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A GIS-BASED ANALYSIS OF URBAN EXTENSION AND LAND USE LAND COVER CHANGE DETECTION IN QASIMABAD, HYDERABAD

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ABSTRACT

In the world, cities are hubs for social, economic, and environmental activities. According to UN-Habitat world cities report about 68% of the total global population will be urban dwellers by 2050. People from different parts move towards cities for its diverse functions. Growing demand of spaces in urban areas put an immense pressure on cities existing conditions, resulting in urban built-up area expansion and slums. The instant impact of urban expansion can be seen on peri-urban outskirts, where land resources are being exploited and converted from one land use to another due to increasing demand for urban land use specifically residential land uses. As a result, this study aims to examine the total change in built-up area expansion and land use land cover change in one of the fasted growing urban centers in Hyderabad, Sindh. A GIS-based analysis approach was used for this. For this purpose, various satellite and analogue maps were used to map built-up area expansion and land use land cover change from 2017 to 2022. In ArcGIS a change detection technique incorporating a set of Esri Landsat satellite images from 2017 to 2021, image difference method was used for land use land cover change analysis. The findings indicate a significant increase in built-up area of Qasimabad over the last 5 years. A significant change has been observed in land use land cover change in Qasimabad from 2017-2021.

Keywords: Land use land cover change, Built-up area, expansion, ArcGIS.

I. INTRODUCTION

According to Demographia (2015) and the UN (2015), the world's biggest and most significant problem now is overpopulation, which necessitates proper social and economic amenities. Cities are the centers of economic expansion, technological advancement, and employment creation (Cohen, 2006). The phrase "engines of economic growth" is used to describe them (Duranton, 2008; Partridge, Olfert & Alasia, 2007; Robinson, 2002). Social, cultural, political, and technical innovation are rife in these areas. Due to the cities' forward-thinking nature, significant investments are attracted, which in turn creates thousands of employment. Because metropolitan regions provide a wide variety of financial prospects, people from rural areas move to cities in pursuit of employment. Population growth and land pressure brought on by the demographic transition from rural to urban regions eventually lead to an increase in the amount of built-up area in cities, both vertically and horizontally (Wu, Zhao, Zhu, & Jiang, 2015; He, Liu, Zeng, Chaohui, & Tan, 2017; Longyu et al., 2009). Thus, a horizontal overflow of the urban population toward the periphery defines urban growth. Urban areas must have enough land for the development and economic process to take place, and this land must be used for hospitals, schools, industrial facilities, and other purposes. This means that the city's surrounding cultivable land may be used for these purposes (Liu et al., 2014; Magsi and Torre, 2012). Additionally, the provision and control of economic and social comfort provide a conundrum and major problem for economics, policymakers, politicians, and scientists to resolve in an amicable way. Global land degradation is mostly caused by the industrial, agricultural, livestock, improper irrigation, deforestation, and urbanization of the wealthy. In a same vein, land is the only supply for human beings' fundamental requirements of food, clothing, fuel, and shelter (Naab et al., 2013; Bertaud, 2010). Researchers are eager to learn about the causes and effects of agricultural land conversion into infrastructure projects given the South Asian nation's growing population and their corresponding enhanced requirements (Magsi and Torre, 2014; Mazhar and Jamal, 2009). Pakistan is an agricultural nation, with agriculture making up around 19.8% of the GDP, providing a living for 42.3% of the total population, directly and indirectly employing about 70% of the labor force, and exporting agricultural products at a rate of about 45%. The population of urban regions is growing, from 38.5 percent in 2014 to 40.0 percent in 2016, while the population of rural areas is steadily dropping, from 61.4 percent in 2014 to 60.1

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percent in 2016. (GoP, 2016). Since most cities are encroaching on agricultural area, conflicts over food and land usage may arise in the future if agricultural land is converted to urban centers (Magsi et al., 2017). This research study's goal is to map the land use and land cover of the Qasimabad Taluka in order to look for changes over the last five years. To hit the targets, the research study's next objectives are pursued.

- To map land use and land cover classification scheme.
- To determine land use land cover change detection from 2017 to the 2021 year.

