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Importance of Land Use and Land Cover Change Analyze In Land Resource Management

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Abstract. Today, in Uzbekistan there are growing opportunities to use modern Geographic Information System (GIS) and Remote Sensing (RS) technologies in the effective management of land resources year by year. At the same time, as a result of the intensive change of eight type of land fund categories, their constant monitoring and maintenance of land balance remains one of the most pressing issues of the today. This research focuses on land use and land cover change analysis by using time series remote sensing data as Landsat 5-TMand 8-OLI in order to study of change of land fund categories of Zangiota district of Tashkent region, Uzbekistan in the period of 2000-2020. In case of creating high accuracy of land use/cover maps of study area NDVI, NDBI and MNDWI analyses combination were carried out for both 2000 and 2020 by using ArcGIS program. Accuracy of obtained land use/cover map of 2020 was 95 % after correlating with in suite data and for 2000 assumed the same. Land use maps of the region analyzed the changes in land fund categories over 20 years.

INTRODUCTION

Nowadays, the ongoing land and water reforms in the Republic of Uzbekistan are focused on the issues of effective management and efficient use of land and water resources in the regions.In particular, the Decree of the President of the Republic of Uzbekistan PF-5742 dated July 17, 2019 on measures for the efficient use of land and water resources in agriculture, emphasizes the need to monitor the use of land and water resources through geographic information systems reported [1]. However, as a result of insufficient work to ensure the implementation of this decree, there are many cases of irrational use of land resources by the population, looting and illegal occupation of housing. Uzbekistan's existing land use does not have a high potential for the following main reasons: a certain inconsistency in the use and management of land resources, forecasting the rational use of land, lack of planning, etc. [2]. Not only in Uzbekistan, but all over the world, there are many conflicts, such as constantly land use change monitoring, land accounting and agricultural land occupation for other purposes. The effectiveness of traditional methods in the complex analysis of land resources in areas with large areas is very low [3-5]. Land cover change analysis based on remote sensing technologies and data provides better results in solving and preventing such problems.

Intense changes of land use spontaneously affect land cover changes. This phenomena is explained by the increase of industry, rapidly growth of the population and the reinforcing demand for food and housing year by year.In the proper distribution and effective management of land resources, it is very important to constantly monitor changes in land cover [6,7]. In the study of land cover, it is advisable to conduct analyzes using time series

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and multi-spectral remote sensing data. The main reason for this is that they have an annual database and provide opportunities to study long-term changes [8, 23]. Currently, land fund management maps are prepared by obtained remote sensing data around the world and used a cartographic basis [9]. Landsat satellite has been position in orbit since its launch in 1972 and continuously providing long-term satellite imagery today[10]. It is effective to analyze the changes observed in the district land fund through images taken from this satellite. It is also possible to increase the accuracy of making the right decisions on land fund management as a result of the observed changes [24]. Nowadays, the current state of lands resources in the country has not been systematically analyzed using the above methods [23]. Periodic changes in the land fund are not strictly controlled based on spatial analysis. Lack of technical documentation in the management of the land fund has led to the failure to ensure compliance with the legal norms established for violations of the law by the population, as a result of which they are not constantly monitored on the basis of remote sensing data. As a result, today there are disagreements between the state and the population over the use of land resources. In particular, as a result of inspections conducted in the Tashkent region in 2020, violations cases have been identified in five districts.

According to statistics, from 3720 cases, 690 hectares of agricultural land were illegally occupied and built houses. It is analysed that about 79% of the 690 hectares of illegally occupied land, or 546 hectares, were high productive irrigated land. The largest number of reported violations on irrigated land was reported in the Zangiota district with 94%. It was also identified that such irregularities have been observed in orchards, vineyards and mulberry groves, as well as in other types of land (pastures, grey lands) [18].

METHODOLOGY

1.STUDY AREA

In this scientific research, the Zangiota district of the Tashkent region of the Republic of Uzbekistan was taken as a study area. The district is located at N $41^{0}22'39''$ northern latitude and E $64^{0}35'07''$ eastern longitude. (Figure 1) The total area of district is 21.692 hectares. The population of the district is 194.8 thousand people. The population is mainly engaged with the cultivation of agricultural products. As a result of district borders with Tashkent city, the most area of irrigated land used by the population is growing from year to year, and it is leading to declining of agricultural land.

