Built-up Analysis of the Hill Town of Nainital

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Abstract

Recently, urbanization has become a major cause of environmental change around the world, especially in mountain areas. This is especially true in developing countries, where urban growth has been rapid but largely haphazard, unplanned, and unregulated. This research looks at how a tourist hub in Uttarakhand's central mountain range has been affected by the fast urbanization that has resulted from technological advancements (India). Comparing Google Earth from 2006 to 2019, this study examined changes in land use/cover for the built-up area. As a foundation map for determining land utilization and cover, images from different periods are used. The result indicates that during 14 years there is a substantial increase in the built-up area of the Nainital by around 68% (i.e., 1.89sq. km).In contrast, sprawling urban growth in the fragile mountains has disrupted critical ecosystem services while also creating employment, a wide range of socioeconomic services, and expanded infrastructure, all of which contribute to the development of their vast hinterlands via the trickle-down effect.

Keywords: Urbanization, Land-use Change, Built-up Area, Sustainable Development, Nainital.

1. INTRODUCTION

Due to urbanization, human activity has profoundly modified the Earth's land surfaces [13]. The term "urbanization" refers to the process that causes more people to settle in urban areas, particularly large cities [6]. Yet, urban land use, which is concerned with surface utilization, is a crucial part of urban planning [21]. More people move to cities because they have access to better jobs and living conditions, due to the infrastructure improvements and conveniences that have been made [13,5]. Consequently, the growing population has harmed the ecosystem [22].

A region's land use/cover pattern develops over time and place as a consequence of both natural & socioeconomic factors. Land use/cover information is essential for urban management & planning, sustainable natural resource management, and socioeconomic development [12]. Land cover is an essential metric for describing the surface of the Earth. This parameter is an important variable that influences & connects numerous aspects of

human & physical environments [16]. While "land use" describes how people interact with the earth [3]. Land use refers to the process by which undeveloped or wild areas are prepared for human habitation, either as farming, pasture, or urban centres. Management of monitoring natural resources and of environmental changes now depend critically on accurate assessments of land use and cover shifts. Human activity drives land use and cover dynamics, which is a widespread, quick, and substantial process that also creates changes that affect humans [1]. Changes in land use/cover have wide-ranging effects on the environment & landscape. Land cover change happens via natural phenomena even in the absence of human activities, while land use change is the modification of land cover by humans for different objectives.

Due to their hard terrain, high gradients, complicated geological structure, climatic conditions, and extensive flora, hilly areas are the most difficult, yet attractive, and complex terrains on which to perform any development activity. Many popular hill stations, including Shimla, Nainital, Dalhousie, and Mussoorie, can be found in this general area. In the last 3 decades, these hill towns have been subjected to significant development pressure (as a result of strong population growth, a big influx of tourists, and improved living circumstances), which has altered their environment & visual appearance. Hill towns have expanded by multiples of their planned and actual densities and are under intense pressure to provide residential, educational, health, work, and recreational services, which is exacerbated by a lack of construction land & high land prices.

This demonstrates that urbanization has a complex association with the environment since it improves life quality while degrading the ecosystem [4]. In addition to environmental

damage, the most notable impact of urbanization is the modification in land use/cover [18]. Land utilization refers to the use of land by humans for various purposes & operations, including settlements or built-up areas. transit. and other infrastructure operations, while landcover refers to the land's coverage [10, 2].

The current paper examines the situation of Nainital to track the urban expansion and buildup changes for the city of Nainital from 2006 to 2019 using GIS techniques and map data [8, 11]. Detecting changes in land-use cover involves identifying differences in the position of an object over time.

Urbanization has complicated human relationships with the environment because it improves the standard of living but, degrades the environment [14]. Initially, land-use change research focused on its physical characteristics, but later, as part of a study objective on global ecological change, scientists realized that land surface impacts climate as a result of land-use change [15]. Midway through the 1970s, it was established that land-use changes influence surface albedo and consequently exchange the surface atmosphere's energy, thereby affecting the local climate [20]. Global biological variety, soil degradation, and the capacity to meet human requirements for biological systems are the most concerning implications of land-use change on the environment, goods, and services [1]. Since human activity, humans have transformed the land to meet their basic survival needs, but at a slower rate than they do today. The current rate of exploitation has brought about unprecedented alterations in the bio-networks & environmental processes [22].

2. STUDY AREA

Nainital is a well-known tourist destination located in the Indian state of Uttarakhand. The

town is situated at a height of 1938m above sea level and has an area of 11.89sq.km, including Naini Lake's 0.46 sq.km. The town of Nainital lies between latitudes 29°24'19"N and longitudes 79°25'46"E. The town's lake has an average depth of 18.55 m [7]. The town has a tropical climate with splendid summers & severe winters. The average summer temperature is 25°C, whereas the average winter temperature is 0°C. The city is expanding rapidly because it serves as an important administrative hub for the state. It is home to the High Court as well as prestigious institutions like the Academy of Administration, Kumaon University, and the Aryabhatta Office of the Kumaon Mandal Vikas Nigam [9].

