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Assessment of the Urbanization Impacts on Land Cover and Land Use Changes using Remote Sensing and Python at Gazipur District, Bangladesh

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Introduction

Urbanization is one of the critical anthropogenic activities which causes habitat destruction, ecosystem loss, and decline of natural vegetation. Urbanization is a primary concern for a developed country, as land-use patterns change unexpectedly and total agricultural land lessens rapidly. The study area is near the capital city of Bangladesh. For the last two decades, urbanization has grown rapidly and unexpectedly in developing countries (Dewan et al., 2009). Being a developing country, Bangladesh has similar obstacles and struggles that work as barriers to achieve the MDG and SDG goals within 2030. For the expansion of population growth, agricultural lands are converted to residential areas. The environmental parameters have been changing for this unplanned urbanization, and the topsoil quality is degrading rapidly. Collaborating GIS, RS, and Landsat imagery work will bring a unique perspective in reducing unplanned urbanization.

Abstract

Urbanization has been the major demographic trend globally. Mapping is vital for the analysis of land use and land cover. Using open-source Landsat data integrated with GIS technologies and other ancillary data (Toby et al., 2000), this study attempts to classify land use in unsupervised classification and create land cover maps in Gazipur Sadar and Kaliakair, rapidly growing urban and industrial zones. We used python coding to enable post-classification change detection analysis. This study quantitatively examined changes in land use/land cover and urban expansion in the study area. Gazipur is a growing metropolitan city, north of the capital city of Dhaka in Bangladesh, experiencing rapid industrialization followed by unplanned Urbanization (Rana, 2011). Over more than two decades, Gazipur experienced an increase in urbanization (44.16%) with a decrease in forest areas (20.87%) and water bodies (5.88%). And, during the last five years, Gazipur experienced a more rapid change with an increase in urbanization (28.03%) and a decrease of forest areas (26.29%) and water bodies (8.92%). These changes caused environmental degradation, land use pattern change, topsoil degradation, and habitat destruction (Al Ahmadi et al., 2009). A significant change in vegetation pattern took place since 1991. The findings of this study and the geospatial information generated from the land use mapping can be used as an essential reference for planners, policymakers, stakeholders, and other interested groups to aid the rational utili-

Location

Gazipur District is located just north of the capital city of Dhaka,

Key Variables and their interaction on Urbanization

- Population Growth
- Climate Change
- Lack of Coordinations
- Lack of Planning
- Poor Urban Financial Management
- Lack of hierarchical Planning Systems

Fig: A

The significant classes of Land use and Land cover are agricultural land, bare land, forest, urban area, and water body. Changes to these classes can be attributed to rapid population growth, unplanned urbanization, and a lack of proper policy implementation. (Figure A and B).

From 1995 to 2020, the Gazipur Sadar area experienced a rapid increase in urbanization (44.16%); on the other hand, the forest areas (20.87%) and water bodies (5.88%) decreasing. During the last five years, Kaliakair experienced a rapid change with increased urbanization (7.37%) and a decrease in agricultural land (23.66%).

Unsupervised Classification of Land use result for 1995, 2000, 2015, 2020

The maps presented in the figure show that the primary classes are agricultural land, bare land, forest, urban area, and the water body of Gazipur Sadar & Kaliakair at 1995, 2000, 2015, 2020.

Fig: B

Fig: C

At Gazipur, the urban area was 91.76 sq km in 2000, and in 2020 the metropolitan area increased 225.41 sq km. The agriculture area is decreasing, in 2000 the area was 230.89 sq km, and in 2020 the place is 48.88 sq km. (Figure C)

At Kaliakair, the urban area was 41.62 sq km in 2000, and in 2020 the metropolitan area increased 71.56 sq km. The agriculture area is decreasing, in 2000 the area was 160.69 sq km, and in 2020 the decreased to 57.49 sq km. (Figure D)

Fig: D

Fig: E

Reference

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Area	Population	Density Per Sq Km
Gazipur Sadar	1820374	3977
Kaliakair	483308	1539

Area	Population (000)			
	1981	1991	2001	2011
Gazipur Sadar	377	588	866	1899
Kaliakair	165	232	267	503

Findings reveal that the area has experienced rapid urbanization and undergone dramatic changes in land cover, as evidenced by a rapid increase in the extent of the built-up regions, resulting in a loss of croplands, vegetation cover, fallow lands, water bodies, and lowlands. These rapid urban expansions have been mainly driven by massive growth in the industry, infrastructure development, population growth, increasing port-related activities, and expansion of residential development, resulting in the consumption of agricultural land, vegetation cover, and hill encroachment. The Dynamics and urban growth of Land Use Variation from 1995-2020 between Gazipur Sadar & Kaliakair show the changes in Land Use and Land cover due to unplanned urbanization and industrialization. The challenges of future urbanization are enormous. Poor management, inefficiency, and lack of coordination among implementing agencies combined with limited financial resources have aggravated the situation. Failure to address them with coordinated and robust planning will have disastrous consequences. Sound planning, a well-thought-out strategy, muscular coordination, and a compact implementation plan supported by ample finance are essential. The findings of this study and the geospatial information generated from the land use mapping can be used as an essential reference for planners, policymakers, stakeholders, and other interested groups, to aid in the rational utilization of limited land resources. Additionally, the information may assist in making decisions regarding future land use plans and urban development to mitigate the adverse effects of land-use change and its attendant environmental impact.

Discussion