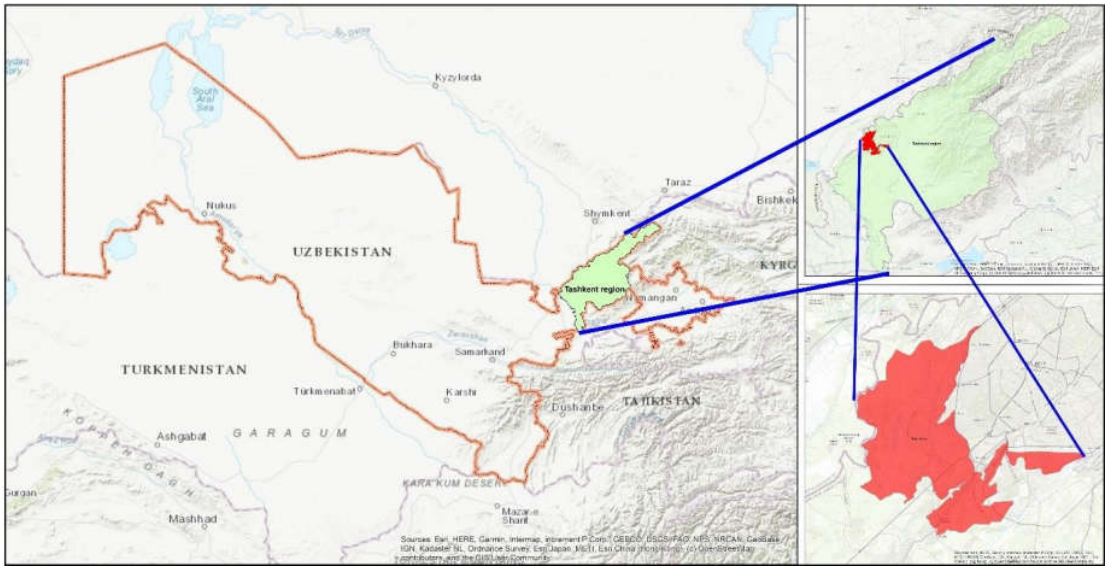

FIGURE 1. Study area

METHODS

In order to creating a land cover map of the study area, the same time Landsat-5TM, 8OLI images for 200 and 2020 are were pre-processed and analyzedby different indices in case of developing accuracy of unsupervised ISO clustering method to the periodic changes in the land cover of the. ArcGIS program was used to data preprocessing, raster combinations, calculation of indices and classification functions. Before occurately distinguish of land use type it is important to know spectral and spatial resolution of Landsat satellite sencors (table 1).

TABLE 1. Spectral and spatial characteristics of Landsat 5 TM and 8 OLI.

Landsat 4-5 ThematicMapper (TM)			Bands	Landsat 8 Operational Land Imagers (OLI)&Thermal infrared Sensor (TIRS)		
Resolution (meter)	**Wavelength (micrometers)**	**Bandname**		**Bandname**	**Wavelength (micrometers)**	**Resolution (meter)**
30	0.45-0.52	Blue	**Band 1**	UltraBlue	0.435-0.451	30
30	0.52-0.60	Green	**Band 2**	Blue	0.452-0.512	30
30	0.63-0.69	Red	**Band 3**	Green	0.533-0.590	30
30	0.76-0.90	NIR	**Band 4**	Red	0.636-0.673	30
30	1.55-1.75	SWIR 1	**Band 5**	NIR	0.851-0.879	30
120*(30)	10.40-12.50	Thermal	**Band 6**	SWIR 1	1.566-1.651	30
30	2.08-2.35	SWIR 2	**Band 7**	SWIR 2	2.107-2.294	30
			Band 8	Panchromatic	0.503-0.676	15
			Band 9	Cirrus	1.363-1.384	30
			Band 10	TIRS 1	10.60-11.19	100*(30)
			Band 11	TIRS 2	11.50-12.51	100*(30)

It is important to carried outNDVI analyses in determining irrigated agricultural, open water and forest areas [19] - [21]. Through this formula agricultural lands and forest fund lands were visualized(1) [11] Figure 2.

$$\boldsymbol{NDVI} = \frac{(\boldsymbol{NIR} - \boldsymbol{Red})}{(\boldsymbol{NIR} + \boldsymbol{Red})} \quad (\boldsymbol{a})$$