Fig. 1 Location map of the study



The town of Nainital, which serves as the administrative centre of the district at present, was historically the summer capital of the United Province while it was under the control of the British. Because of this, the Land Utilization cover of the city will be shifting as a result.In 1842, the first village arose on the lakeshore of Nainital. According to the "(Census of India 2011)", Nainital has a total population of 41,461, with males accounting for 52% and females for 48% [16].

It is possible to reach Nainital through the Ramnagar Nainital, Haldwani-Nainital, or Bhawali Nainital routes. The closest train station is in Kathgodam, 35 km away; it is the northern terminal of the North Eastern Railway. The closest airport is in Pantnagar, which is situated 70 miles away. The region of Nainital features wonderful summers & winters. Summer temperatures average around 25°C., while winter temperatures can drop around 0°C. The city sees snowfall frequently during the winter. During the monsoon season, rainfall is typically abundant.

2.1 The objective of the study

To show the urban expansion and analyse the built-up area changes in the city of Nainital from 2006 to 2019.

3. METHODOLOGY

3.1 GIS Analysis

Using the GIS software Map INFO, the data are analyzed as part of the study's methodology. Using Google Maps as a base map for 2006 and 2019, MapInfo generates polygons for a variety of categories. The entire coverage consists of a single UNION. The value of coverage was added to the table operation. The final union coverage includes the sum of each polygon's score. By superimposing the two land-use layers produced by the 2006–2019 land-use change maps, the land-use change value is determined. The produced map depicts the 14year change in land usage. This study classifies land use/cover in the built-up space.

4. **RESULTS & DISCUSSIONS**

4.1 Land use/cover status

Figs. 2 and 3 depict the spatial distribution pattern of land utilisation and cover in the Nainital city area for built-up areas from 2006 to 2019. The land use/cover and change are considerable, with the built-up area in 2006 being 23.55% (2.80 sq. km), but in 2019 the same land use/cover is observed the built-up

land is 39.44% (4.69 sq. km) of the total area i.e. 11.89 sq km.

Fig.2 Land use/cover for built-up area 2006-2019

Change in Builtup area from 2006-2019



Table: 1 Built-up area in the city for the period 2006 to 2019

	2006		2019		Change 2006-2019	
The total area of Nainital 11.89sq. km	Area in Sq. Km	Percentage	Area in Sq. Km	Percentage	Area in Sq. Km	Percentage
Total built-up area	2.80	23.55%	4.69	39.44%	1.89	68%

Fig. 3 Nainital Built-up 2006-2019



4.2 Issues of development in Nainital hill towns

The problems that hill towns face as a result of fast urbanization & development are as follows:

i. High population growth owing to migration from neighbouring regions and a large influx of tourists exerts a heavy strain on existing housing and infrastructure, resulting in the construction of more multi-story structures for residential, office, and commercial use in hill towns.

ii. The majority of hill stations are situated in ecologically fragile areas. The ecological equilibrium of cities is impacted by the highdensity growth of multi-story buildings and the reduced carrying capacities of hill towns. In addition, hill cities' natural topography, vegetation, and natural drainage pattern have been degraded through enormous construction, resulting in environmental deterioration.

iii. Hill towns are prone to natural risks like landslides, earthquakes, floods, cloudbursts, and fire, among others. The majority of structures have been erected or are in the process of being constructed without complying with safety standards for natural hazards, leaving them vulnerable to severe damage in the event of any natural disaster.

iv. The loss of trees & vegetation, unrestrained buildings, the covering of hills with buildings, roads that are too narrow and dangerous, and the encroachment of private property onto public land have all contributed to the transformation of hill cities into concrete jungles.

v. In the present context, there is about a 68% increase in the built-up area from the year 2006 to 2019.

Picture: 1Built-up area in Nainital, Uttarakhand



CONCLUSION

The transition of the selected area's landscape from predominately natural to predominately man-made is correlated with a substantial increase in crop production and settlement pattern. The selected research, conducted in one of Uttarakhand's hill towns in the Kumaun region of the Lesser Himalayas, suggests that data analyses with the use of Google Earth and map data are useful for identifying changes in land-use change and cover rapidly and precisely. According to this study, urban Nepal primarily consists of built land. There was a 68% increase in the built-up area, or 1.89 sq. km, during the specified 14 years. The construction of buildings and infrastructure has resulted in a multifold increase in land value. accompanied by a decrease in its availability. Unauthorized building construction, encroachment, other unlawful sale & acquisition operations, and land grabbing are all on the rise as a result, which is worrying evidence of a worsening human-environmental & socioeconomic situation in the area.

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