II. METHODOLOGY

Analogue and satellite maps of Qasimabad from 2017 to 2021 derived from Esri Landsat data were used in the research utilizing ARCGIS GEOSPATICAL methods. Information regarding the satellite photos and maps utilized in this investigation is provided in Table 1. The five years of the research. The year 2017 serves as the study's baseline and is the primary source for land use and land cover methodology. For defining Qasimabad's boundaries, Google Maps was also used. Using ArcGIS 10.2, all of these pictures and maps were scaled to the same dimensions and placed in the same coordinate system within the GIS. Using Universal Transverse Mercator projection settings, they were geocoded and georeferenced (WGS 1984 UTM Zone). Maps of land usage and land cover were made after further processing the pictures. Major land use classifications were identified and categorized during the early phase of the research based on data collected from satellite pictures and field trips. On the basis of five classifications, the map was examined. These five categories are populated areas, agricultural land, aquatic bodies, savanna, and other. After distinct land use classes were selected and defined, five land use maps of the research region were produced using the ArcGIS 10.2 program. Land usage and land cover were mapped at a scale of 1:20000 using vector-based visual interpretation techniques (Dutta, 2012; Fazal, 2013). Cross-checking with Google Earth photos was done for the post-classification validation and accuracy evaluation. The post-classification analysis of Land Use Land Cover Change utilized one of the most popular techniques for change detection, simple image differencing (Lu, Mausel, Brondzio, & Moran, 2004). (LULCC). Each land use class's area was estimated for various time periods, and data on land use area variations for the research periods were then computed and documented. A thorough graphic depiction of the study's approach is shown in Fig. 3.

Study Area:

In Pakistan's Sindh province, Hyderabad is the second-largest city. It is the fourth-largest city in the nation. On the remains of Neroon Kot, a Mauryan fishing town along the Indus River's bank, Mian Ghulam Shah Kalhoro built the city in 1768. It serves as the administrative center for the Hyderabad district and was once Sindh's capital. Hyderabad is Sindh's second-largest city after Karachi. It is the fourteenth most populated city in Pakistan. In 2022, Hyderabad's metro area would have 1,926,000 residents, a growth of 2.07 percent from 2021. Hyderabad has four talukas. These are Hyderabad city, Hyderabad rural, Latifabad and Qasimabad. Qasimabad has total area of 35 Sq Km. According to estimates, Qasimabad has 304,779 residents (Census 2017). Qasimabad has growth rate of 5.24%. Qasimabad has average household size of 5.02 persons.

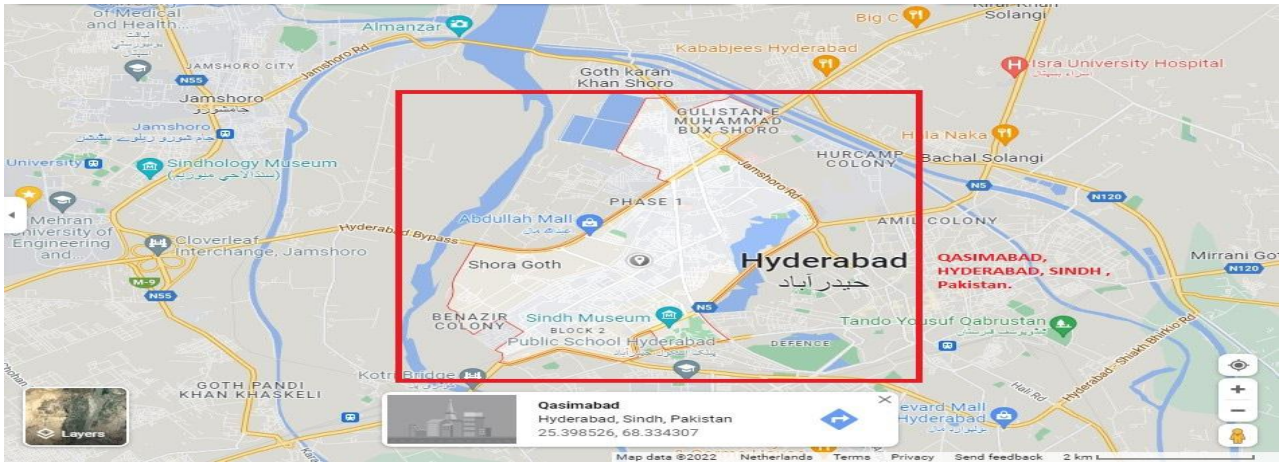

Figure 1: Shows Location of study area.