Where, NIRand red are near infrared and red bands of Landsat

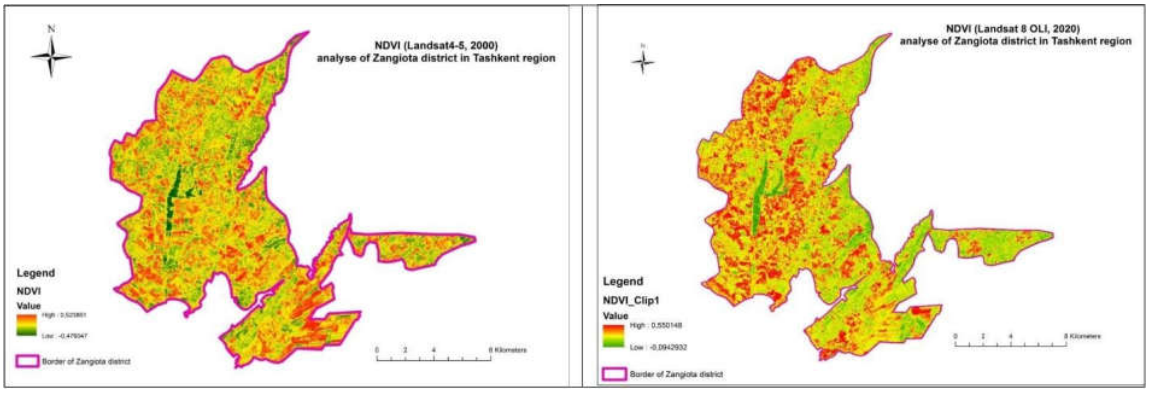

FIGURE 2. NDVI analysis of the study area

It is more efficient to determine identify lands in general use by the population. To this we can visualize lands covered with buildings and structures, engineering structures, social objects using by NDBI analyses (b) Figure 3.

$$NDBI = \frac{(\mathbf{SWIR} - \boldsymbol{NIR})}{(\mathbf{SWIR} + \mathbf{NIR})} \quad (\boldsymbol{b})$$

Where, SWIR and NIR are Short-wave infrared andnear infrared bands of Landsat

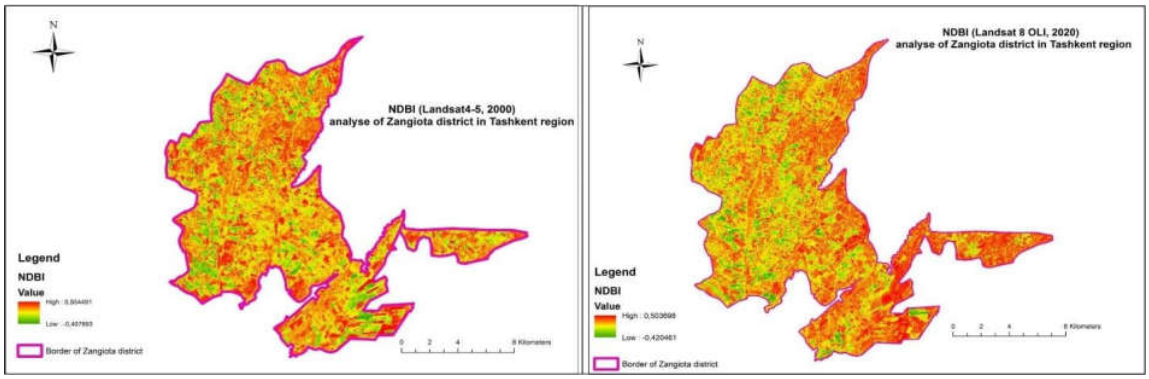

FIGURE 3. NDBI analysis of the study area

Thenin order to identifying water bodies in study area NDWIanalyses carried out by following formula (*d*).

$$NDWI = \frac{(NIR - SWIR)}{(NIR + SWIR)} \quad (\boldsymbol{d})$$

However, in formula (d) it is more difficult to obtain accurate information not only on open water areas but also on irrigated lands as a result of excessive water content, so water fund lands can be determined from formula (e) [13] Figure 4.

