2018 and Finally, the area of green has decreased to 1253.96 km² in 2001 to 600.250 km² in 2018.

3. CONCLUSIONS

1- As a result of the survey, from 2001 to 2018, Kabul province's water bodies declined to 14,746 square kilometres, residential areas increased to 398,897 square kilometres, bare lands and unused areas increased to 269,041 square kilometres, and green areas declined to 653.71 square kilometres.

2- The Prepared maps in this research are used by the Kabul Provincial Administrators in economical, social, urban development planning, green, and recreation areas.

ACKNOWLEDGEMENT

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BIOGRAPHIES

I was born in 1972 in Kabul Province, Afghanistan. I defend my Masters dissertation in 1993 in "Kabul polytechnic University" I'm working as Assistant Professor of Geomatics and Cadastre Faculty in Kabul Polytechnic University.