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III. MODELING AND ANALYSIS

In the ArcGIS Environment, the imageries of study area of different years from 2017 to 2022 are incorporated and analyzed using ArcGIS geospatial analysis. The imageries and process are highlighted in fig 2 given below:

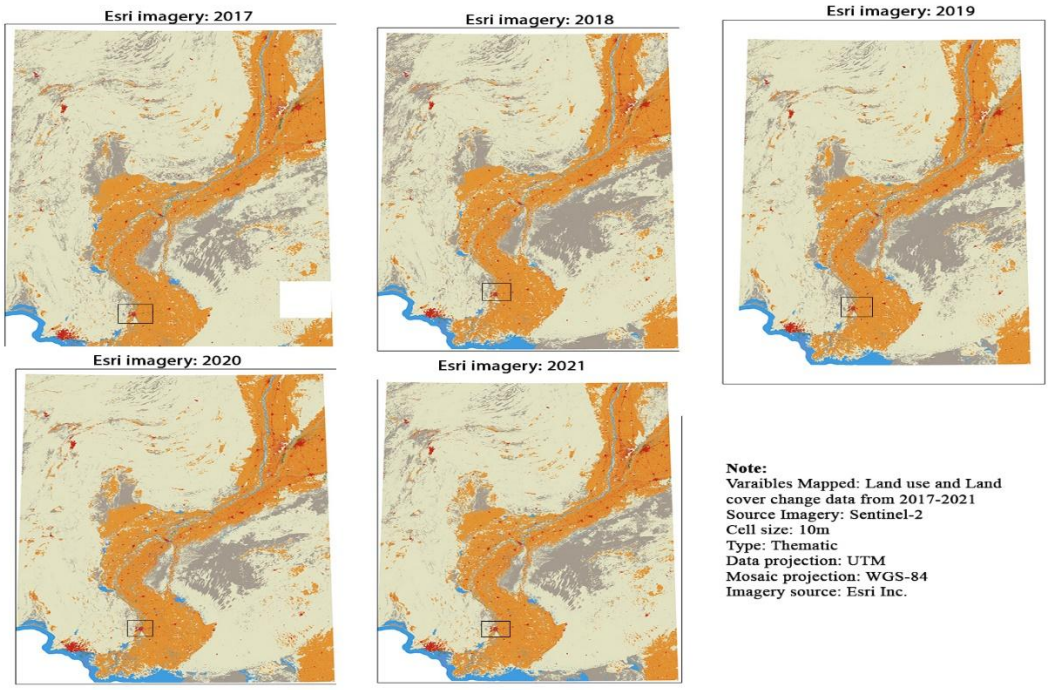

Figure 2: Shows the imageries of study area of different years from 2017-2022.