$$MNDWI = \frac{(Green - SWIR)}{(Green + SWIR)} \quad (\boldsymbol{e})$$

Where, SWIR and Green are short-wave infrared andgreen bands of Landsat

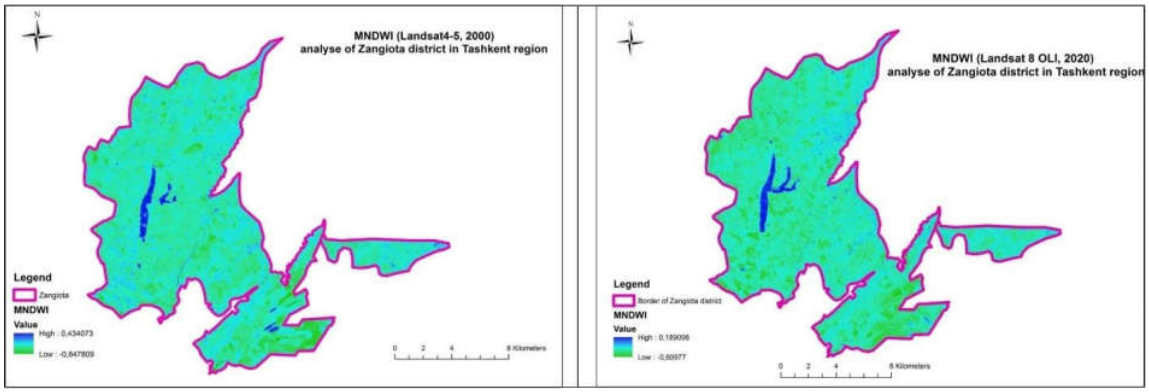

FIGURE 4. MNDWI analysis of the study area

Compositing above calculated indices New Raster (NR) was obtained containing NDVI, MNDWI and NDBI. Then NR used as a data for unsupervised classification by ISO clustering tool of ArcGIS.

RESULTS

By unsupervised classification 4 type of land fund categories: agriculture, residential, water and reserved areas were identified (Figure 5). Lands intended for nature protection, health and recreation purposes and forest areas were included agricultural lands. Cause of spatial resolution of images and similarity of reflectance of landcategories as industrial, transport, communication, defense and historical and cultural significance were the reflectance as residential areas. In order to assessing accuracy of four classified land cover map, accuracy assessment tool of ArcGIS used. Accuracy of land cover map of 2020 was 95 percent after correlating with ground truth data. Due to using similar satellite images, accuracy of land cover map of 2000 assumed as 95 percent.

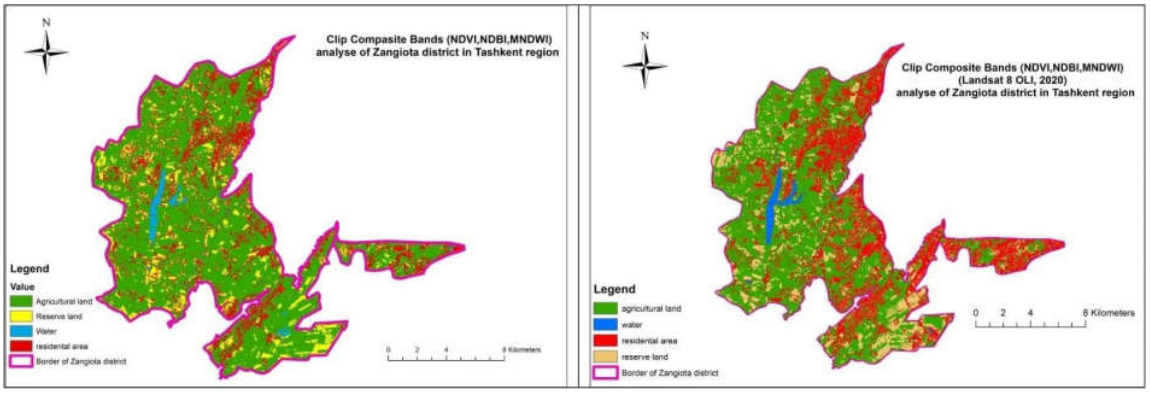

FIGURE 5. Land cover maps of Zangiota district for 2000 (left) and 2020 (right)

DISCUSSION AND CONCLUSION

It was clearly seen analyzing land cover changes by remote sensing data is more effective in maintaining the land balance, monitoring the transformation of the land fund category. By processing remote sensing data, it is possible to study changes in the land cover and thereby determine the change in the types of land use [25]. These data are a highly effective tool, especially in the study of suburban areas, in the organization and management of their territory [13] - [14]. Using land use and land cover changes, it is possible to analyze the area and visualize the most suitable areas for land redistribution and redistribution [15] - [17]. The article analyzes the territory of Zangiota district of Tashkent region of the Republic of Uzbekistan by processing remote sensing data. It uses images from the satellite platform Landsat 5TM and Landsat 8OLI. By calculating their NDVI, NDBI, MNDWI indicators, land fund categories were partially formed. The changes observed in the land fund status of the studied area in 2000 and 2020 were analyzed. In summary, land resources can be managed and monitored on the basis of remote sensing data. Through this, the possibility of arbitrarily occupying lands and using them for purposes other than the intended purpose is much higher. It is advisable to conduct long-term analyzes based on remote sensing data, visualize them and develop recommendations and models for the future.

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