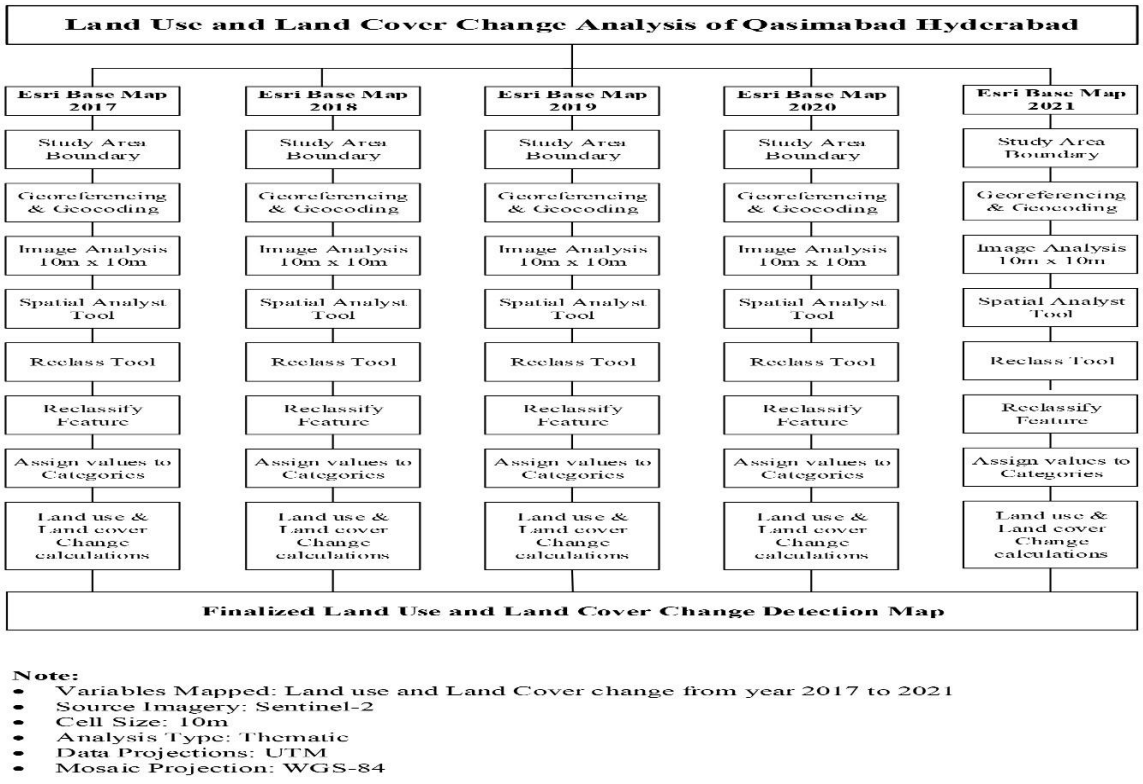

Figure 3: Shows the flow chart of geospatial analysis.

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IV. RESULTS AND DISCUSSION

In this research, results have been drawn by applying geo spatial techniques to the source imageries. The imageries of past five years from 2017 to 2021 have been collected and analyzed. Imageries are classified into different land uses which are built-up area, crops, water body, scrub land and others. The imageries are compared, and land use land cover change is calculated using ArcGIS geo spatial techniques. The results are further portrayed into geographical as well as tabular form.

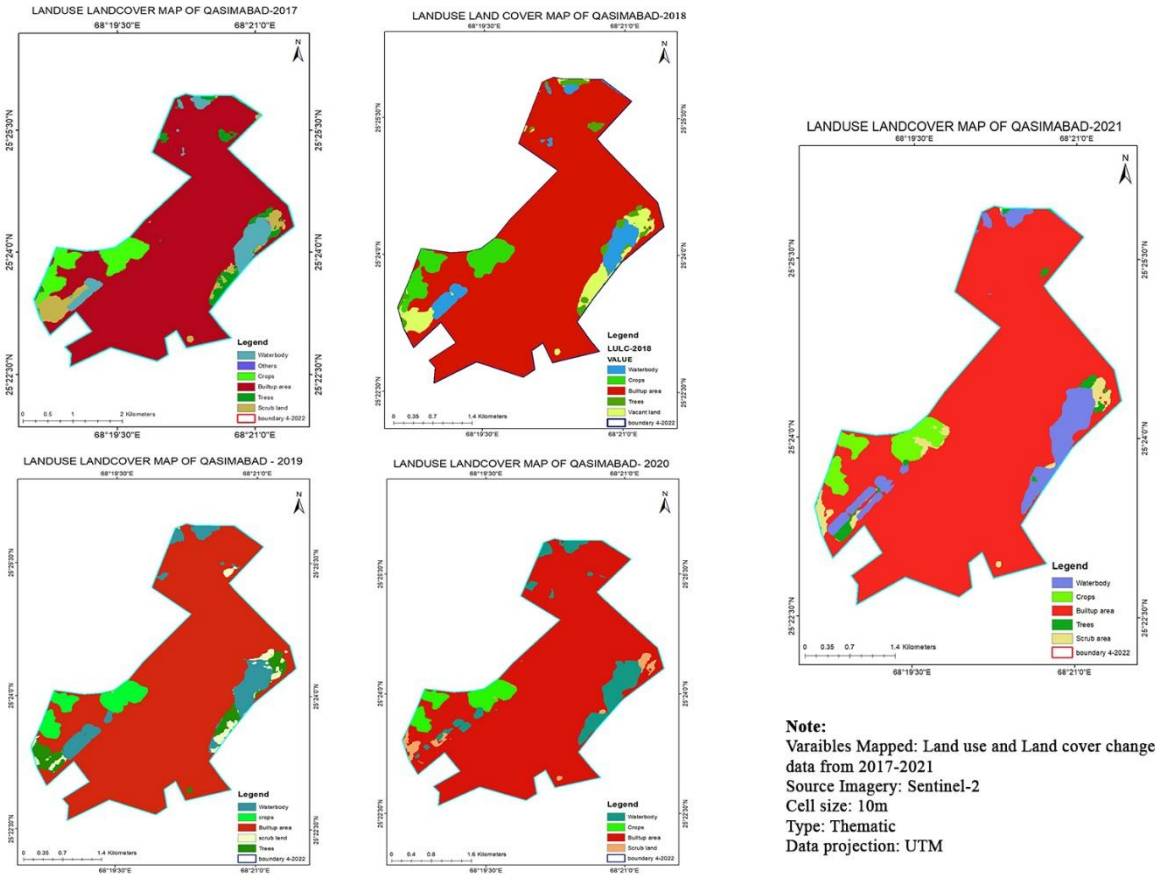

Figure 4: Shows the analyzed maps of Study area

Table 1: Land use land cover calculations of study area from 2017 to 2021.

LAND USE LANDCOVER CHANGE DATA CALCULATIONS OF QASIMBABAD FROM 2017-2021						
YEAR	**BUILT UP AREA IN SQKM**	**OTHERS (ROADS, OPEN SPACES & VACANT LAND)**	**AREA IN SQKM**	**PERCENTAGE (BUILT-UP)**	**INCREASE (BUILT-UP)**	**OVERALL INCREASE IN PERCENTAGE(BUILT-UP)**
2017	11	3	14	78.571	0	**6.04571%**
2018	11.5656	2.2738	14	82.611	+ 4.04	
2019	11.5597	4.7294	14	82.569	- 0.042	
2020	11.967	1.8724	14	85.478	+ 2.909	
2021	11.8464	1.993	14	84.617	- 0.861	

Extension of Built-up area and reduction of other land uses:

The increase in area under built-up classes is attributed to the city's urban expansion. The city's built-up area has been grown and expanded because of population growth and socio-economic transformations. The city's

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built-up area has grown from 2718.16 acres (11 Sqkm) in 2017 to 2927.30 acres (11.8464 Sqkm) in 2021.While land use for other classes is decreased from 741.316 acres (3 Sqkm) in 2017 to 492.48 acres (1.993) in 2021. The built-up area's notable land use classes included residential and commercial, among others. The expansion of urban built-up area occurred in all the directions of study area. According to analyses an extension of 209.14 acres has been occurred in Qasimabad, Hyderabad. This brings an overall increase of 6.04571 % in built-up area percentage from 2017 to 2021.

V. CONCLUSION

In the last few years, Qasimabad has experienced a phenomenal growth in its urban area. The people from different parts of interior Sindh are moving towards Qasimabad for different purposes like education, health, economic and environment conditions. The inflow of surrounding rural poor to cities in search of employment and industrial growth transformed the city into an economic growth center, resulting in overall infrastructural development in the region. This has accelerated the rate of urbanization, eventually leading to the expansion of urban built-up beyond municipal jurisdiction, along its outskirts, resulting in unchecked land conversion and a rise in land prices. Qasimabad urban expansion has rapid changes in urban land uses which are more visible along the roadside and out skirts of city. A numerous number of housing schemes has been launched at major highway connecting to Qasimabad. For which purpose a large amount of land has been converted from agricultural to urban centers. According to recent reports published by Hyderabad development authority 3508 acres of valuable agricultural land has been converted into urban area in Qasimabad in just past 10 years. Qasimabad urban expansion has been unorganized and uncontrolled, resulting in haphazard development along the major roadways. This is really an alarming situation for all relevant stakeholders to come front and play their role in better development of the area. Strict land conversion regulations, as well as location-specific local need-based land use planning, are required for smart and sustainable land use in the city.

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